

**Food insecurity among adults and adolescents in Australia, Canada, Chile,
Mexico, the United Kingdom, and the United States before and during the
Coronavirus Disease 2019 Pandemic**

by

Alexandra Pepetone

A thesis
presented to the University of Waterloo
in fulfillment of the
thesis requirement for the degree of
Doctor of Philosophy
in
Public Health Sciences

Waterloo, Ontario, Canada, 2024
© Alexandra Pepetone 2024

Examining Committee membership

The following served on the Examining Committee for this thesis. The decision of the Examining Committee is by majority vote.

External Examiner

DR. ERICA DI RUGGIERO
Associate Professor
Dalla Lana School of Public Health
University of Toronto

Supervisor

DR. SHARON I. KIRKPATRICK
Associate Professor
School of Public Health Sciences
University of Waterloo

Internal Members

DR. WARREN DODD
Associate Professor
School of Public Health Sciences
University of Waterloo

DR. EDWARD A. FRONGILLO
Professor
Arnold School of Public Health
University of South Carolina

Internal-External Member

DR. JENNIFER CLAPP
Professor
School of Environment, Resources & Sustainability
University of Waterloo

Author's declaration

This thesis consists of material all of which I authored or co-authored: see Statement of Contributions included in the thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Statement of contributions

Alexandra Pepetone was the sole author of Chapters 1-4 and 8, which were written under the supervision of Dr. Sharon Kirkpatrick and were not written for publication.

This thesis consists in part of three manuscripts that have been published or prepared for publication. Exceptions to sole authorship include:

Chapter 5: Pepetone A, Frongillo EA, Dodd KW, Wallace MP, Hammond D, Kirkpatrick SI. Prevalence and severity of food insecurity before and during the Coronavirus Disease 2019 Pandemic among adults and youth in Australia, Canada, Chile, Mexico, the United Kingdom, and the United States. *The Journal of Nutrition*. 2023 Apr 1;153(4):1231-43.

Chapter 6: Pepetone A, Frongillo EA, Dodd W, Lindberg R, Vanderlee L, White M, Aburto Soto TC, Dubin JA, Wallace MP, Dodd KW, Singh N, Kirkpatrick SI. Characterizing national level economic and social policy responses during the Coronavirus Disease 2019 Pandemic and their relation to known patterns in household food insecurity in Australia, Canada, Chile, Mexico, the United Kingdom, and the United States.

Chapter 7: Pepetone A, Frongillo EA, Dodd W, Vanderlee L, Lindberg R, Wallace MP, Dubin JA, White CM, Dodd KW, Hammond D, Kirkpatrick SI. Determining whether economic and social policy responses mitigated anticipated increases in food insecurity among adults and adolescents in Australia, Canada, Chile, Mexico, the United Kingdom, and the United States before and during the Coronavirus Disease 2019 Pandemic, 2018-2022.

As lead author of these three chapters, I was responsible for contributing to the development of research questions, analytic plans, and hypotheses, collecting the data, conducting the data analysis, and drafting the manuscripts. Co-authors contributed throughout the research process and provided feedback throughout, with significant editorial contributions from my supervisor Dr. Sharon Kirkpatrick.

Abstract

Background: Household food insecurity is a major public health concern with negative consequences for health and well-being among adults and adolescents. During the Coronavirus disease 2019 (COVID-19) pandemic, shocks and stabilizers may have affected the prevalence and severity of household food insecurity overall and among subgroups of the population. For example, restrictions to reduce the spread of COVID-19 led to loss of employment, potentially increasing risk of food insecurity, whereas policies such as income supplementation for those who lost employment may have had a stabilizing effect. Comparing changes in household food insecurity across multiple countries over time can shed light into how packages of economic and social policy responses implemented or revised by national level governments during the pandemic may have influenced household food insecurity, providing insights into strategies to ameliorate household food insecurity, including in times of crisis.

Objectives: The objectives of this thesis were to 1) characterize changes, or lack thereof, in the prevalence and severity of food insecurity among adults and adolescents in Australia, Canada, Chile, Mexico, the United Kingdom, and the United States from before (2019) to during (2020) the pandemic (**Chapter 5**); 2) examine national level government economic and social policy responses implemented or revised in these countries to, in part, mitigate the impacts of the COVID-19 pandemic and related safety measures (**Chapter 6**); and 3) determine whether economic and social policy responses appeared to mitigate anticipated increases in food insecurity during the COVID-19 (**Chapter 7**). The countries of interest were identified based on the similarity in the languages spoken, food environments, and culture among other characteristics.

Methods and results: Three inter-related studies addressed the thesis objectives, with two of the studies integrating consultation with a collaborative working group to facilitate the relevance and applicability of study findings by considering country-specific contexts. Two studies drawing upon the International Food Policy Study considered food insecurity data reported by adults aged 18 to 100 years and directly by adolescents aged 10 to 17 years, enabling comparison in trends among the two population subgroups over time. Among adults, food insecurity was measured using the 18-item Household Food Security Survey Module, enabling categorization of the households in which participants lived as food secure or food insecure over the past 12 months. Among adolescents, the 10-item Child Food Insecurity Experiences Scale was used, enabling consideration of the number of food insecurity experiences (i.e., no, few, many, or several) they had over the past 12 months.

The first study (**Chapter 5**) drew upon repeat annual cross-sectional data from adults ($n = 63,278$) and adolescents ($n = 23,107$) to examine changes in food insecurity prevalence and severity from before (2019) to during (2020) the COVID-19 pandemic in the countries of interest. Based on adjusted binary and multinomial logistic regression models, adults in Australia (adjusted odds ratio (AOR): 0.81; 95% CI: 0.72-0.92) and Canada (AOR: 0.87; 95% CI: 0.77-0.99) were less likely to live in food-insecure households during (2020) relative to before (2019) the pandemic. There was little indication of changes in the odds of adults living in food-insecure households in the United Kingdom (AOR: 0.90; 95% CI: 0.79-1.02) and the United States (AOR: 1.05; 95% CI: 0.93-1.19) in 2020 relative to 2019, while in Mexico, adults were more likely (AOR: 1.15; 95% CI: 1.02-1.31) to live in food-insecure households in 2020. Findings related to changes in the severity of food insecurity were similar. Adolescents in Mexico were more likely (AOR: 1.43; 95% CI: 1.19-1.71) to report experiencing food insecurity in 2020

compared to 2019. In Australia (adjusted relative risk ratio (ARRR): 2.24; 95% CI: 1.65-3.02) and the United States (ARRR: 1.39; 95% CI: 1.04-1.86), adolescents had a higher relative risk ratio of many compared to no experiences of food insecurity in 2020 compared to 2019. No differences in the prevalence or number of experiences of food insecurity among adolescents were observed in other countries.

In the second study (**Chapter 6**), packages of economic and social policy responses to, in part, mitigate the impacts of the pandemic and safety measures to limit spread of the virus in the countries of interest were characterized. Potentially relevant policy responses implemented or revised by national governments between January 2020 and December 2022 were identified using eight policy response trackers. A theory of change articulating the hypothesized influence of different types of policy responses on household food insecurity guided the inclusion criteria. Two rounds of screening were conducted to identify the final set of 142 relevant economic and social policy responses. Hypotheses about how policy packages influenced household food insecurity in 2021 and 2022 were developed based on observed changes in household food insecurity from 2019 to 2020 and broader contextual events. Consideration of the influence of policies on food insecurity in 2021 and 2022 integrated evidence from other sources. Financial-based policy responses (e.g., unemployment protection) were emphasized in Australia, Canada, and the United Kingdom. In Chile, Mexico, and the United States, there was a more equal distribution of financial-based and resource-based (e.g., food assistance) policy responses. Across most countries and years, policy packages provided long periods of coverage (six months or more). Mexico was an exception in 2021 with a mix of policy responses that had short- and long-term coverage.

The third study (**Chapter 7**) drew upon repeat cross-sectional data from 104,418 adults and 44,759 adolescents from 2018 (adults only), 2019, 2020, 2021, and 2022 to determine whether economic and social policy responses mitigated anticipated increases in food insecurity among adults and adolescents during the COVID-19 pandemic. Three lines of inquiry were used to realize this objective. First, year-to-year changes in food insecurity among adults and adolescents and in the known determinants (e.g., difficulty making ends meet) and consequences (e.g., poor quality diets) of food insecurity were compared. Alignment in changes would instill confidence that the nature of food insecurity did not change during the pandemic and set the foundation for the subsequent two lines of inquiry. Second, among adults living in households, the predicted prevalence of food insecurity in 2020, 2021, and 2022 had the pandemic not occurred was estimated (this analysis was not conducted for adolescents given the lack of data for 2018). Hypothesized changes in food insecurity among adults living in households for each country by year given that the pandemic occurred and considering broader contextual events (e.g., global inflation, Brexit in the United Kingdom) were developed to guide assessment of whether economic and social policy responses mitigated anticipated increases in food insecurity. Observing that the observed proportion of adults in food-insecure households was lower or did not differ from the predicted proportion would suggest that economic and social policy responses mitigated anticipated increases in food insecurity. Third, adjusted multinomial or binary logistic regression models with interactions for the survey year and selected characteristics that indicate high risk of experiencing food insecurity (e.g., households with children) assessed changes in the odds or relative risk ratio of food insecurity among adults living in households and adolescents during (2020 to 2022) relative to before (2019) the COVID-19 pandemic among the subgroups selected. Subgroups with selected characteristics were anticipated to be more likely to experience

food insecurity during the pandemic. If this finding was not observed, it would suggest that economic and social policy responses mitigated anticipated increases in food insecurity among those at high risk during the pandemic.

Alignment between changes in food insecurity among adults living in households and adolescents and its known determinants and consequences ranged across countries and over time. The variation in alignment was likely due to the range of factors that could influence food insecurity and the unlikelihood that a one percent change in the proportion of food insecurity would equate to a one percent change in the singular category examined for each determinant and consequence. The observed proportions of food insecurity among adults living in households were lower than predicted had the pandemic not occurred in Australia, Canada, and the United States at various time points, suggesting that policy responses to address pandemic-related disruptions mitigated increases in food insecurity that were otherwise anticipated to due to shocks related to COVID-19 safety measures. Subgroups that were anticipated to be more likely to experience food insecurity during (2020 to 2022) relative to before (2019) the COVID-19 pandemic largely did not, with indication that some subgroups were better protected by policies introduced during the pandemic compared to beforehand.

Conclusions: Although some increases in food insecurity among adults were observed through the pandemic in the countries examined, it appears that economic and social policies introduced by national governments mitigated otherwise large, anticipated increases due to loss of income and other shocks to households. The lack of increases in the proportions of adolescents experiencing food insecurity in most countries reinforces the notion that policy packages influenced food insecurity during the pandemic. Nonetheless, household food insecurity remains

prevalent and increased in later years, likely due to the expiration of policy responses, inflation, and other events globally.

Though long-term economic and social policies to address household food insecurity are lacking in the countries examined, this work indicates it is possible for governments to ameliorate this serious public health problem using policy levers. Packages of policy responses that focused on financial-based support and/or scaled up existing policy responses mitigated anticipated increases in food insecurity among adults in 2020. Policy packages also appear to have contributed to the observed prevalence of food insecurity among adults living in households being the same or lower than the predicted prevalence through the pandemic. These findings are salient as the world works to achieve the 17 Sustainable Development Goals by 2030 against the backdrop of ongoing crises anticipated to sharply increase risk of household food insecurity, including the climate emergency and conflicts.

Acknowledgments

Funding for this research was provided by the following sources:

- Social Sciences and Humanities Research Council Canada Graduate Scholarship – Master’s Scholarship: 2020-2021,
- Stipend from the Canadian Institutes of Health Research, National Science and Engineering Research Council, and Social Sciences and Humanities Research Council Implementing Smart Cities Interventions to Build Healthy Cities (SMART) Training Platform (2022),
- Ontario Graduate Scholarship (2022-2023), and
- Social Sciences and Humanities Research Council (SSHRC) Doctoral Fellowship (2023-2024).

I have also received funding from the SMART Training Platform, Ontario Ministry of Research and Innovation Early Researcher Award held by SIK, and Graduate Student Research Dissemination Award to enable travel to conferences where work within and beyond this thesis was presented.

There are many people without whom I would not have been able to make it to this stage of my academic journey. To the members of my thesis committee, I remember feeling excited but nervous at the prospect of having you on my thesis committee, which sounds odd because I knew collaborating with committee members was part of the degree. Your collective depth of knowledge and breadth of research is both inspiring and humbling. Going from learning about pieces of your work during my coursework and comprehensive exam to collaborating with you on my thesis is something I still have not fully comprehended.

To my external examiner, Dr. Erica Di Ruggiero, and internal-external examiner, Dr. Jennifer Clapp, although we did not cross paths until the latter stages of my degree, I am appreciative of your time and the input you provided during my PhD. Dr. Edward Frongillo and Dr. Warren Dodd, your depth of knowledge, thoughtful comments, feedback, and overall support were invaluable and greatly appreciated throughout my degree. You challenged me to think more deeply about my research area and provided clarity on a range of topics and questions that I had throughout the process. I feel very fortunate to have been able to undertake this degree with your guidance. To Dr. Sharon Kirkpatrick, my supervisor, it is hard to believe that five years have already passed. I remember sitting in your office for our first one-to-one meeting at the start of my master’s when you asked if I would be interested in fast tracking into my PhD. At the time it felt like a distant reality but here we are at the end of my PhD. Your continual guidance and support throughout this process has allowed me to get to where I am today. Your remarkable eye for detail helped me learn how to convey information concisely and precisely about topics I knew little to nothing about five years ago. What a journey!

I would also like to thank all the members of my collaborative working group. Your insights and contributions were and are greatly appreciated! I feel very lucky to have been afforded the opportunity to collaborate with you during my PhD. Your contributions shaped core pieces of my thesis and you served as an important sounding board for my work. I would also like to thank members of the International Food Policy Study team more broadly. I feel incredibly fortunate that I was allowed the opportunity to access and use data related to the COVID-19 pandemic at the height of the pandemic knowing that I requested a lot of data, and it would be years before the projects would come to a close.

To my teammates past and present, thank you for your endless support and positivity. I feel very lucky that I had the opportunity to work and learn alongside you given your range of expertise, life experiences, and research topics. Although I chose to complete my degree remotely, we were able to stay connected and I never felt out of place when we had in-person team meetings or outings. Alyssa and Joy, our weekly writing groups were equally about work and chatting through whatever experiences we were having each week. These conversations kept me grounded even during the many tough moments of this degree. I took and continue to take a lot of comfort in the shared challenges we experienced during our degrees as this made me feel less alone during difficult moments. Pam, you offered me unconditional friendship and support during the good and the bad that came with this degree and for that I feel incredibly grateful. From impromptu coffee chats to various outings, you helped me remember to pause and enjoy life's moments outside of my PhD. I would also like to thank Erica, Megan, and Nicole. I feel very lucky that we started weekly coffee chats during our master's and that they have continued up to this point. These chats helped me stay connected with you, something I am not good at doing, and take my mind off my work. To all my lab mates and friends thank you and I cannot wait to see where you go in your careers and the positive impact you will have.

Last, but certainly not least, thank you to my family, Cindy, Chris, James, Zach, and Tess. There have been many ups and downs throughout my education. You were always willing to listen and provided comfort during the challenging moments and celebrated my wins like they were your own. I appreciate your patience when you asked if I wanted to do something and I would regularly say no I can't, I have to work. Your outside perspective always helped me see the bigger picture and remember that school is not my entire life, even though it certainly felt like it at times. Moments spent going for walks, watching random tv series and doing puzzles helped me take breaks from my work and make it to the end of this degree. Thank you!

Table of contents

Examining Committee membership.....	ii
Author’s declaration.....	iii
Statement of contributions.....	iv
Abstract	v
Acknowledgments.....	xi
List of figures.....	xvi
List of tables	xvii
List of abbreviations.....	xix
1.0 Background.....	1
1.1 Overview and scope.....	1
1.2 Thesis organization.....	4
2.0 Literature review	5
2.1 Food security and food insecurity	5
2.1.1 Household food insecurity measurement	6
2.1.2 Prevalence of household food insecurity	8
2.1.3 Child and adolescent experiences of food insecurity	10
2.1.4 Determinants of household food insecurity	12
2.1.5 Consequences of household food insecurity.....	15
2.1.6 Responses to household food insecurity.....	17
2.2 The COVID-19 pandemic and country-specific context	21
2.2.1 Australia.....	23
2.2.2 Canada	24
2.2.3 Chile	25
2.2.4 Mexico	25
2.2.5 United Kingdom.....	26
2.2.6 United States	27
2.3 Implications of the COVID-19 pandemic and associated safety measures	28
2.4 Natural experiments and cross-country comparisons	29
3.0 Rationale and specific aims	31
3.1 Rationale	31
3.2 Specific aims	33

3.2.1 Study one – prevalence analysis	33
3.2.2 Study two – policy analysis	33
3.2.3 Study three – attribution analysis	34
4.0 General methods.....	35
5.0 Study 1 – Prevalence analysis.....	40
5.1 Overview	41
5.2 Introduction	43
5.3 Methods.....	45
5.3.1 Measures	48
5.3.2 Statistical analyses.....	51
5.4 Results	52
5.5 Discussion	63
5.6 Conclusion.....	69
6.0 Study 2 – Policy analysis.....	70
6.1 Overview	71
6.2 Introduction	73
6.3 Methods.....	74
6.3.1 Search strategy	75
6.3.2 Eligibility criteria	79
6.3.3 Theory of change.....	81
6.3.4 Policy response screening.....	83
6.3.5 Data extraction	85
6.3.6 Synthesis and hypothesis development	86
6.4 Results	104
6.5 Discussion	110
6.5.1 Food insecurity and policy responses.....	110
6.5.2 Policy implications	114
6.6 Conclusion.....	117
7.0 Study 3 – Attribution analysis.....	118
7.1 Overview	119
7.2 Introduction	121
7.3 Methods.....	123

7.3.1 Measures	126
7.3.2 Statistical analyses.....	130
7.4 Results	136
7.5 Discussion	160
7.6 Conclusion.....	166
8.0 Discussion	167
8.1 Summary	167
8.2 Policy analysis hypothesis testing	171
8.3 Interpretation of findings	173
8.4 Key themes across studies.....	176
8.4.1 Food insecurity and the COVID-19 pandemic	176
8.4.2 Past, present, and future disparities?	177
8.4.3 Balancing breadth and depth within comparative research	178
8.5 Strengths and limitations.....	180
8.6 Policy implications and implications for research and monitoring	183
8.6.1 Policy implications – Policy responses and methods of delivery	183
8.6.2 Policy implications – Policy response communication	184
8.6.3 Implications for research and monitoring – Food insecurity measurement	185
8.6.4 Implications for research and monitoring – Policy response tracker recommendations	189
8.7 Conclusions	190
References	192
Appendices	222
Supplemental materials for Chapter 5	222
Supplemental materials for Chapter 6	230
Supplemental materials for Chapter 7	234

List of figures

Figure 5.1: Proportion of adults aged 18 to 100 years living in food-insecure households in 2018, 2019, and 2020, by country, International Food Policy Study (n = 63,278).	56
Figure 5.2: Proportion of adolescents aged 10 to 17 years experiencing food insecurity in 2019 and 2020, by country, International Food Policy Study (n = 23,107).....	58
Figure 6.1: Flow diagram outlining the stages of the policy analysis and points of consultation with collaborative working group to facilitate consideration of country-specific contexts to support the applicability and relevance of study findings.	75
Figure 6.2: Flow diagram outlining the number of policy responses included and excluded, with reason for exclusion, during the identification process.	84
Figure 6.3: Timelines indicating when economic and social policy responses were implemented or revised by national level governments during the COVID-19 pandemic, by country, (n = 142).	86
Figure 7.1: Proportion of adults aged 18 to 100 years living in food-insecure households and proportion of adults reporting selected determinants and consequences of food insecurity in 2018 to 2022, by country, International Food Policy Study (n = 104,418).	142
Figure 7.2: Proportion of adolescents aged 10 to 17 years experiencing food insecurity and proportion of adolescents reporting selected determinant and consequence of food insecurity in 2019 to 2022, by country, International Food Policy Study (n = 44,759).	145
Figure 7.3: Observed versus predicted proportions of adults aged 18 to 100 years living in food-insecure households in 2018 to 2022, by country, International Food Policy Study (n = 104,418) ¹	148

List of tables

Table 2.1: Overview of select social protection programs.	20
Table 5.1: Number of adults aged 18 to 100 years and adolescents aged 10 to 17 years who completed the surveys, whose data were excluded, whose data were available for analysis, and whose data were included in the analytic samples from the International Food Policy Study survey in 2018, 2019, or 2020 in Australia, Canada, Chile, Mexico, the United Kingdom, or the United States.	47
Table 5.2: Sociodemographic characteristics of adults aged 18 to 100 years participating in the International Food Policy Study in 2018, 2019, and 2020, by country (n = 63,278) ¹⁻³	53
Table 5.3: Sociodemographic characteristics of adolescents aged 10 to 17 years participating in the International Food Policy Study in 2019 and 2020, by country (n = 23,107) ¹⁻³	55
Table 5.4: Adjusted odds of living in households with any level of food insecurity and marginal, moderate, or severe food insecurity in 2020 compared to 2019 among adults aged 18 to 100 years, by country, International Food Policy Study (n = 63,278) ^{1,2}	61
Table 5.5: Adjusted odds of any experiences and by the number of experiences of food insecurity in 2020 compared to 2019 among adolescents aged 10 to 17 years, by country, International Food Policy Study (n = 23,107) ^{1,2}	62
Table 6.1: Description of policy response trackers used to identify economic and social policy responses implemented or revised by national level governments during the COVID-19 pandemic in Australia, Canada, Chile, Mexico, the United Kingdom, and the United States.	77
Table 6.2: Inclusion-exclusion criteria for first and second rounds of policy response screening.	80
Table 6.3: Hypotheses for how food insecurity changed, or not, on a year-to-year basis relative to the prior year or available time point from before the COVID-19 pandemic in 2020 to 2022, by country.	100
Table 6.4: Breakdown of included policy responses in Australia, Canada, Chile, Mexico, the United Kingdom, and the United States during the COVID-19 pandemic by policy category, mechanism of influence and magnitude of impact on food insecurity, 2020 to 2022.	105
Table 6.5: Breakdown of included policy responses in Australia, Canada, Chile, Mexico, the United Kingdom, and the United States during the COVID-19 pandemic by policy category and policy type, 2020 to 2022.	108
Table 7.1: Number of adults aged 18 to 100 years and adolescents aged 10 to 17 years who completed the surveys, whose data were excluded, whose data were available for analysis, and whose data were included in the analytic samples from the International Food Policy Study survey in 2018, 2019, 2020, 2021, or 2022 in Australia, Canada, Chile, Mexico, the United Kingdom, or the United States.	126
Table 7.2: Possible combinations of alignment and discrepancies between year-to-year changes in the proportion of food insecurity and specific categories of determinants and consequences.	132
Table 7.3: Hypotheses for observed compared to predicted proportion of adults living in food-insecure households by country in 2020, 2021, and 2022.	134

Table 7.4: Sociodemographic characteristics of adults aged 18 to 100 years participating in the International Food Policy Study in 2018, 2019, 2020, 2021, and 2022, by country (n = 104,418) ^{1,2}	138
Table 7.5: Sociodemographic characteristics of adolescents aged 10 to 17 years participating in the International Food Policy Study in 2019, 2020, 2021, and 2022, by country (n = 44,759) ^{1,2}	140
Table 7.6: Adjusted relative risk ratio of living in households with marginal, moderate, or severe food insecurity in 2020, 2021, or 2022 compared to 2019 among adults aged 18 to 100 years, by country and year-by-characteristics interaction for levels of the characteristics selected <i>a priori</i> , International Food Policy Study (n = 104,418) ¹	151
Table 7.7: Adjusted odds of any experiences of food insecurity 2020, 2021, or 2022 compared to 2019 among adolescents aged 10 to 17 years, by country and year-by-characteristics interaction for levels of the characteristics selected <i>a priori</i> , International Food Policy Study (n = 44,759) ¹	158
Table 8.1: Policy analysis hypotheses for year-to-year changes in food insecurity compared to observed year-to-year trends in food insecurity among adults in six countries.	172

List of abbreviations

AOR	Adjusted odds ratio
ARRR	Adjusted relative risk ratio
AUS	Australia
BIG	Basic income guarantee
BIPOC	Black, Indigenous, People of Color
CAN	Canada
CARES Act	Coronavirus Aid, Relief, and Economic Security Act
CHI	Chile
CI	Confidence interval
COVID-19	Coronavirus disease 2019
ELCSA	Escala Latinoamericana y Caribeña de Seguridad Alimentaria (Latin American and Caribbean Food Security Scale)
HFSSM	Household Food Security Survey Module
IFPS	International Food Policy Study
MEX	Mexico
ORE#	Office of Research Ethics number
Ref	Reference category
SAS	Statistical analysis software
SNAP	Supplemental Nutrition Assistance Program
SDGs	Sustainable Development Goals
UK	United Kingdom
US	United States
USDA	United States Department of Agriculture

1.0 Background

1.1 Overview and scope

Adequate food access is essential for health and well-being. Approximately 2.4 billion people globally had limited access to food in 2022 (1), despite a supply from all foods of approximately 2,959 kilocalories per capita per day in 2021 (2). This disconnect demonstrates that adequate food availability is necessary but not sufficient to address food insecurity (3–5). Food insecurity is the “lack [of] regular access to enough safe and nutritious food for normal growth and development and an active and healthy life” (6). The permeation of neoliberalism globally has contributed to the endurance of food insecurity by compromising the distribution of agroecological, economic, and social supports necessary for access to food (7). Neoliberalism is based on the notion that resources are more effectively distributed by the free market than by the government (8,9). Under this model, government social support is limited, and individuals are expected to independently fix the problems they experience, such as poverty (8). Food insecurity is also perpetuated by colonialism and capitalism. Colonialism is the establishment of control in an area or over group of people (10), while capitalism is an economic system in which the production of goods and services is controlled by private owners, e.g., businesses, rather than the government and a primary goal is to make money (11). Capitalism is linked to inequality, which ultimately contributes to poverty and food insecurity (8). Thus, ensuring individuals have sufficient agency and power to acquire food either through access to financial resources to purchase food or land and water to produce food is essential (7).

In high-income countries, food insecurity in households is often characterized as limited access to food due to financial constraints (12,13). Household food insecurity is tied to a range of adverse consequences among adults and adolescents, including unfavorable nutritional

outcomes, chronic disease, and poor mental health (14–17). Responses to household food insecurity in high-income countries have predominantly been food-based (18–21), while substantial evidence demonstrates income-based supports are more effective (18,22–27). Addressing the financial precarity and social inequity that underlie household food insecurity in high-income countries is essential for achieving the Sustainable Development Goals (SDGs), including SDG 2, “End hunger, achieve food security and improved nutrition and promote sustainable agriculture”, by 2030 (28,29). Efforts to eliminate household food insecurity would also assist in addressing SDG 1, “End poverty in all its forms everywhere” and SDG 3, “Ensure healthy lives and promote well-being for all at all ages” (29) because of the interconnections between poverty, food insecurity, and health. Attainment of these goals has been threatened by the Coronavirus disease 2019 (COVID-19) pandemic (30–32). There are indications that the COVID-19 pandemic has exacerbated food insecurity globally by disrupting daily life through the implementation of safety measures (e.g., lockdowns) to contain its spread (33–36). However, responses to mitigate the negative consequences of COVID-19 related safety measures, including income supports, may have reduced the prevalence and severity of food insecurity. Research is needed to understand if food insecurity has changed and what policy responses may have been protective against experiences of food insecurity.

This thesis augments the growing body of research about the impact of the COVID-19 pandemic, and related safety measures, on food insecurity among adults living in households and adolescents in Australia, Canada, Chile, Mexico, the United Kingdom (UK), and the United States (US) using repeat cross-sectional data and a policy analysis. These geographic contexts were selected due to their overarching similarities in culture, language, and food environment (37). Drawing upon Hofstede's Six Dimensions of Culture, power distance, individualism,

motivation towards achievement and success (dimension name recently changed from masculinity), uncertainty avoidance, long term orientation, and indulgence, there are varying degrees of similarity across the selected countries (38–40). For example, in Australia, Canada, the UK, and the US, there is a lower level of power distance—the extent to which there is inequality in the distribution of power in a society and it is accepted—while in Chile and Mexico, the power distance is higher. These countries were also of interest to compare because most are classified as high-income countries, with a federalist government organization, and political regimes that are either an electoral or liberal democracy (41–44).

Analyses of repeat cross-sectional data interrogated changes in food insecurity prevalence in 2020 relative to 2019. A policy analysis compared packages of economic and social policy responses implemented or revised between January 2020 and December 2022 in the countries of interest. Repeat cross-sectional data were also used to determine whether food insecurity prevalence differed, or not, from the prevalence predicted had the COVID-19 pandemic not occurred in 2020, 2021, and 2022 and examined population subgroups anticipated to be more likely to experience food insecurity during (2020 to 2022) relative to before (2019) the COVID-19 pandemic.

1.2 Thesis organization

This thesis starts with a review of the literature on food insecurity among adults and adolescents before providing an overview of the context associated with the COVID-19 pandemic in each country of interest (**Chapter 2**). **Chapter 3** outlines the rationale and the specific aims for each of the three studies contained within this thesis. A brief overview of the methods used in each study and the process for engaging with collaborative working group members are outlined in **Chapter 4**. **Chapters 5, 6, and 7** are three inter-related studies that address each of the specific aims noted in **Chapter 3**. Repeat cross-sectional data from the International Food Policy Study are used in **Chapters 5 and 7**, while **Chapter 6** is a policy analysis that relies primarily on grey literature. **Chapter 8** provides a general discussion of findings from the three studies and concludes with implications for future research and policy (**Chapter 8**).

2.0 Literature review

This section contains an overview of four topic areas that pertain to the focus of this thesis, food insecurity among adults and adolescents during the COVID-19 pandemic in Australia, Canada, Chile Mexico, the UK, and the US. The first section provides an overview of food security and insecurity, followed by an overview of the COVID-19 pandemic and country-specific context. The implications of the COVID-19 pandemic and associated safety measures are discussed, before briefly concluding the literature review with an overview of natural experiments and cross-country comparisons.

2.1 Food security and food insecurity

Food security and food insecurity are two inter-related yet distinct concepts. The Food and Agriculture Organization of the United Nations states that food security is “A situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life” (1,45). Food security includes four inter-related dimensions: availability, access, utilization, and stability (1,46). The High Level Panel of Experts on Food Security recently recommended the addition of the agency and sustainability dimensions given their influence on food security (47). These dimensions collectively highlight the range of factors needed to enable food security.

Food insecurity, the “lack [of] regular access to enough safe and nutritious food for normal growth and development and an active and healthy life” (6), is recognized as a major global concern (1). The Food and Agriculture Organization of the United Nations monitors the prevalence of individuals experiencing of food insecurity using the Food Insecurity Experience Scale (1). As of 2023, 29.6% of the global population experienced moderate or severe food

insecurity in the previous year (1). The lowest prevalence was observed in North America and Europe (8.0%), while the highest prevalence in 2022 was observed in Africa (60.9%) (1). These figures demonstrate the global scale of food insecurity and the challenges that lie ahead as the world strives to “End hunger, achieve food security and improved nutrition and promote sustainable agriculture” by 2030 (29).

More broadly, numerous other experience-based modules and scales were developed and used to quantify the prevalence and severity of food insecurity at the household level prior to the development of the Food Insecurity Experience Scale (48,49). At the household level, food insecurity is defined as the inability to access food due to limited financial resources (12) and encompasses four domains: food quality, food quantity, psychological effects, and social effects (50–52). This conceptualization of food insecurity is related to the access dimension of food security.

2.1.1 Household food insecurity measurement

Food insecurity at the household level is often measured in high-income countries using the Household Food Security Survey Module (HFSSM) (53–56). In Canada and the US, the 18-item HFSSM is included on national surveys (53,54). The HFSSM was developed in 1995 as part of the US Department of Agriculture’s (USDA) work to quantify the prevalence of households experiencing food insecurity and hunger in the US (57,58). This measure was designed to be unidimensional and capture experiences of food insecurity related to inadequate food access due to insufficient financial resources (58). Thus, other experiences of food insecurity, including food safety, acquisition of food using socially acceptable means, and nutritional quality of diets, contained in the Life Sciences Resource Office food insecurity

definition that guided HFSSM development were not integrated into the module (57). The HFSSM also does not capture food security dimensions—food availability, utilization, stability, agency, and sustainability—outlined by the Food and Agriculture Organization of the United Nations and the High Level Panel of Experts on Food Security (46,47).

Ten items in the 18-item HFSSM query experiences of food insecurity among adults in the household, with eight enquiring about experiences of food insecurity among children under the age of 18 years as reported by an adult in the household (57,59). Experiences captured range from worrying about running out of food and cutting back on the quality or quantity of food consumed to going a whole day without eating (57,59). Hunger, a severe manifestation of food insecurity, is also captured in the HFSSM. The USDA and Health Canada use different coding methods to determine household food security status and, in turn, different naming conventions (60,61). To apply the USDA coding method, the number of affirmations to questions on the full module are summed to classify households as having high food security (0 affirmations), marginal food security (1 to 2 two affirmations), low food security (households without children: 3 to 5 affirmations; households with children: 3 to 7 affirmations), and very low food security (households without children: 6 to 10 affirmations; households with children: 8 to 18 affirmations) (60). In contrast, Health Canada draws upon scores based on each of the adult and child scales to classify households as food secure (0 affirmations), marginally food insecure (1 affirmation), moderately food insecure (adult scale: 2 to 5 affirmations, child scale: 2 to 4 affirmations), or severely food insecure (adult scale: 6 or more affirmations, child scale: 5 or more affirmations) (61). When there is discordance between the classification based on the adult and child scales, the most severe classification is used. Prevalence estimates generated using the USDA and Health Canada coding methods are not directly comparable because of differences in

the number of affirmations that correspond to each food security classification and how the adult and child scales are combined to determine household food security status (62).

Food insecurity measurement in the UK, which was recently added to national level surveys, also draws upon the HFSSM (63). Measurement of food insecurity in Australia occurs inconsistently and the most current estimate at the national level is from 2011/2012 financial year and drawn from a single item (64–66). In Chile and Mexico, recent food insecurity estimates were captured using the Food Insecurity Experience Scale and presented as three-year averages (67). The Latin American and Caribbean Food Security Scale (ELCSA) is also applicable to the Chilean and Mexican (68,69). Like the HFSSM, the ELCSA captures experiences of food insecurity among adults and children in the household using 15 items. This thesis draws upon the HFSSM and uses Health Canada’s coding method and naming convention.

2.1.2 Prevalence of household food insecurity

Beginning in 2019, the HFSSM was included on the Canadian Income Survey, enabling annual estimation of food insecurity prevalence in Canada. Estimates from the Canadian Income Survey are higher than estimates from the Canadian Community Health Survey, the survey previously used to monitor food insecurity. Differences are only partially explained by survey design differences (70). In the ten Canadian provinces, the prevalence of household food insecurity in the past 12 months based on data collected between January to June 2022 was estimated to be 17.8% (12). The prevalence of food insecurity in the US in 2022 as measured by the HFSSM with a 12-month reference period was 12.8% (13). As noted, prevalence estimates between the USDA and Health Canada coding methods are not comparable, which partially explains the higher prevalence estimates in Canada compared to the US (62).

In the UK, two different surveys have been used to estimate the prevalence of food insecurity, Food and You 2 and the Family Resource Survey. Food and You 2 is a cross-sectional survey administered biannually in England, Northern Ireland and Wales (71). Weighting is applied to facilitate the representativeness of the sample (71). The Family Resource Survey collects data on an annual basis and is representative of all private households in the UK (72,73). Based on the Food and You 2 survey conducted from April to July 2022, which used the 10-item HFSSM and USDA coding method, the prevalence of marginal, low, and very low household food security in the past 12 months was 32% in England, 35% in Northern Ireland, and 38% in Wales (74). When the survey was repeated between October 2022 and January 2023, the prevalence of food insecurity was 38% in England, 41% in Northern Ireland, and 43% in Wales (71). An estimated 17% of households experienced marginal, low or very low food security in the previous 30 days during the 2022/2023 financial year, as measured by the 10-item HFSSM in the Family Resources Survey (73).

A food relief program, Foodbank, commissions annual data collection to estimate the prevalence of household food insecurity in Australia (75). Data are weighted to be nationally representative with respect to age, gender, household composition, state, and location (capital city versus rest of state). The Foodbank Hunger Report 2023 estimated the prevalence of marginal, low, or very low food insecurity to be 48% in Australia during the previous 12 months, as measured by the administration of 18-item HFSSM during July 2023 and the USDA coding method (76).

Using data from the Gallup World Poll, the three-year average from 2020 to 2022 of moderate and severe food insecurity, as measured by the Food Insecurity Experience Scale with

a 12-month reference, was 27.6% in Mexico (67). Following the same methodology, the three-year average prevalence of moderate or severe food insecurity in Chile was 18.1% (67).

2.1.3 Child and adolescent experiences of food insecurity

Prior research consistently demonstrates households with children and adolescents are more likely to be food-insecure or have a higher prevalence of food insecurity compared to households without children (63,71,74,77–80). Radimer et al. characterized hunger as a managed process whereby children are partially protected from the initial concerns and reductions in food quality and quantity (50,52), a finding that has been corroborated by further research (81–84). Despite this understanding, there is a substantive body of evidence demonstrating that adults are only partially aware of the extent of food insecurity experienced by children (85–88). Among 16 families who identified as Hispanic in South Carolina, in-depth interviews demonstrated that adults reported only two-fifths of the experiences of food insecurity their children and adolescents shared (85). Similar findings have been drawn from research conducted with dyads in the US (86–88).

Children and adolescents experience food insecurity differently than adults (85,89–91). Household food insecurity among adults is conceptualized to encompass four domains, including food quality, food quantity, psychological effects, and social effects. In contrast, research suggests that children and adolescents' experiences fall within two domains, awareness (cognitive, emotional, physical) and taking responsibility (participation in food management, initiation of food management, resource generation) (85,89–91). Recognizing that children and adolescents understand and can report their experiences of food insecurity (85,89), researchers in conjunction with United Nations Children's Fund recently developed a scale to capture

experiences of food insecurity among school-aged children aged 5 to 18 years (92). This scale has been examined for accuracy, cross-context equivalence, and reliability (92). Acceptable criterion validity relative to other markers of food insecurity and cross-context equivalence were demonstrated using Cronbach alpha (0.88 to 0.94 across countries) and confirmatory factor analysis. The Child Food Insecurity Experiences Scale uses ten items to query about child and adolescent experiences of food insecurity and their frequency of occurrence (92). Similar to the HFSSM, each item is scored and summed to result in an overall score that classifies children as having no (0 affirmations), few (1 to 6 affirmations), several (7 to 11 affirmations), or many (12 to 20 affirmations) experiences of food insecurity (92). Development of a food insecurity scale for children enables direct estimation of food insecurity prevalence among this population (92), which is important because adults are not always aware of all of children's experiences of food insecurity, resulting in the underestimation and potentially mischaracterization of this public health problem.

In Canada and the US, the prevalence of children under 18 years of age living in food-insecure households is estimated using the HFSSM (12,13). It is estimated that 24.3% of children in Canada and 18.5% of children in the US lived in food-insecure households in 2022 (12,13). Due to differences in coding methods estimates are not comparable (62).

The Food Foundation, an organization aiming to alter business practices and policies related to food in the UK (93), has estimated the prevalence of children under 18 years of age living in food-insecure households as reported by adults to be 12% in the previous 6-months as of January 2021 when measured using three items that were adapted from the HFSSM (34). When directly asking children and adolescents in the UK about their experiences of food insecurity, the prevalence of food insecurity experiences was estimated to be 20% among

individuals aged 8 to 17 years during Christmas 2020/January 2021 (34). Data were collected from children and adolescents aged 7 to 17 years during September 2022. However, only those living in England were surveyed (94). Therefore, this estimate does not reflect an estimate of food insecurity for the UK, which includes England, Northern Ireland, Scotland, and Wales.

Quantification of food insecurity among children and adolescents in Australia is limited by the lack of national monitoring using a comprehensive measure of food insecurity (65,66). Nevertheless, the Foodbank Hunger Report 2023 estimated that 47% of households with children under 18 years of age experienced low or very low food security in the previous 12 months, as measured by the 18-item HFSSM using the USDA coding (75).

The food insecurity estimates in Chile and Mexico noted above do not differentiate between adults and children under 18 years of age. Therefore, the prevalence of food insecurity among children is unclear (67).

2.1.4 Determinants of household food insecurity

This section reviews the determinants of household food insecurity, when evidence is available, in the countries of interest to this thesis. Evidence on the determinants of household food insecurity is primarily drawn from Canadian and US research due to the availability of household food insecurity data from national level surveys. Findings from Australia and the UK are also presented when available.

Household food insecurity is driven by financial insufficiency rather than a lack of food skills or other related knowledge needed to acquire, prepare, and consume food (95,96). Thus, individuals who are socially and economically disadvantaged in colonial and capitalistic societies are more vulnerable to food insecurity compared to individuals who do not face social

and economic disadvantage. A 2019 study demonstrated that individuals in Canada who draw upon employment insurance, workers compensation, or social assistance are two to three times more likely to live in food-insecure households compared to those who rely on income received through wages, salaries, or self-employment (77). These findings reinforce prior research that similarly identified reliance on employment insurance or social assistance as a determinant of household food insecurity (12,80). In Canada, social assistance is largely not indexed to inflation, meaning these benefits are not able to cover the cost of living (97). Contrastingly, individuals in households whose main source of income is seniors' income (pensions, dividends, interest) are less likely to experience food insecurity (12,77,98,99), with pensions indexed to inflation (100). More broadly, the contrast between receipt of social assistance and seniors' income with respect to food insecurity risk demonstrates that low levels of income are tied to food insecurity (71,74,79,80,101–103).

Beyond income, assets, savings, liquidity constraints, and debt influence resources available for food and therefore, risk of food insecurity. Households with assets and savings are better protected against food insecurity (104–106) given their ability to buffer against fluctuations in income (98). Research demonstrates households are more likely to be food insecure if they have liquid assets equivalent to less than three months of income compared to households that have liquid assets equivalent to at least three months of income (105). Food insecurity is more likely in households that lack non-pension financial assets that equal at least six months of income compared to households that have this asset. Households with inadequate assets, or asset poverty, are also more likely to be food insecure (105). In US households with children, the type of debt accumulated is associated with household food insecurity (107). Households are more likely to be food insecure if they have medical debt compared to if they do

not. There is little indication, however, that credit card debt and total debt from all sources, credit card, legal bills, loans from relatives, medical, and other sources of unsecured debt, are associated with food insecurity (107). The odds of experiencing food insecurity are higher among individuals who rent their housing compared to those who own their housing (12,77,80,108). Research published in 2020 in Canada demonstrated that the value of the home owned may play a role in the likelihood of living in food-insecure households (109).

Food insecurity has been found to be more pervasive among individuals identifying as women than among individuals identifying as men (110–112). This gender gap has been attributed to differences in level of educational attainment, level of income, and social networks (110). A higher number of women and girls live in poverty than men and boys (113,114), likely contributing to the differential pattern of food insecurity. Racial and ethnic identity has also been identified as a determinant of food insecurity. Research has repeatedly demonstrated that households headed by individuals identifying as Black, Latino, or Indigenous are more likely to live in food-insecure households compared to households headed by individuals identifying as White (63,77–80,101,115). Lower levels of educational attainment, such as completing some post-secondary education or high school education compared to completion of a university degree, are associated with a higher odds of food insecurity (12,77–79,101,103). Moreover, individuals who hold consistent full-time employment are less likely to experience food insecurity compared to individuals who work multiple jobs, part-time, or inconsistent hours, or who are unemployed (71,74,78,101). Household composition is also tied food insecurity. Lone caregiver households, particularly those led by individuals identifying as women, and households with children are more likely to be food-insecure compared to households without children or households where an individual lives alone (63,71,74,77–80,103).

2.1.5 Consequences of household food insecurity

Food insecurity has deleterious consequences for adults and children, demonstrated in cross-sectional and longitudinal research. Consumption of fruits, vegetables, and dairy products is lower among adults living in food-insecure households compared to adults in food-secure households (14,116–119). Diet quality, as measured by the Healthy Eating Index-2005, Alternate Healthy Eating Index-2010, Healthy Eating Index-2015, and Canadian Healthy Eating Index, is also lower among adults in food-insecure households (117,119–121). Beyond nutrition implications, living in food-insecure households is tied to poor self-reported general and physical health. Adults in food-insecure households are more likely to have asthma, diabetes, heart disease, hyperlipidemia, and hypertension than adults in food-secure households (16,122,123). The odds of poor self-reported mental health, anxiety, depression, and suicidal ideation are also higher among adults in food-insecure households (15,124,125). Reciprocal associations between food insecurity and chronic conditions have been demonstrated, whereby individuals with one or more chronic condition are more likely to live in food-insecure households compared to adults with no chronic conditions (126). Household food insecurity also undermines the ability to manage chronic conditions, including diabetes (127,128), celiac disease (129), and human immunodeficiency virus (130,131). A 2021 meta-analysis shows that food insecurity is associated with low medication adherence (132). Cross-sectional and longitudinal research also demonstrates that living in food-insecure households is associated with higher healthcare use (e.g., hospitalization, same-day surgery) and costs compared to living in food-secure households (133–139). Among adults, food insecurity is associated with mortality (140,141).

Children and adolescents in food-insecure households have been found to have inadequate intakes of calcium, magnesium, protein, vitamin A, and vitamin D (14,142). Intake of fruit, vegetables, and dairy products is lower among children and adolescents living in food-insecure households compared to their food-secure peers (14,117,143). Children under 18 years of age in food-insecure households are also more likely than food-secure peers to have a higher incidence of injuries (144), worse general health (145–148), anemia (149,150), and asthma (151,152). Evidence from the US National Health Interview Study suggests that rates of lifetime and current diagnosis of asthma are 16.3% and 19.1% higher, respectively, among children aged 2 to 17 years in food-insecure households compared to those in food-secure households (147). There are considerable differences in health care utilization by food security status. Children aged 2 to 17 years in food-insecure households visited the emergency department at a 25.9% higher rate and delayed medical care because of costs at a 146.5% higher rate compared to if they lived in food-secure households. Rates of requiring dental care, medical care, and mental health care but being unable to afford these services are 105.5%, 179.8%, and 114.3% higher, respectively, among children in food-insecure households compared to those living in food-secure households (147). Similarly, children and adolescents in Ontario, Canada who lived in food-insecure households had higher mental or substance use disorder-related health service use compared to their peers in food-secure households (153). Higher healthcare costs among children living in food-insecure households relative to children in food-secure households have also been identified among children aged 1 to 17 years in Ontario (154). Among children and adolescents, food insecurity, food insufficiency, and hunger are associated with anxiety, depression, dysthymia, poor-self reported mental health, mood disorders, suicidal ideation, and suicide attempts (124,155–159). Mental health during adolescence and young adulthood is negatively

influenced by hunger during childhood (160,161). Food insecurity and food insufficiency among children also negatively influences academic achievement, behavior, and psychosocial development (162–167). Longitudinal research using data from the Early Childhood Longitudinal Study, Kindergarten Class demonstrates that living in food-insecure households is associated with diminished development of approaches to learning (e.g., eagerness to learn), interpersonal relations (e.g., expressing opinions in a positive way), and self-control (e.g., controlling temper) (166,167). Collectively, the range of adverse consequences associated with food insecurity underscores the urgency of addressing this issue, particularly during early life given the potential for enduring negative ramifications.

2.1.6 Responses to household food insecurity

This section provides a brief overview of interventions that directly or indirectly address household food insecurity in high-income countries. Policy responses range from food-based assistance, which has been emphasized in responses to household food insecurity (18–21), to economic and social policy responses (168). Examples of interventions that fall within these categories are discussed with respect to their utility for addressing household food insecurity.

Food banks and food pantries are supports that provide individuals with food at no cost. Evidence suggests this type of intervention provides limited benefit (169–171) and is insufficient for alleviating food insecurity (18,172). Food-based support is unable to eliminate food insecurity because it does not address the economic hardship that underlies food insecurity (19,171,173). Use of food banks can also confer stigma, leading to feelings of embarrassment, fear, and shame among individuals accessing food from food banks (169,171,174,175), which can lead individuals to avoid these supports (169). Even when food banks are accessed, they are

unable to supply the quality and quantity of food needed to address experiences of household food insecurity (169,171,172), further underscoring the inability of this support to eliminate food insecurity. Nevertheless, food banks remain a primary strategy for addressing food insecurity in Australia, Canada, the UK, and the US (18–21). Community food programs, such as community kitchens and gardens, similarly aim to support food security by providing opportunities to grow food, facilitating communal cooking, or teach individuals how to manage limited financial and food resources (18,176,177). Like food banks, community food programs in high-income countries are unable to ameliorate food insecurity (95,176–178) because they do not address the financial insufficiency that underlies food insecurity.

A well-known social policy response is the US Supplemental Nutrition Assistance Program (SNAP). SNAP, originally known as the Food Stamp Program, was created as a way to compensate for food surpluses while supporting individuals unable to access food during the Great Depression (179,180). Over time, this program has expanded to a range of interventions; nonetheless, central to this program is the provision of money on a designated card that can be used to buy select foods. Evidence suggests SNAP reduces food insecurity but is insufficient to fully eliminate all experiences of food insecurity (18,181–185).

Among children, limited access to food is partially addressed through school meal programs in Chile, Mexico, the UK, and the US (186–188). National school meal programming is not in place in Australia and Canada (188). Despite some benefits of food-based social supports, researchers and providers of food-based programming have raised concerns about focusing solely on food provision rather than targeting resources towards programming that addresses the key drivers of food insecurity (176,186).

Pensions and cash transfers are other forms of social and economic policies that have mostly been found to support food security (**Table 2.1**). The prevalence of food insecurity is lower among individuals receiving pensions compared to those not receiving pensions (98,99) because this financial support provides an income floor below which individuals cannot fall. Moreover, there are several examples of cash transfers that have, in part, supported amelioration of food insecurity in Canada, including the Canada Child Benefit (previously the Universal Child Care Benefit), the Poverty Reduction Strategy in Newfoundland and Labrador, and a one-time increase to the social assistance benefit program in British Columbia (23–26). The PROSPERA Social Inclusion Program, a conditional cash transfer program for families in Mexico, has been shown to reduce the severity of household food insecurity (27). Using a quasi-experimental design, it was determined that countries in Europe with social protection (e.g., cash transfers and in-kind benefits) spending of at least \$10,000 per capita were able to buffer against increases in food insecurity prevalence, even when unemployment rose and wages declined, compared to regions where spending on social protection spending was limited (189). In contrast, the introduction of the UK’s Universal Credit is associated with increased food bank use (190). The requirements to receive Universal Credit, length of time for claims to be processed, and payments in arrear have been noted as potential mechanisms that drive associations between simultaneous increases in Universal Credit claims and food bank use (190). In Chile, research on the influence of cash transfer programs targeting subgroups of the population (e.g., Ethical Family Income, Ingreso Ético Familiar) (191) appears to be limited.

Table 2.1: Overview of select social protection programs.

Social protection program	Benefit details	Country
Pensions (192)	A benefit that replaces a portion of an individual's income when they retire.	Australia, Canada, Chile, Mexico, UK, US
Canada Child Benefit (Universal Child Care Benefit) (193)	Income-based support program that provides financial support to households with individuals under the age of 18 years. Disbursement amount varies based on adjusted family net income and number of children in the household.	Canada
Newfoundland and Labrador poverty reduction strategy (194)	The poverty reduction strategy included five goals including strengthening the social safety net and improving earned incomes. Initiatives to address these aims included implementing a Rent Supplement Program, increasing Income Support benefits, and expanding eligibility for the Earned Income Supplement.	Canada
British Columbia social assistance program (195)	Income-based support program that provides financial assistance to households based on their assets and income. The value of this benefit was increased from 2005 to 2007 (the timeframe investigated by Li et al., 2015).	Canada
PROSPERA Social Inclusion Program (196)	A conditional cash transfer program with the goal of improving diet quality and diversity, among other aims.	Mexico
Universal Credit (197)	Financial assistance provided to individuals to help offset their cost of living. This benefit is provided to adults who have a total level of investments, savings, and money up to £16,000.	United Kingdom
Ethical Family Income, Ingreso Ético Familiar (191)	A joint program that recommends actions for social and labor support and provides financial support through conditional cash transfers.	Chile

Collectively, the evidence indicates governments do have the capacity to address food insecurity using economic and social policies, though these are currently limited. Despite the benefit of some financially based social supports, they are often temporary and provide support to a limited portion of the population (22). A basic income guarantee (BIG), an income transfer program that provides an income threshold below which individuals cannot fall (22,198,199), is

an alternative to the interventions noted. In Ontario, a pilot project demonstrated the utility of a BIG in addressing food insecurity (200). The MINCOME experiment in Dauphin, Manitoba provided a similar opportunity to explore the benefits of a BIG. However, data related to food insecurity were not collected (201). Several BIG pilots were pending or underway in the US as of May 2022 (202). A petition calling for universal basic income in the UK was considered by the UK Parliament Petitions Committee in 2020; however, no further action towards implementation has been taken (203). As of 2022, a BIG has not been implemented in any country (204).

2.2 The COVID-19 pandemic and country-specific context

In December 2019, SARS-CoV-2 (commonly known as COVID-19) was identified (205,206). COVID-19 rapidly spread around the globe, prompting the World Health Organization to declare a Public Health Emergency of International Concern from January 30, 2020 to May 5, 2023 and characterize its spread as a pandemic in March 2020 (207). Over the years that followed, safety measures of various stringencies and durations were implemented to reduce the spread of COVID-19 (208,209). Measures included requiring mask wearing in public spaces, maintaining physical distance (at least two meters of space between individuals), and lockdowns (210,211). As a side effect, there were widespread disruptions to daily life, including cancellation of mass gatherings, retail and travel restrictions, and childcare, school, and workplace closures (210,211).

A range of policy responses were implemented to provide short-term support as a means to mitigate these disruptions (212). Policy responses implemented to counter disruptions may have influenced food insecurity given they included unemployment protection, employment

protection, housing, income supports, healthcare (213), all of which are types of policy responses demonstrated to influence food insecurity (28,98,189,214). The Blavatnik School Government, University of Oxford systematically tracked government policy responses to the COVID-19 pandemic globally between January 2020 and December 2022 (209,215).

To contextualize the COVID-19 pandemic in each country under investigation, information about when the first case of COVID-19 was detected, when a state of emergency was declared, estimates of the number of COVID-19 cases and deaths, and vaccination rates is provided. Select indices corresponding to how strict government responses to the COVID-19 pandemic were, the level of income support, and debt and contract relief provided were also of interest because they summarize country-specific contextual features with the potential to influence food insecurity.

The Stringency Index, focused on COVID-19 containment and closure policies, characterizes how strict government responses to COVID-19 were, ranging from 0 (least strict) to 100 (most strict) (215). Metrics that composed the Stringency Index included international travel controls, restrictions on internal movement, public information campaigns, stay-at-home requirements, closure of public transportation, restriction on public gatherings, cancellation of public events, workplace closures, and school closures (216). The Blavatnik School Government, University of Oxford also tracked income support as well as debt and contract relief (217,218). Income support included cash transfers, salaries for lost wages, and universal basic income provided by the government to individuals who could not work or lost their job during the COVID-19 pandemic (217,218). For each country on a daily basis, the level of support was designated as having no income support, coverage for less than 50% of lost salary, coverage for more than 50% lost salary, or no data available. Debt and contract relief at the household level

was similarly recorded for the highest level of government, national or territory/state, and included policies which banned evictions, halted loan repayment, and stopped the termination of utility services (217,218). The level of debt and contract relief was recorded as no relief, narrow relief (relief for one type of contract), broad relief, or no data. Below are country-specific overviews that provide information about COVID-19 spread, vaccination rates, as well as the timing of income support and debt relief to situate the context within which to consider changes in food insecurity during the COVID-19 pandemic.

2.2.1 Australia

The first case of COVID-19 was announced on January 25, 2020 (219) and on March 18, 2020, a state of emergency was declared in Australia (220). As of April 21, 2024, 11,836,372 cases (46,417/100,000) of COVID-19 and 25,165 deaths (99/100,000) were recorded (221). Vaccination in Australia started on February 21, 2021. According to the World Health Organization, 21,766,240 individuals (85%) in Australia had completed their primary series vaccination as of November 26, 2023, with 14,405,773 individuals (56%) receiving at least one booster or additional COVID-19 vaccine dose (221). Leveraging the Blavatnik School of Government, University of Oxford's COVID-19 Government Response Tracker, the stringency of government policies reached 50 (out of 100) in March 2020 and remained above this threshold until March 2021 (215,222,223). By the end of May 2021, the stringency was above 50 and remained so until December 2021. The stringency increased to above 50 again in January 2022 before dropping and remaining below 50. Income support provided in Australia covered less than 50% of lost salaries between March 2020 and March 2021 (217,218). The composite measure for debt relief indicates broad-based support was provided in Australia during late March 2020

(217,218). By January 2021, relief efforts were provided to only a sub-set of the population, with cessation of relief measures by the end of March 2021. As of December 31, 2022, there were no income supports or debt relief policies in place (217,218).

2.2.2 Canada

The first case of COVID-19 was reported on January 25, 2020 (224), while a state of emergency was never declared by the federal government in Canada (220). Implementation of any state of emergency was by provincial and territorial governments. As of April 21, 2024, 4,789,387 cases (12,690/100,000) of COVID-19 and 54,282 deaths (144/100,000) were recorded (221). Vaccination in Canada started on December 14, 2020. Based on the World Health Organization, 31,314,748 individuals (83%) in Canada had completed their primary series vaccination as of November 26, 2023, with 19,860,368 individuals (53%) who had received at least one booster or additional COVID-19 vaccine dose (221). Stringency reached 50 (out of 100) in March 2020 and remained at this level until March 2022 (215,222,223). From March 2022 onward, the stringency declined. After the onset of the COVID-19 pandemic, income supports provided greater than 50% of lost salary for individuals who lost their job or were unable to work (217,218). This support was later reduced to less than 50% coverage of lost wages during July 2021 and maintained until May 2022. Debt relief was provided to a narrow range of recipients until November 2022 (217,218). As of December 31, 2022, there were no income supports or debt relief policies in place (217,218).

2.2.3 Chile

The first case of COVID-19 was reported on March 3, 2020 (225) and on March 18, 2020, a national emergency was declared in Chile (225). As of April 21, 2024, 5,399,561 cases (28,246/100,000) of COVID-19 and 62,669 deaths (328/100,000) were recorded (221). Vaccination in Chile started on December 21, 2020. Based on the World Health Organization, 17,721,847 individuals (93%) in Chile had completed their primary series vaccination as of November 26, 2023, with 15,779,147 individuals (83%) receiving at least one booster or additional COVID-19 vaccine dose (221). Government responses reached a stringency of 50 (out of 100) in March 2020 and remained above this threshold until October 2021 (215,222,223), after which the stringency never rose above 50. During this period of stringency above 50, a stringency of 80, a threshold that has been suggested to identify high stringency (226), was surpassed multiple times. Starting early April 2020, income support was provided for less than 50% of total lost wages (217,218). By mid-June 2020, this support was increased to cover greater than 50% of lost wages. During July 2021, income support was reduced to cover less than 50% of total lost wages before being ceased at the end of August 2021 (217,218). At the end of March 2020, narrow debt relief was provided in Chile, which was later increased to broad based support in August 2020. Towards the end of July 2021, support for debt relief ended. As of December 31, 2022, there were no income supports or debt relief policies in place (217,218).

2.2.4 Mexico

The first case of COVID-19 was reported on February 28, 2020 (220) and on March 30, 2020, a state of emergency was declared in Mexico (220). As of April 21, 2023, 7,709,747 cases (5,980/100,000) of COVID-19 and 335,011 deaths (260/100,000) were recorded (221).

Vaccination in Mexico started on December 24, 2020. According to the World Health Organization, 81,407,121 individuals (63%) in Mexico had completed their primary series vaccination as of November 26, 2023, with 57,014,052 individuals (44%) receiving at least one booster or additional COVID-19 vaccine dose (221). The stringency in Mexico reached 50 (out of 100) in March 2020 and remained at or above this level until January 2021 (215,222,223). Like Chile, the stringency rose above 80 in Mexico by end the of March 2020 and lasted until the end of May 2020 (226). After the stringency dropped below 50 in January 2021, the stringency rose above 50 from July to August 2021 before remaining below 50. Income support was provided for the shortest and latest period in 2020, relative to the other countries considered, with coverage supporting less than 50% of total wages lost due to the pandemic lasting from October 2020 to February 2021 (217,218). Broad level debt relief provided in Mexico closely aligned with peak income support levels in the country (217,218). From February 2021 to May 2022, narrow debt relief were provided. As of December 31, 2022, there were no income supports or debt relief in place (217,218).

2.2.5 United Kingdom

The first case of COVID-19 was reported on January 31, 2020 (220), while a state of emergency appears to have never been declared in the UK (220,227). As of April 21, 2024, 24,920,037 cases (36,709/100,000) of COVID-19 and 232,112 deaths (342/100,000) were recorded (221). Vaccination in the UK started on December 21, 2020. Based on the World Health Organization, 50,762,968 individuals (75%) in the UK had completed their primary series vaccination as of November 26, 2023 (221). Information on individuals with at least one booster or additional COVID-19 vaccine dose is not available. The UK had a stringency of 50 (out of

100) from March 2020 to July 2021 (215,222,223). In January 2021, the stringency crossed the threshold of 80 and remained at this level until March 2021 (226). After the stringency dropped below 50 in July 2021, it remained below this level. In the UK, coverage for greater than 50% of lost wages was provided from mid-March 2020 to October 2021 (217,218). Debt relief followed a similarly generous amount of relief, with broad-based relief introduced in March 2020 and lasting until October 2021. After this time, narrow relief was provided until June 2022 (217,218). As of December 31, 2022, there were no income supports or debt relief policies in place (217,218).

2.2.6 United States

The first case of COVID-19 was reported on January 20, 2020 (228) and on March 13, 2020, a state of emergency was declared in the US (228). As of April 21, 2024, 103,436,829 cases (31,250/100,000) of COVID-19 and 1,186,079 deaths (358/100,000) were recorded (221). Vaccination in the US started on December 14, 2020. Data from the World Health Organization indicated that 230,637,348 individuals (70%) in the US had completed their primary series vaccination as of November 26, 2023, with 118,438,297 individuals (36%) receiving at least one booster or additional COVID-19 vaccine dose (221). A stringency of 50 (out of 100) was reached in March 2020 and remained above this level until July 2021 (215,222,223). The stringency fluctuated above and below 50 several times between August 2021 and December 2021 before remaining below 50. Like Canada and the UK, the US provided coverage for greater than 50% of lost salaries after the onset of the pandemic (217,218). This support, however, was reduced to less than 50% coverage by early May 2021 and eventually withdrawn in September 2021. The US government provided narrow debt relief from the end of March 2020 through to the end of

July 2021 (217,218). In early August 2021, relief was temporarily removed before being reinstated several days later. This coverage remained in place until October 2021. As of December 31, 2022, there were no income supports or debt relief policies in place (217,218).

2.3 Implications of the COVID-19 pandemic and associated safety measures

The COVID-19 pandemic and related safety measures differentially impacted portions of the population (229–232). Rates of infection and death from COVID-19 occurred disproportionately among individuals who identify as Asian, Black, Indigenous, and Hispanic (229,233,234). Reasons for inequitable disease burden are rooted in factors that limit the ability to engage in physical distancing, such as holding an occupation within the essential workforce and living in overcrowded housing (233). Structural discrimination and racism are underlying drivers of inequitable distribution of healthcare outcomes as individuals who are marginalized by colonial and capitalistic societies are not afforded the ability to access necessary care, which further undermined the capacity to recover from COVID-19 (230,233,235). The impact of this ongoing disadvantage in the context of the COVID-19 pandemic has deepened existing inequities (236,237), including experiences of food insecurity.

After the onset of the COVID-19 pandemic and introduction of associated safety measures, increases in the prevalence of food insecurity were documented in Australia, Canada, Chile, Mexico, the UK, and the US (30,36,94,238–241). However, interpretation of trends in the prevalence of food insecurity from before to during the COVID-19 pandemic is complicated by the use of different measurement tools, measurement over different reference periods, and studies conducted at different times of the year (238,240,241). These differences make it challenging, and in some instances not possible, to compare food insecurity estimates from

before to those during the pandemic (242). Comparable measurement of food insecurity before and during the COVID-19 pandemic is critical for understanding changes, or lack thereof, in food insecurity. The introduction of various economic and social policy responses to offset the impact of COVID-19 pandemic and related safety measures also raises questions about their influence on food insecurity. Accurate measurement of food insecurity is needed to examine the influence that economic and social policy responses had on food insecurity.

2.4 Natural experiments and cross-country comparisons

The COVID-19 pandemic was a natural experiment due to its rapidly evolving nature and variation in policy responses between countries. Natural experiments are part of the broader umbrella of quasi-experimental designs (243,244), which offer researchers a range of pragmatic study designs to explore the influence that policy responses have on an outcome of interest, such as household food insecurity (245,246). Natural experiments are also advantageous because they do not rely on strict participant inclusion criteria and highly controlled research settings (247), which makes them more externally valid than randomized experiments (243,247). When implementing interventions such as policies, context is critical to consider because it shapes the feasibility of implementing, uptake, and impact of an intervention (248), which demonstrates the value of drawing upon study designs that maximize external validity. Numerous studies within the field of food insecurity research have drawn upon natural and quasi-experiments (23,24,249). These designs are also suitable for cross-country comparison (37). Cross-country comparison is of interest because it strengthens the ability to study the influence of interventions, e.g., national level policy responses, when randomization is not possible (37). Comparison across countries facilitates the study of how existing policy responses can be improved by drawing upon

successes from other countries or indicating policy responses that may be helpful to adapt and implement (250–252). The rapidly evolving nature of the COVID-19 pandemic and natural variation in policy responses between countries provides an invaluable opportunity to study the influence that policy responses had on food insecurity across countries.

3.0 Rationale and specific aims

3.1 Rationale

The COVID-19 pandemic and associated safety measures disrupted daily life and, in turn, may have increased the prevalence of food insecurity (33–36,253). Measurement of the prevalence, determinants, and consequences of household food insecurity in North America has been facilitated by the inclusion of the HFSSM on national level surveys (53,54), with increasing attention on household food insecurity in Australia, Chile, Mexico, and the UK prior to and during the pandemic. Lack of consistent measurement, however, on national level surveys in all countries noted makes it challenging to understand the nature of changes, or lack thereof, in food insecurity after the onset of the pandemic. Estimates of individual-level food insecurity prevalence during the COVID-19 pandemic are available on a global scale (1). These estimates, however, are presented as regional aggregates, which creates challenges in understanding country-specific estimates (1). Access to consistent country level estimates of food insecurity is critical for implementing or revising policy responses to address food insecurity.

Relatedly, during the COVID-19 pandemic, a range of policy responses that may have influenced food insecurity was implemented or revised by national level governments. Financial shocks induced by measures to reduce the spread of COVID-19 may have exacerbated food insecurity while the economic and social policy responses implemented or revised during the pandemic may have acted as stabilizers, mitigating increases in financial hardship and, in turn, food insecurity. Research is needed to understand the influence that the COVID-19 pandemic and related economic and social policy responses had on food insecurity so insight into the types of policy responses that safeguard against food insecurity during, and even beyond, periods of crisis can be gleaned. The body of evidence on household food insecurity in high-income

countries provides ample evidence to inform the implementation of interventions to address this longstanding issue in this context (18,22–27). These interventions, however, are not in place or are only provided to portions of the population. Insight from policy responses implemented or revised during the COVID-19 pandemic have the potential to complement existing research on responses to address food insecurity and underscore policy responses that ameliorate food insecurity.

Finally, measurement of food insecurity before and during the COVID-19 pandemic primarily relied on adult reports of children’s experiences of food insecurity (33–35,70,238,239,254–257). Relying on adult reports does not enable experiences of food insecurity unique to children to be captured, with substantive evidence that there is discordance between adult and child reports (85–88). Thus, research focused on understanding children’s self-reported experiences of food insecurity, particularly during the pandemic, is needed.

Overall, deepening the knowledge base on food insecurity during the COVID-19 pandemic will add clarity to this complex period while providing insight into policy responses that can contribute to the amelioration of food insecurity and more broadly support the attainment of SDG 1, SDG 2, and SDG 3. The data source for this thesis, the International Food Policy Study (IFPS), consistently assessed food insecurity among adults and adolescents and relevant sociodemographic characteristics for multiple years before and after the onset of the COVID-19 pandemic. This data source also was designed to enable researchers to draw comparisons across countries (37). Thus, IFPS provides a unique opportunity to consider how the pandemic and associated safety measures have influenced food insecurity.

3.2 Specific aims

The overall aim of this thesis was to understand patterns in food insecurity in Australia, Canada, Chile, Mexico, the UK, and the US from an adult and adolescent perspective during the COVID-19 pandemic. Below are specific aims for each of the three studies conducted to address the overall aim of this thesis.

3.2.1 Study one – prevalence analysis

1. Did the proportions of adults living in food-insecure households and of adolescents experiencing food insecurity in Australia, Canada, Chile (adolescents only), Mexico, the United Kingdom, and the United States change from 2019 to 2020?
2. Did the changes in the proportions of adults living in food-insecure households and adolescents experiencing food insecurity in each country qualitatively follow the same trajectory?

3.2.2 Study two – policy analysis

1. How did national level government policy responses to the COVID-19 pandemic and associated safety measures (e.g., lockdowns) compare across Australia, Canada, Chile, Mexico, the United Kingdom, and the United States?
2. How did packages of policy responses map onto known patterns in household food insecurity observed in prior research?

3.2.3 Study three – attribution analysis

Were anticipated increases in food insecurity mitigated by national level economic and social policy responses implemented or revised during the pandemic?

1. Did changes in observed determinants and consequences of food insecurity in each country from 2018 (adults only) and 2019 to 2020, 2021, and 2022 align with observed changes in food insecurity among adults and adolescents from 2018 (adults only) and 2019 to 2020, 2021, and 2022?
2. Were observed changes in the proportion of adults living in food-insecure households in 2020, 2021, and 2022 within each country greater or lesser than what would have been expected had the pandemic not occurred based on the observed change from 2018 to 2019?
3. Were the odds of food insecurity higher among subgroups more likely to experience food insecurity compared to their counterparts in 2020, 2021, and 2022 compared to 2019?

4.0 General methods

Three inter-related studies were conducted to address the research aims noted. Specific aims in studies one (prevalence analysis, **Chapter 5**) and three (attribution analysis, **Chapter 7**) were examined using repeat cross-sectional data from the IFPS (37), while the second study (policy analysis, **Chapter 6**) addressed the specific aims through a policy analysis. In-depth overviews of the methods for each study are available in **Chapters 5, 6, and 7**.

IFPS is a repeated cross-sectional study that collects information about food policies and dietary patterns in multiple countries (37). The surveys include numerous self-reported scales that have been drawn or adapted from Statistics Canada, the USDA as well as other standardized sources (258–261). Surveys also collect information about food insecurity in the previous 12 months from adults using the 18-item Household Food Security Survey Module and adolescents using the 10-item Child Food Insecurity Experiences Scale (58,59,92). The quasi-experimental survey design facilitates the exploration how food-related policies influence dietary patterns and other outcomes of interest (e.g., food insecurity). Data were collected annually via online surveys in November and December from adults aged 18 to 100 years and adolescents aged 10 to 17 years living in Australia, Canada, Chile (adolescents only), Mexico, the UK, and the US. **Chapter 5** used adult data from 2018 (year 2), 2019 (year 3), and 2020 (year 4) and adolescent data from 2019 (year 1) and 2020 (year 2). **Chapter 7** used all years included in **Chapter 5** and additional data for 2021 and 2022 (Adults: years 5 and 6, Adolescents: years 3 and 4). All iterations of the IFPS were reviewed and received ethics clearance through a University of Waterloo Research Ethics Committee (ORE# 30829 and ORE#: 41477).

The primary data source for **Chapter 6** was eight policy response trackers that systematically reported on government policy measures (208,212,269,215,262–268). Policy

response trackers were selected as the primary data source because most information about policy responses during the COVID-19 pandemic was documented outside the peer reviewed literature. The search strategy for **Chapter 6** was based on practices recommended for conducting systematic grey literature searches and was developed in consultation with a research librarian at the University of Waterloo (270). Two rounds of screening occurred to identify the final list of included policy responses. Prior to the second round of screening, a theory of change articulating the hypothesized influence of economic and social policy responses implemented or revised during the COVID-19 pandemic on household food insecurity was developed to guide the second round of screening. Synthesis of policy analysis findings was facilitated by country-specific hypotheses that specified how packages of economic and social policy responses were anticipated to influence household food insecurity on a yearly basis.

The policy and attribution analyses (**Chapters 6 and 7**) were informed by input from collaborative working group members. Consultation with a collaborative working group was integrated to enhance the relevance and applicability of study findings to research and policy practice in Australia, Canada, Chile, Mexico, the UK, and the US. The Cochrane Six-Step Stakeholder Engagement Framework and National Cancer Institute Collaborative Team Science Field Guide served as guiding documents for the collaboration (271,272). Detailed information about interactions with the working group is outlined below and aligned with the Collaborate level of engagement specified by the International Association for Public Participation Spectrum of Public Participation (273). The Collaborate level is characterized by two-way interaction that supports the integration of collaborator knowledge and recommendations into a project.

Working group members were selected based on their research expertise in food insecurity and/or policy science and prior involvement with the IFPS. The working group

included Drs. Rebecca Lindberg (Deakin University, Australia), Warren Dodd, Joel Dubin, David Hammond, Sharon Kirkpatrick, and Michael Wallace (University of Waterloo, Canada), Lana Vanderlee (Université Laval, Canada), Camila Corvalán (University of Chile), and Tania Aburto Soto (Instituto Nacional de Salud Pública, Mexico), Martin White (University of Cambridge, UK), Kevin Dodd (US National Cancer Institute), and Edward Frongillo (University of South Carolina, US) and Christine White and Navreet Singh (University of Waterloo, Canada). All individuals were sent an e-mail inviting them to participate in the working group and were provided a summary of the proposed project and estimated level of involvement. The involvement anticipated at the time of invitation included provision of feedback on study aims, methods, interpretation of findings, and knowledge translation methods, with capacity to participate in at least three 60 to 90-minute virtual meetings between June 2023 and August 2024. A collaborator on the IFPS from Health Canada was invited but declined to maintain a degree of separation between the researchers and knowledge users.

Once working group members confirmed their interest in participating in the project, they were sent an e-mail asking for feedback on an outline for the policy analysis (**Chapter 6**). An initial collaborative working group meeting was held on July 10, 2023, and was 50-minutes in duration. During this meeting, a brief overview of all thesis studies and a detailed overview of the policy analysis (**Chapter 6**) was provided before engaging in discussion. Feedback from this meeting was integrated into the policy analysis methods and resulted in the development of a theory of change. Meeting minutes were circulated following the meeting.

The theory of change was circulated to working group members for feedback prior to integration into the policy analysis (**Chapter 6**). Meeting materials were circulated one week in advance of the November 2, 2023 meeting. The meeting included a recap of the policy analysis

and key points from the initial working group meeting in July 2023 before outlining materials developed since the initial meeting and engaging in an open discussion. Following the meeting, minutes were circulated.

A third working group meeting was held to discuss how to synthesize and visualize findings from the policy analysis (**Chapter 6**). Meeting materials were sent before the meeting on January 30, 2024. Through discussion during the meeting, it was determined that conclusions from the policy analysis needed to be set within the context of the COVID-19 pandemic in each country as well as consider country-specific (e.g., Brexit in the UK), and global events (e.g., inflation) beyond the COVID-19 pandemic. Information from the prevalence analysis (**Chapter 5**) that drew on 2018 to 2020 IFPS data and the packages of policy responses compiled in the policy analysis were recommended to be used to generate hypotheses for how household food insecurity changed between 2020 and 2022. Hypotheses could then be discussed with working group members on a country-by-country basis to confirm they were reasonable and considered contextual details that may have influenced household food insecurity. Following the meeting, minutes were circulated, and hypotheses were drafted. Subsequent meetings to discuss country-specific hypotheses were scheduled with one to two working group members per country.

Country-specific meetings ranging from 40 to 50-minutes in length took place between March 19 and March 29, 2024 with select working group members. Pre-meeting materials were circulated on March 13, 2024. Information discussed during the meetings was integrated into the hypotheses and used as the basis for synthesizing finding from the policy analysis (**Chapter 6**). For the attribution analysis (**Chapter 7**), working group members were asked to review and provide input on an outline for the study in April 2024. Once the outline was finalized, analyses were conducted, and the manuscript was drafted (**Chapter 7**).

The prevalence analysis (**Chapter 5**) was completed prior to the implementation of the working group and involved Drs. David Hammond, Sharon Kirkpatrick, and Michael Wallace (University of Waterloo), Kevin Dodd (National Cancer Institute), and Edward Frongillo (University of South Carolina).

5.0 Study 1 – Prevalence analysis

Title: Prevalence and severity of food insecurity before and during the Coronavirus Disease 2019 Pandemic among adults and youth in Australia, Canada, Chile, Mexico, the United Kingdom, and the United States

Status: Published in *Journal of Nutrition*, 2023 Apr 1;153(4):1231-1243. doi: 10.1016/j.tjnut.2022.12.031

Authors: Alexandra Peppone¹, Edward A. Frongillo², Kevin W. Dodd³, Michael P. Wallace⁴, David Hammond¹, Sharon I. Kirkpatrick¹

¹School of Public Health Sciences, University of Waterloo

²Department of Health Promotion, Education, and Behavior, Arnold School of Public Health, University of South Carolina

³Division of Cancer Prevention, National Cancer Institute, National Institutes of Health

⁴Department of Statistics and Actuarial Science, University of Waterloo

Acknowledgements: DH: designed the International Food Policy Study; AP, EAF, and SIK: formulated the research questions; AP: conducted the analyses and led the drafting of the manuscript; and all authors: provided critical feedback and read and approved the final manuscript. AP held an Ontario Graduate Scholarship and received a stipend from a Canadian Institutes of Health Research (CIHR)/Natural Sciences and Engineering Research Council/Social Sciences and Humanities Research Council Healthy Cities Research Training Platform. Funding for the International Food Policy Study was provided by a CIHR Project Grant (PJT-162167), with an additional support from Health Canada, the Public Health Agency of Canada (PHAC), and a CIHR-PHAC Applied Public Health Chair held by DH.

5.1 Overview

Background: Disruptions from the Coronavirus disease 2019 (COVID-19) pandemic potentially exacerbated food insecurity among adults and adolescents.

Objective: The objective was to examine changes in the prevalence and severity of food insecurity among adults and adolescents from before (2019) to during (2020) the pandemic in multiple countries.

Methods: Repeated cross-sectional data were collected among adults aged 18 to 100 years (n = 63,278) in five countries in November-December 2018 to 2020 and among adolescents aged 10 to 17 years (n = 23,107) in six countries in November-December 2019 to 2020. Food insecurity in the past year was captured using the Household Food Security Survey Module and the Child Food Insecurity Experiences Scale. Changes in the prevalence and severity of food insecurity were examined using binary and multinomial logistic regression models, respectively. Models included age, gender, racial/ethnic identity, and other sociodemographic characteristics associated with food insecurity to adjust for possible sample differences across years. Models were weighted to reflect each country's population.

Results: Adults (adjusted odds ratio (AOR): 1.15; 95% CI: 1.02-1.31) and adolescents (AOR: 1.43; 95% CI: 1.19-1.71) in Mexico were more likely to live in food-insecure households in 2020 versus 2019. Adults in Australia (AOR: 0.81; 95% CI: 0.72-0.92) and Canada (AOR: 0.87; 95% CI: 0.77-0.99) were less likely to live in food-insecure households in 2020. Trends in severity aligned with changes in prevalence, with some exceptions. Adolescents in Australia (adjusted relative risk ratio (ARRR): 2.24; 95% CI: 1.65-3.02) and the United States (ARRR: 1.39; 95% CI: 1.04-1.86) had a higher relative risk of many versus no experiences of food insecurity in 2020. There was no evidence of change among adults and adolescents in the remaining countries.

Conclusions: Except for Mexico, few changes in food insecurity among adults and adolescents were observed from before to during the COVID-19 pandemic. Action is needed to support households at risk of food insecurity.

Keywords: COVID-19 pandemic; cross-country comparison; household food security; public health nutrition; adolescent food security.

5.2 Introduction

The inability to access food due to limited financial resources, or food insecurity (274), is a major global concern (275,276). In 2015, the United Nations set 17 Sustainable Development Goals, including the aim to “End hunger, achieve food security and improved nutrition and promote sustainable agriculture” by 2030 (29). The State of Food Security and Nutrition in the World 2020 report indicated the individual-level prevalence of moderate or severe food insecurity globally, as measured by the Food Insecurity Experience Scale, was approximately 26% in 2019, with a steady increase observed since 2014 (253).

Food insecurity is a serious public health problem given its numerous nutritional, mental, and physical health consequences (14,15,123). Among adults in Canada, the United Kingdom (UK), and the United States (US), lower fruit and vegetable consumption has been observed among those living in food-insecure compared to food-secure households (14,117,118). Higher prevalence estimates of inadequate nutrient intakes have also been observed among those living in food-insecure compared to food-secure households (14). In addition to nutritional concerns, numerous mental and physical health conditions among adults, including depression, anxiety, hypertension, and diabetes, are associated with living in food-insecure households (15,122,123).

Similar associations between food insecurity and poor health have been observed among adolescents (14,155,277), with concerns about detrimental impacts on development (164,165). In Canada and the US, adolescents living in food-insecure households have been found to consume fewer servings of fruits, vegetables, and dairy products (14,143,278). Adolescents living in food-insecure households have also been found to experience poorer mental health compared to those living in food-secure households (155,161). For example, experiences of food insufficiency, or not having enough food to eat, and hunger, an indicator of severe food insecurity, among

adolescents are associated with dysthymia and suicidality in the short- (155) and long-term (161). Associations between hunger and poor general health have also been observed (277). Further, adolescents experiencing food insecurity are more likely to have delayed academic and psychosocial development compared to their food-secure peers (164,165). Overall, food insecurity during early life is troubling given the range of impacts during childhood and beyond.

Adults and adolescents who are socially and economically disadvantaged are most vulnerable to food insecurity and its devastating consequences (274). Research in North America has repeatedly demonstrated that individuals living with low income, who are precariously employed or unemployed, and who have lower levels of formal education are more likely to experience food insecurity (77,274,279). Given the link with structural disadvantage, experiences of food insecurity disproportionately burden individuals who are lone parents, identify as women, or identify as Black, Indigenous, or Latino (115,274). Similar patterns have been observed among culturally and linguistically diverse communities in Australia and the UK (64,280). Consequently, the burden of food insecurity and associated outcomes is not equally distributed among the population.

Disruptions induced by the coronavirus disease 2019 (COVID-19) pandemic have heightened disadvantage faced by subgroups of the population (33–35,281), including the potential exacerbation of food insecurity globally (33–36,253). While concern is highest about increases in the Global South, there is also concern about rates of household food insecurity in the Global North, with lower but not trivial pre-pandemic prevalence estimates of approximately 10% (253,274,282). Existing research suggested that the prevalence of food insecurity in numerous countries, such as Australia (240), Canada (36), the UK (34), and the US (283), may have increased during the early stages of the pandemic. These investigations, among others,

provided rapid insight into the potential impact of the COVID-19 pandemic and associated public health measures on food insecurity. Differences in measures used to assess the prevalence and severity of food insecurity before and during the COVID-19 pandemic, however, complicate comparisons across time points (242). Further, some prior investigations focused on adults living in a particular state or individuals who identify as women (33,240,283), again hindering comparisons across studies and limiting generalizability to broader populations. The purpose of this study was to examine changes in the prevalence and severity of food insecurity among adults aged 18 to 100 years and adolescents aged 10 to 17 years in multiple countries using consistent measures of food insecurity before to during the COVID-19 pandemic.

5.3 Methods

Repeated cross-sectional data were drawn from the International Food Policy Study, conducted in Australia, Canada, Chile (adolescents only), Mexico, the UK, and the US (284). These countries were selected because of similarities in culture, official languages, and food environments (37). Self-administered web-based surveys were conducted in November-December in 2018 (adults only), 2019, and 2020. Surveys were conducted in English in Australia and the UK, Spanish in Chile and Mexico, English and French in Canada, and English and Spanish in the US. French and Spanish translations were reviewed by members of the research team who were fluent in each language.

Adults aged 18 to 100 years were recruited through the Nielson Consumer Insights Global Panel and their partner panels in 2018, 2019, and 2020. Age and sex quotas facilitated recruitment of adults reflective of each country's population. In 2018, quotas based on device screen size were used to minimize scrolling to view images associated with some questions.

Email invitations with unique survey access links were sent to a random sample of adult panelists within each country. Adolescents aged 10 to 17 years were indirectly recruited through parent/guardians enrolled in the same panels in 2019 and 2020. Recruitment of adolescent respondents was not contingent on recruitment of caregivers to the adult study. Survey invitations were sent to adults who confirmed they had a child within the age range of interest living in their household. Only one child per household was invited to participate. Sex and age quotas in the UK and the US facilitated recruitment of adolescents reflective of the broader population (quotas were not employed in the other countries due to limited panel sizes). In 2019, no adults and adolescents were recruited from the same households, with 13 dyads recruited from the same households in 2020.

Following eligibility screening based on age, sex, and residing in a target country, potential respondents were provided with information about the study and an opportunity to consent (adults) or assent (adolescents). Adult respondents and parents/guardians of adolescent respondents received remuneration in accordance with their panel's usual incentive structure (e.g., points-based or monetary rewards, chances to win prizes). Research demonstrates these incentives increase response rates and decrease response bias (285–287). The study was reviewed by and received ethics clearance through a University of Waterloo Research Ethics Committee (adult: ORE# 30829, adolescent: ORE# 41477). Full descriptions of the study methods are available in the Technical Reports for each year (<http://foodpolicystudy.com/methods/>).

The adult sample included both repeat and new respondents in 2019 and 2020. To mitigate the influence of remembering prior responses on survey completion, only the first instance of survey completion by a given respondent was retained (288), resulting in the

exclusion of 1,684 respondents in 2019 and 342 respondents in 2020. Respondents with missing food security data were also excluded (adults: n = 77 in 2018, n = 59 in 2019, n = 105 in 2020; adolescents: n = 18 in 2019, n = 14 in 2020), leaving analytic samples of 22,747, 19,225, and 21,306 adults from the 2018 to 2020 surveys, respectively, and 11,090 and 12,017 adolescents from the 2019 and 2020 surveys, respectively. The numbers of adults and adolescents who completed the surveys, whose data were excluded, whose data were available for analysis, and who were included in the analytic samples for each of 2018 (adults only), 2019, and 2020, are summarized in **Table 5.1**.

Post-stratification sample weights were constructed using a raking algorithm, with population estimates drawn from the census in each country based on age group, sex, region, ethnicity (except in Canada), and education (except in Mexico) (289–293).

Table 5.1: Number of adults aged 18 to 100 years and adolescents aged 10 to 17 years who completed the surveys, whose data were excluded, whose data were available for analysis, and whose data were included in the analytic samples from the International Food Policy Study survey in 2018, 2019, or 2020 in Australia, Canada, Chile, Mexico, the United Kingdom, or the United States.

Adult surveys			
Sample type	2018 (year 2)	2019 (year 3)	2020 (year 4)
Completed	28,684	29,290	30,131
Excluded ¹	5,860	8,322	8,378
Available for analysis	22,824	20,968	21,753
Analytic ^{2,3}	22,747	19,225	21,306
Adolescent surveys			
Sample type	2018	2019 (year 1)	2020 (year 2)
Completed	Not applicable	11,491	12,489
Excluded ¹	Not applicable	383	458
Available for analysis	Not applicable	11,108	12,031
Analytic ³	Not applicable	11,090	12,017

¹Data were excluded by the International Food Policy Study team because the respondent was ineligible or due to missing information on region, inadequate sample size to reliably construct sample weights (e.g., participants within the Canadian territories), invalid response to a data quality question, survey completion time under 15 minutes for adults and 10 minutes for

adolescents, and/or invalid responses to at least three of 20 open-ended measures (adults only).

²Only the first instance that respondents answered the survey were retained, excluding 1,684 respondents in 2019 and 342 respondents in 2020.

³Data were excluded for respondents with missing food security data: adults: n = 77 in 2018, n = 59 in 2019, n = 105 in 2020; adolescents: n = 18 in 2019, n = 14 in 2020.

5.3.1 Measures

The 18-item Household Food Security Survey Module (HFSSM), routinely used in research and surveillance in the Global North (53,54,59), was used to assess household food security status over the past year among respondents to the adult survey (57,258). Ten items assess food security status among adults in the household and, where applicable, the remaining eight items query about the experiences of children under the age of 18 years. The HFSSM probes experiences ranging from worrying about running out of food and not being able to afford balanced meals to going a whole day without eating (61). Using Health Canada's coding method (61), adults were classified as living in households that were food secure (0 affirmations), marginally food insecure (1 affirmation), moderately food insecure (2 to 5 affirmations adult scale, 2 to 4 affirmations child scale), or severely food insecure (6 or more affirmations adult scale, 5 or more affirmations child scale) (61). If there was discordance between the classifications based on adults and children, the more severe classification denoted the food security status of the household. For the current analyses, in addition to a four-level variable indicating severity of food insecurity, a dichotomous variable was constructed, considering those living in marginally, moderately, and severely food-insecure households to be food insecure. Marginal food insecurity was considered within the food-insecure category because of its adverse influence on health (294).

The adolescent survey included the 10-item Child Food Insecurity Experiences Scale (92), comprising items that span worrying about running out of food, compromises to diet

quality, eating less, going hungry, and experiencing emotional elements of food insecurity, such as shame, over the past year. This scale has been assessed for reliability, accuracy, and cross-context equivalence among children and adolescents aged 5 to 18 years in 13 countries, including those in this study (92). High internal consistency was found using Cronbach alpha (0.88 to 0.94 across countries) and confirmatory factor analysis, while acceptable criterion validity relative to other markers of food insecurity and cross-context equivalence was also demonstrated. An adolescent-reported measure of food insecurity was included because prior research suggests adolescents are aware of and can report experiences of food insecurity, with their reports diverging from those of their caregivers (85,86,89). Response options for each item include never (scored value of 0), 1 or 2 times (scored value of 1), and many times (scored value of 2). Based on the resulting continuous score, adolescents were categorized as having no (0 affirmations), few (1 to 6 affirmations), several (7 to 10 affirmations), or many (11 to 20 affirmations) experiences of food insecurity over the past year (92). In addition to the four-category variable indicative of the number of experiences of food insecurity, a dichotomous variable was constructed, considering those with few or more experiences of food insecurity as food insecure.

Adult respondents entered their age using a numeric response option (258). Recognizing the gendered nature of food insecurity (295,296), gender identity was used instead of sex and was queried using categories recommended by the Canadian Institutes of Health Research (297). Categories included man, woman, trans male/trans man, trans female/trans woman, gender queer/gender non-conforming, other, don't know and refuse to answer. For analytic purposes, response options were condensed to man (including trans male/trans man), woman (including trans female/trans woman), and gender queer/gender non-conforming/other/not stated. Response

categories for racial/ethnic identity and cultural diversity were country-specific and grouped by the study team into Black/Indigenous/People of Color (BIPOC) and/or speaks language other than English at home; White, not Indigenous, and/or English-speaking at home (White and/or English-speaking); or not stated (258). The White and/or English-speaking category encompasses respondents in Australia who only spoke English at home and did not identify as Indigenous (Aboriginal or Torres Strait Islander). In Australia, language is used as a component of cultural diversity (298). The White and/or English-speaking category also included individuals in Mexico who did not identify as Indigenous, and individuals in Canada, the UK, and the US who identified as White only. All other response options were considered to align with the BIPOC and/or speaks language other than English at home category. Response options for highest level of educational attainment were also country-specific and categorized into low (secondary education or less), medium (some post-secondary education), high (university degree or above), or not stated. For employment status, respondents were provided with 14 options, including providing an open-ended response (258). Within the current analyses, responses were classified as working, not working (e.g., parental leave), unemployed, and not stated. Perceived income adequacy was gauged by asking respondents how easy or difficult it is to make ends meet (258). Response options ranged from very difficult to very easy, with the opportunity to select don't know or prefer not to answer. For the current analyses, these categories were combined into very difficult/difficult (difficult), neither easy nor difficult (neither), easy/very easy (easy), and not stated (103). Respondent living arrangement was queried using 11 response options and consolidated into no other adults or children, other adults but no children, no other adults but children, other adults with children, and not stated (103).

Adolescents selected their age from a pre-populated list that ranged from 10 to 17 years (258). Adolescents were asked to identify their sex as male or female (gender identity was not queried among adolescents). Racial/ethnic identity and cultural diversity reported by respondents were grouped using the same method as applied to the adult survey (258), resulting in three categories: BIPOC and/or speaks language other than English at home, White and/or English speaking, and not stated. Perceived income adequacy was gauged using an adolescent-oriented question: “Does your family have enough money to pay for things your family needs?” (258). Response options ranged from not enough to more than enough money and were consolidated into not enough/barely enough money (not enough), enough/more than enough money (enough), and not stated.

5.3.2 Statistical analyses

Analyses were conducted using SAS, version 9.4 (Cary, NC), with SURVEY commands applied to allow the application of sample weights. Univariate frequency tables were used to characterize sociodemographic characteristics as well as adult-reported household and adolescents self-reported food security using the four-category variables, by country and year. Weighted binary logistic regression models stratified by country assessed changes in the prevalence of living in households with any level of food insecurity or having any experiences of food insecurity (i.e., using the dichotomous variable) in 2020 relative to 2019. To account for possible differences in the samples across years, models were adjusted for variables associated with food insecurity in previous research (64,103,274,282), including age, gender identity (adult) or sex (adolescents), racial/ethnic identity and cultural diversity, educational attainment (adult only), employment status (adult only), perceived income adequacy, and living arrangement

(adult only). The adult model included an indicator of food insecurity status in 2018 to strengthen inference about changes in food security between 2019 and 2020 (2018 data were not available for adolescents). Weighted multinomial logistic regression models examined changes in the severity of food insecurity among adults and adolescents in each country using the four-category food security variable and adjusting for the aforementioned covariates. Sensitivity analyses excluding perceived income adequacy from all models were conducted given the impact of the COVID-19 pandemic on economic stability (30).

The analyses in this paper are intended to be primarily descriptive, and the limited inferences made consider the strength of the evidence from point estimates and confidence intervals in a holistic manner (299). P-values are reported to facilitate strict inference by readers, although explicit adjustment for multiple testing may be complicated due to the non-independence of some tests (300).

5.4 Results

The country-specific distributions of the adult sample from 2018 to 2020 (**Table 5.2**) and the adolescent sample from 2019 to 2020 (**Table 5.3**) were consistent with each country's population distributions by age, gender identity (adults) or sex (adolescents), and racial/ethnic identity and cultural diversity, per the weighting protocol. The sociodemographic characteristics of the samples by year are summarized in **Supplemental tables 5.1 to 5.5**.

Table 5.2: Sociodemographic characteristics of adults aged 18 to 100 years participating in the International Food Policy Study in 2018, 2019, and 2020, by country (n = 63,278)¹⁻³.

Country	Australia (n = 11,645)	Canada (n = 12,570)	Mexico (n = 12,621)	United Kingdom (n = 13,294)	United States (n = 13,148)
	n (%)	n (%)	n (%)	n (%)	n (%)
Year					
2018	4,083 (34.9%)	4,386 (34.9%)	4,132 (32.8%)	5,516 (41.5%)	4,630 (35.1%)
2019	3,479 (30.1%)	3,908 (31.1%)	4,210 (33.3%)	3,703 (27.9%)	3,925 (29.9%)
2020	4,083 (35.0%)	4,276 (34.0%)	4,279 (33.9%)	4,075 (30.6%)	4,593 (34.9%)
Age⁴, years	46.0 (45.7-46.4)	47.7 (47.3-48.1)	39.7 (39.3-40.0)	47.9 (47.6-48.2)	46.7 (46.4-47.1)
Gender identity					
Man (including trans male/trans man)	5,674 (48.9%)	6,129 (49.4%)	6,449 (47.5%)	6,502 (48.5%)	6,173 (47.6%)
Woman (including trans female/trans woman)	5,942 (50.8%)	6,380 (50.1%)	6,118 (52.1%)	6,755 (51.2%)	6,920 (51.9%)
Other/not stated	29 (0.3%)	61 (0.6%)	54 (0.4%)	37 (0.3%)	55 (0.5%)
Racial/ethnic identity and cultural diversity					
BIPOC and/or speaks language other than English at home	1,799 (25.8%)	2,541 (20.4%)	2,038 (20.2%)	1,278 (11.4%)	3885 (36.0%)
White and/or English speaking	9,810 (73.9%)	9,797 (77.5%)	10,321 (77.8%)	11,912 (87.9%)	9198 (63.4%)
Not stated	36 (0.3%)	232 (2.1%)	262 (2.0%)	104 (0.7%)	65 (0.6%)
Educational attainment⁵					
Low	4,133 (42.0%)	3,429 (42.4%)	2,693 (22.0%)	4,200 (49.6%)	4,612 (57.4%)
Medium	3,972 (32.0%)	4,953 (33.2%)	1,582 (13.4%)	3,694 (21.2%)	2,846 (9.9%)
High	3,500 (25.5%)	4,138 (24.0%)	8,322 (64.5%)	5,324 (28.5%)	5,649 (32.5%)
Not stated	40 (0.4%)	50 (0.4%)	24 (0.2%)	76 (0.7%)	41 (0.3%)
Employment status					
Working	5,678 (48.9%)	6,125 (45.3%)	8,644 (65.8%)	6,423 (47.5%)	6,005 (41.0%)
Not working	4,655 (38.9%)	5,129 (42.0%)	3,012 (26.3%)	5,622 (40.9%)	5,621 (44.5%)
Unemployed	1,182 (11.0%)	1,128 (10.9%)	824 (6.7%)	1,144 (10.7%)	1,182 (11.1%)

Not stated	130 (1.2%)	188 (1.9%)	141 (1.2%)	105 (0.9%)	340 (3.4%)
Perceived income adequacy					
Difficult	2,992 (26.1%)	3,114 (27.6%)	5,472 (45.5%)	2,817 (23.4%)	3,671 (30.3%)
Neither	4,437 (38.7%)	4,747 (38.2%)	4,848 (37.7%)	4,762 (37.2%)	4,392 (34.6%)
Easy	4,108 (33.9%)	4,591 (33.0%)	2,206 (16.0%)	5,592 (38.4%)	4,949 (33.9%)
Not stated	108 (1.2%)	118 (1.1%)	95 (0.7%)	123 (1.0%)	136 (1.3%)
Living arrangement					
No other adults or children	2,344 (19.0%)	2,943 (24.0%)	679 (6.0%)	2,820 (21.4%)	2,718 (20.8%)
Other adults but no children	5,444 (46.9%)	5,981 (47.6%)	4,329 (34.7%)	6,147 (44.5%)	5,492 (42.9%)
No other adults but children	802 (7.0%)	688 (5.5%)	820 (7.4%)	3494 (26.9%)	897 (7.3%)
Other adults with children	3,003 (26.6%)	2,926 (22.6%)	6,750 (51.5%)	793 (7.0%)	3,999 (28.6%)
Not stated	52 (0.5%)	32 (0.4%)	43 (0.4%)	40 (0.3%)	42 (0.4%)

¹Abbreviation: BIPOC, Black, Indigenous, People of Color.

²Cell sizes are unweighted and may not align with the percentages, which are weighted using sample weights.

³Percentages may not sum to 100% due to rounding.

⁴Mean and 95% confidence interval for age. Sample size is equivalent to the sample size noted by country.

⁵Low educational attainment includes secondary education or less, medium includes some post-secondary education, high educational attainment includes university degree or above.

Table 5.3: Sociodemographic characteristics of adolescents aged 10 to 17 years participating in the International Food Policy Study in 2019 and 2020, by country (n = 23,107)¹⁻³.

Country	Australia (n = 3,021)	Canada (n = 7,564)	Chile (n = 2,867)	Mexico (n = 3,438)	United Kingdom (n = 3,036)	United States (n = 3,181)
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Year						
2019	1,431 (47.4%)	3,674 (48.6%)	1,252 (43.7%)	1,616 (47.0%)	1,518 (50.0%)	1,599 (50.3%)
2020	1,590 (52.6%)	3,890 (51.4%)	1,615 (56.3%)	1,822 (53.0%)	1,518 (50.0%)	1,582 (49.7%)
Age⁴, years	13.4 (13.3-13.5)	13.5 (13.4-13.5)	13.5 (13.4-13.6)	13.5 (13.4-13.5)	13.4 (13.4-13.5)	13.5 (13.4-13.6)
Sex						
Male	1,626 (51.4%)	3,869 (50.9%)	1,593 (51.1%)	1,924 (50.6%)	1,498 (51.3%)	1,629 (51.1%)
Female	1,395 (48.6%)	3,695 (49.1%)	1,274 (48.9%)	1,514 (49.4%)	1,538 (48.7%)	1,552 (48.9%)
Racial/ethnic identity and cultural diversity						
BIPOC and/or speaks language other than English at home	600 (24.6%)	1,957 (27.3%)	310 (14.4%)	439 (20.3%)	364 (17.0%)	886 (47.9%)
White and/or English speaking	2,409 (75.0%)	5,480 (71.0%)	2,485 (83.3%)	2,906 (76.8%)	2,646 (82.1%)	2,287 (51.7%)
Not stated	12 (0.4%)	127 (1.7%)	72 (2.2%)	93 (3.0%)	26 (0.9%)	8 (0.4%)
Perceived income adequacy						
Not enough	678 (21.9%)	1,318 (17.6%)	887 (31.8%)	1,065 (33.3%)	759 (24.7%)	762 (26.2%)
Enough	2,314 (77.1%)	6,144 (81.0%)	1,946 (67.2%)	2,350 (66.1%)	2,242 (74.1%)	2,393 (73.0%)
Not stated	29 (1.0%)	102 (1.4%)	34 (1.1%)	23 (0.6%)	35 (1.1%)	26 (0.8%)

¹Abbreviation: BIPOC, Black, Indigenous, People of Color.

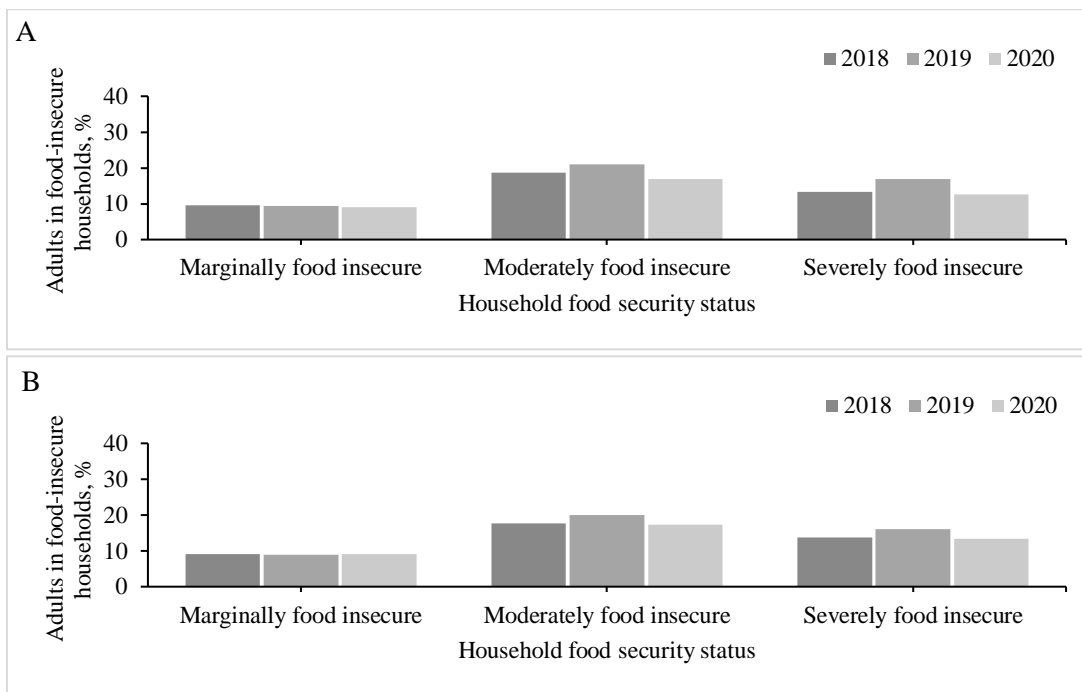
²Cell sizes are unweighted and may not align with the percentages, which are weighted using sample weights.

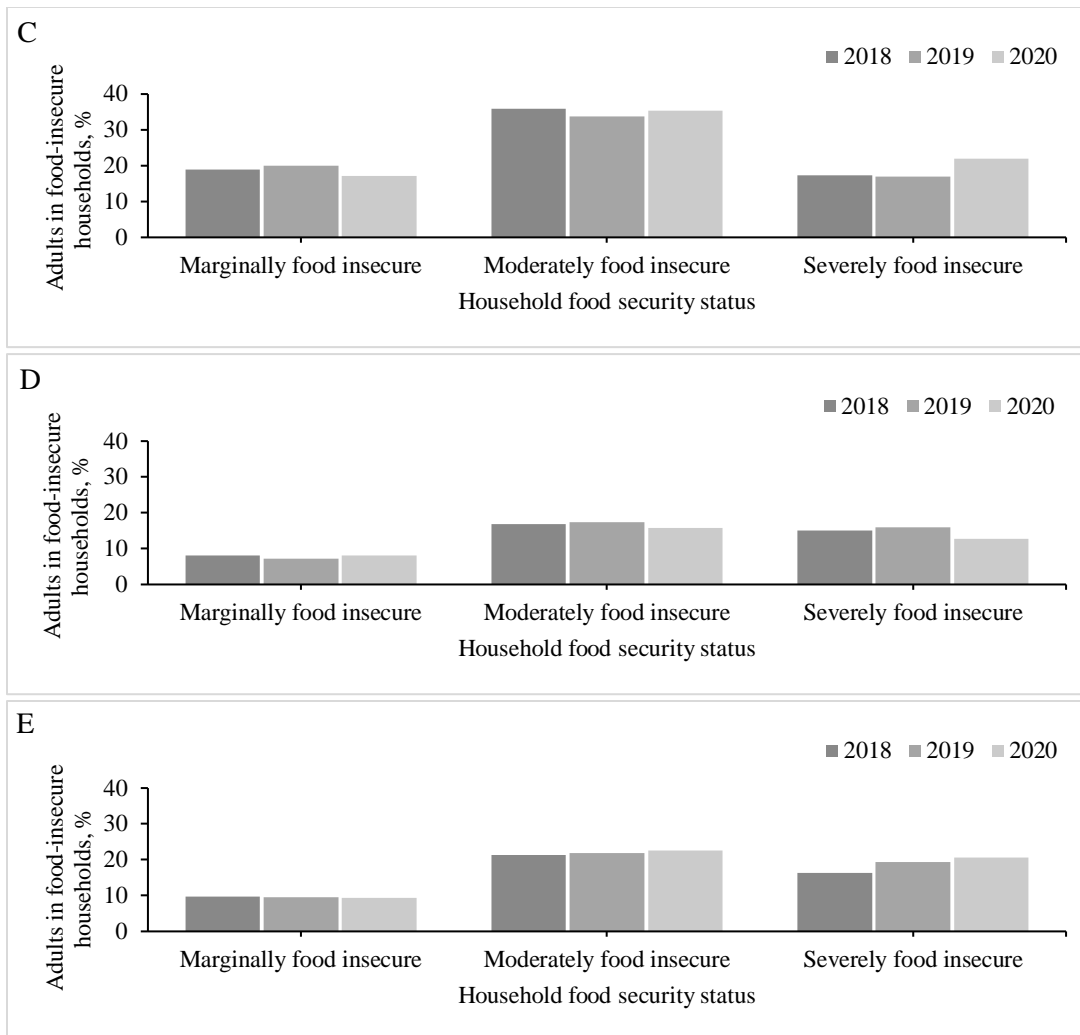
³Percentages may not sum to 100% due to rounding.

⁴Mean and 95% confidence interval for age. Sample size is equivalent to the sample size noted by country.

In the most recent year (2020), approximately half of adult respondents in Mexico reported it was difficult to make ends meet. In the remaining countries, the prevalence of adults reporting difficulty making ends meet ranged from 20.3% to 30.6%. The proportions of adults living in households with any level of food insecurity ranged from 36.6% to 74.6% (**Figure 5.1**). The prevalence of adolescents reporting their families did not have enough money to meet their needs ranged from 17.9% to 37.7% across countries. Among adolescents in Mexico, the prevalence of food insecurity, based on few or more experiences, was 73.1% in 2020. In the remaining countries, the prevalence of food insecurity, based on few or more experiences, ranged from 35.0% to 70.3% in 2020 (**Figure 5.2**).

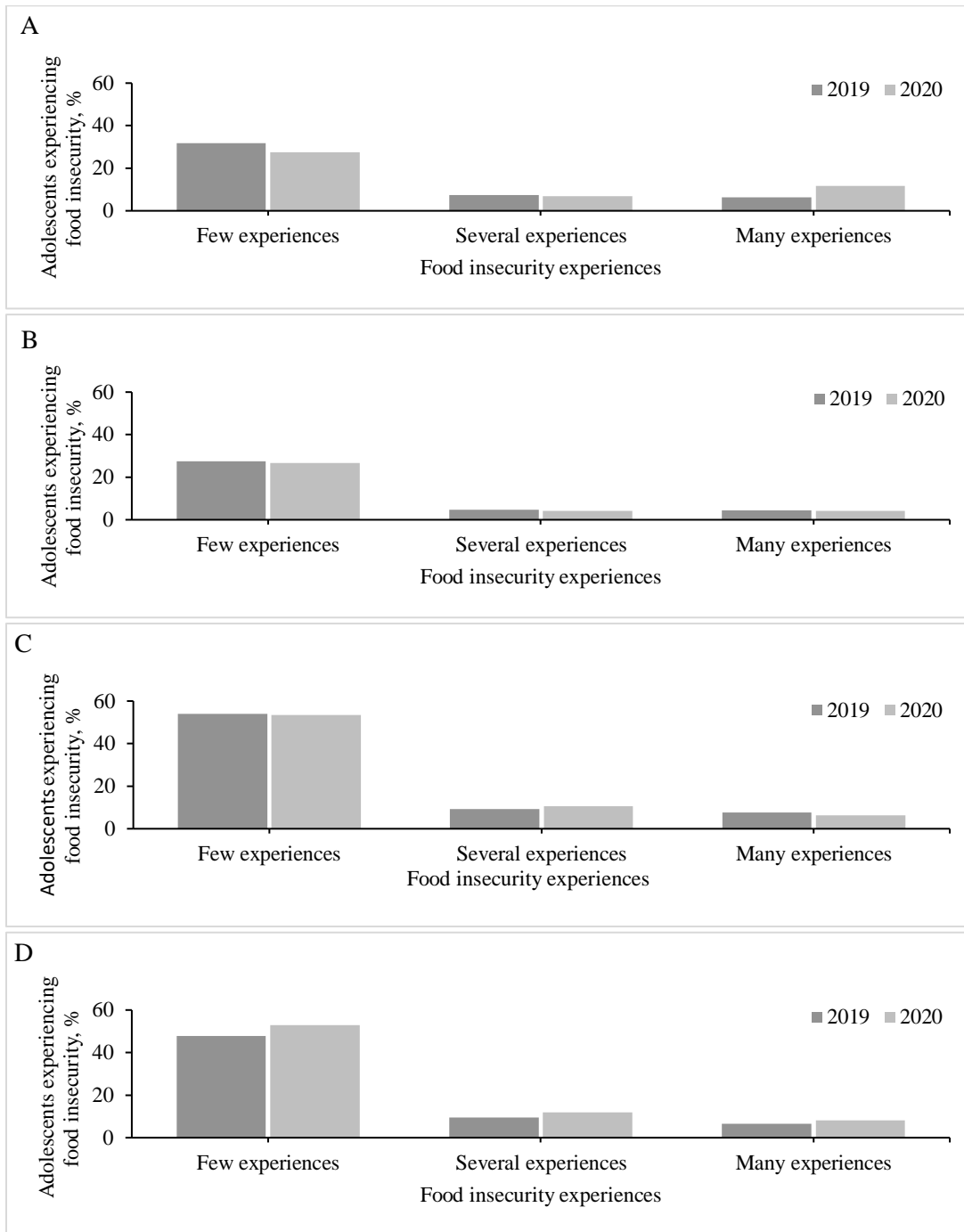
Figure 5.1: Proportion of adults aged 18 to 100 years living in food-insecure households in 2018, 2019, and 2020, by country, International Food Policy Study (n = 63,278).

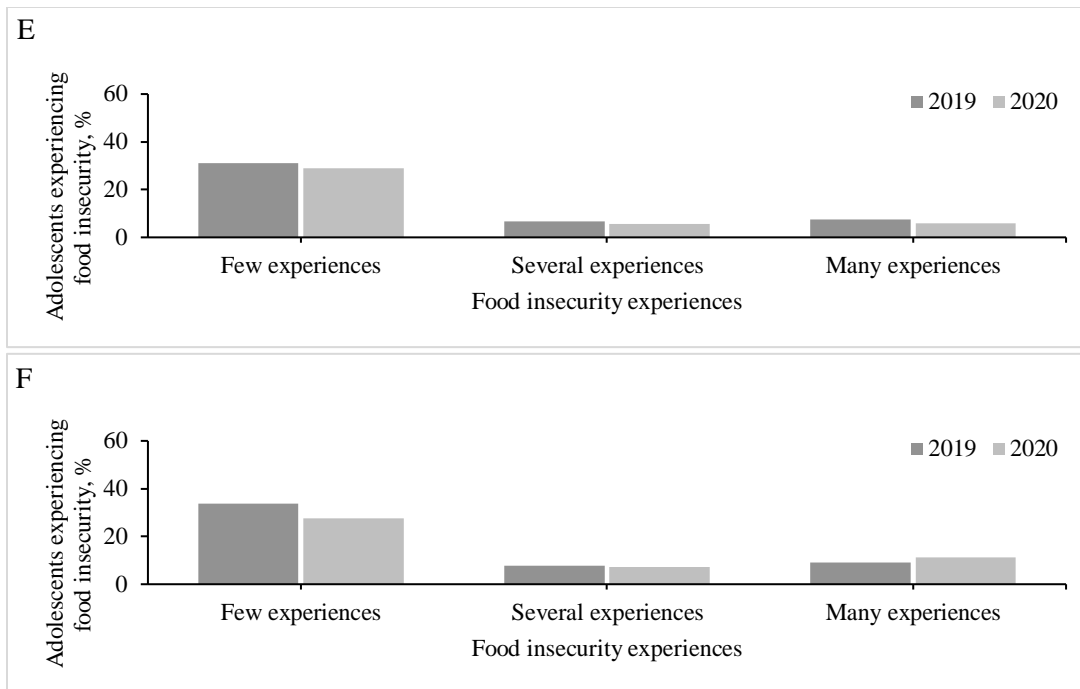




Weighted percentages of the proportions of adults living in food-insecure households in 2018, 2019, and 2020 in (A) Australia (n = 11,645), (B) Canada (n = 12,570), (C) Mexico (n = 12,621), (D) the United Kingdom (n = 13,294), and (E) in the United States (n = 13,148).

Figure 5.2: Proportion of adolescents aged 10 to 17 years experiencing food insecurity in 2019 and 2020, by country, International Food Policy Study (n = 23,107).





Weighted percentages of the proportions of adolescents experiencing food insecurity in 2019 and 2020 in (A) Australia (n = 3,021), (B) Canada (n = 7,564), (C) Chile (n = 2,867), (D) Mexico (n = 3,438), (E) the United Kingdom (n = 3,036), and (F) the United States (n = 3,181).

Changes in the odds of adult food insecurity from 2019 to 2020 (adjusting for food security status in 2018) differed by country. Among adults in Mexico, the odds of living in households with any level of food insecurity were higher (adjusted odds ratio (AOR): 1.15; 95% CI: 1.02-1.31) in 2020 compared to 2019 (**Table 5.4**). Relatedly, among adults in Mexico, the relative risk ratio of living in moderately (adjusted relative risk ratio (ARRR): 1.18; 95% CI: 1.02-1.36) and severely (ARRR: 1.40; 95% CI: 1.19-1.66) food-insecure compared to food-secure households were higher in 2020 versus 2019 (**Table 5.4**). The odds of living in households with any level of food insecurity were lower in Australia (AOR: 0.81; 95% CI: 0.72-0.92) in 2020 versus 2019. Considering severity, the relative risk ratio of adults in Australia living in either moderately (ARRR: 0.78; 95% CI: 0.67-0.91) or severely (ARRR: 0.79; 95% CI: 0.66-0.94) food-insecure households compared to food-secure households were lower in 2020

versus 2019. In Canada, the odds of living in a household with any level of food insecurity were lower (AOR: 0.87; 95% CI: 0.77-0.99) in 2020 versus 2019 (**Table 5.4**). The adjusted relative risk ratio of living in moderately food-insecure households relative to living in food-secure households were lower in Canada (ARRR: 0.84; 95% CI: 0.72-0.97) in 2020 versus 2019. There was little evidence of changes in the odds of living in households with food insecurity from 2019 to 2020 in the UK (AOR: 0.90; 95% CI: 0.79-1.02). When considering severity, the relative risk ratio of adults living in severely food-insecure households were lower in the UK (ARRR: 0.82; 95% CI: 0.68-0.99) in 2020 versus 2019. In the US, little evidence of changes in the odds of living in households with food insecurity from 2019 to 2020 was observed (AOR: 1.05; 95% CI: 0.93-1.19). Similarly, no changes were observed in the US when considering severity (**Table 5.4**).

There was little or weak evidence of changes in the likelihood of adolescent-reported experiences of food insecurity from 2019 to 2020 in any country, except in Mexico, where the odds of adolescents experiencing food insecurity were higher in 2020 (AOR: 1.43; 95% CI: 1.19-1.71) (**Table 5.5**). Among adolescents in Mexico, the relative risk ratio of few (ARRR: 1.42, 95% CI: 1.18-1.71) and several (AOR: 1.48; 95% CI: 1.07-2.04) experiences of food insecurity compared to no experiences were higher in 2020 compared to 2019 (**Table 5.5**). The relative risk ratio of many versus no experiences of food insecurity were higher in Australia (ARRR: 2.24; 95% CI: 1.65-3.02) and the US (ARRR: 1.39; 95% CI: 1.04-1.86) in 2020 versus 2019. There was little or weak evidence of other changes in the number of experiences of food insecurity among adolescents. Sensitivity analyses excluding perceived income adequacy yielded similar findings among adults and adolescents (results not shown).

Table 5.4: Adjusted odds of living in households with any level of food insecurity and marginal, moderate, or severe food insecurity in 2020 compared to 2019 among adults aged 18 to 100 years, by country, International Food Policy Study (n = 63,278)^{1,2}.

Country	Australia		Canada		Mexico		United Kingdom		United States	
	AOR (95% CI)	P-value	AOR (95% CI)	P-value	AOR (95% CI)	P-value	AOR (95% CI)	P-value	AOR (95% CI)	P-value
Any level of food insecurity ³	0.81 (0.72-0.92)	0.0009	0.87 (0.77-0.99)	0.0287	1.15 (1.02-1.31)	0.0246	0.90 (0.79-1.02)	0.11	1.05 (0.93-1.19)	0.42
2020 versus 2019	ARRR (95% CI)	P-value	ARRR (95% CI)	P-value	ARRR (95% CI)	P-value	ARRR (95% CI)	P-value	ARRR (95% CI)	P-value
Marginally food insecure ⁴	0.90 (0.74-1.09)	0.26	0.97 (0.80-1.16)	0.72	0.99 (0.84-1.16)	0.89	1.05 (0.85-1.28)	0.68	1.00 (0.83-1.20)	0.98
Moderately food insecure ⁴	0.78 (0.67-0.91)	0.0012	0.84 (0.72-0.97)	0.0216	1.18 (1.02-1.36)	0.0217	0.87 (0.74-1.03)	0.10	1.05 (0.91-1.22)	0.50
Severely food insecure ⁴	0.79 (0.66-0.94)	0.0088	0.83 (0.69-1.01)	0.06	1.40 (1.19-1.66)	<0.0001	0.82 (0.68-0.99)	0.0391	1.08 (0.92-1.27)	0.34

¹Abbreviation: AOR, adjusted odds ratio; ARRR, adjusted relative risk ratio.

²Sample sizes by year are as follows 22,747 in 2018, 19,225 in 2019, and 21,306 in 2020. Sample sizes by food security category, irrespective of country and year, are 34,005 adults lived in food secure households, 6,657 adults lived in marginally food insecure households, 13,222 adults lived in moderately food insecure households, and 9,394 adults lived in severely food insecure households.

³Any level of food insecurity corresponds to one or more affirmations in the Household Food Security Survey Module.

⁴Marginally food insecure corresponds to one affirmation in the Household Food Security Survey Module, moderately food insecure corresponds to two to five affirmations on the adult scale and/or two to four affirmations on the child scale, or severely food insecure corresponds to six or more affirmations adult scale and/or five or more affirmations on the child scale.

Table 5.5: Adjusted odds of any experiences and by the number of experiences of food insecurity in 2020 compared to 2019 among adolescents aged 10 to 17 years, by country, International Food Policy Study (n = 23,107)^{1,2}.

Country	Australia		Canada		Chile		Mexico		United Kingdom		United States	
	AOR (95% CI)	P-value	AOR (95% CI)	P-value	AOR (95% CI)	P-value	AOR (95% CI)	P-value	AOR (95% CI)	P-value	AOR (95% CI)	P-value
2020 versus 2019												
Any experiences ³	1.16 (0.98-1.37)	0.08	0.90 (0.81-1.00)	0.06	0.94 (0.78-1.13)	0.49	1.43 (1.19-1.71)	0.0001	0.88 (0.74-1.04)	0.14	0.94 (0.79-1.13)	0.52
2020 versus 2019												
Few experiences ⁴	0.98 (0.82-1.18)	0.86	0.92 (0.82-1.03)	0.14	0.94 (0.78-1.14)	0.54	1.42 (1.18-1.71)	0.0002	0.90 (0.75-1.09)	0.28	0.83 (0.68-1.01)	0.06
Several experiences ⁴	1.18 (0.86-1.61)	0.30	0.82 (0.64-1.05)	0.11	1.02 (0.75-1.40)	0.90	1.48 (1.07-2.04)	0.0168	0.84 (0.59-1.18)	0.31	1.03 (0.74-1.44)	0.86
Many experiences ⁴	2.24 (1.65-3.02)	<0.0001	0.84 (0.65-1.07)	0.15	0.75 (0.53-1.08)	0.12	1.43 (0.99-2.07)	0.06	0.75 (0.54-1.05)	0.10	1.39 (1.04-1.86)	0.0249

¹Abbreviation: AOR, adjusted odds ratio; ARRR, adjusted relative risk ratio.

²Sample sizes by year are as follows 11,090 in 2019 and 12,017 in 2020. Sample sizes by food security category, irrespective of country and year, are 11,947 adolescents reported no experiences of food insecurity, 7,989 adolescents reported few experiences of food insecurity, 1,587 adolescents reported several experiences of food insecurity, and 1,584 adolescents reported many experiences of food insecurity.

³Any experiences of food insecurity corresponds to one or more affirmations on the Child Food Insecurity Experiences Scale.

⁴Few experiences corresponds to one to six affirmations on the Child Food Insecurity Experiences Scale, several experiences corresponds to seven to ten affirmations, many experiences corresponds to eleven to twenty affirmations.

5.5 Discussion

A prior cross-country comparison raised concerns about increases in the prevalence of food insecurity after the onset of the COVID-19 pandemic in March 2020 (30), as have studies conducted early in the pandemic in the countries considered here (34,36,238–240,283). We found evidence of increasing likelihood and severity (adults) or numbers of experiences (adolescents) of food insecurity from 2019 to 2020 in Mexico. The proportions of adolescents reporting many experiences of food insecurity also increased in Australia and the US from 2019 to 2020. Among adults and adolescents in the remaining countries, however, the likelihood of food insecurity was either lower or unchanged from 2019 to 2020, with assessment of severity suggesting improvements or no changes.

Consistent with our findings for adults and adolescents, research conducted early in the pandemic suggested the prevalence of household food insecurity increased in Mexico compared to before the pandemic (239). The observed decline in the likelihood of adults living in food-insecure households from 2019 to 2020 in Australia and Canada and the lack of change in the likelihood among adults in the UK and US, however, contrast findings of research conducted in those countries early in the pandemic. Research conducted in Australia, Canada, the UK, and the US between March and August of 2020 found increases in the proportions of adults living in food-insecure households and the prevalence of household food insecurity within the prior 30 days (36,240), three months (241), six months (34,94), or since the onset of the pandemic (283). In late 2020, it was estimated that a lower proportion of individuals aged 12 years and older in Canada lived in food-insecure households in the past year compared to prior to the pandemic (254). Other investigations conducted in the US in May and December of 2020 found no change in the prevalence of household food insecurity in the previous 12 months (301,302).

To our knowledge, no other studies have compared the prevalence of food insecurity from before to during the COVID-19 pandemic using adolescent-reported data. A study of individuals in grades six and seven living in New Orleans, US in the fall of 2020 found that almost three-in-ten “had worried about the amount or type of food available” (303). In the UK, 18% of individuals between the age of 8 to 17 years experienced food insecurity through the 2020 summer break, as measured using seven questions that queried about going to a friend’s house to eat, eating less, and feeling hungry (34,94). These estimates of food insecurity among adolescents are lower than those observed here, and do not shed light on changes from before to during the pandemic.

The differences in trends in food insecurity across countries considered in this study, based on consistent measures of food insecurity and data collection time points, likely reflect heterogeneity in the timing and stringency of public health restrictions to mitigate the spread of COVID-19 (e.g., workplace closures and stay-at-home orders), the transient disruptions in food supply chains, and the timing and adequacy of social protection measures by country (30,213,215,304). The observed increases in food insecurity in Mexico versus other countries may relate to the lack of policy responses compared to the other countries in this investigation. Social protection programs such as the Coronavirus Supplement in Australia (305), the Canadian Emergency Response Benefit (213), the Emergency Family Income program in Chile (306), Universal Credit in the UK (307), and the Federal Pandemic Unemployment Compensation program in the US (213) were altered or implemented, potentially contributing to the declines or lack of change in food insecurity observed between 2019 and 2020. In contrast, limited economic responses to the pandemic in Mexico have been noted, for example, including the provision of loans to small- and medium-sized business and enabling advanced withdrawal of pension funds

(308,309). As of October 2020, spending on social protection measures, such as income supports, during the pandemic was equal to 0.5% of Mexico's gross domestic product (GDP) (309,310). The levels of spending in Australia, Canada, Chile, the UK, and the US were higher (7.6% to 11.6% of GDP) during the same timeframe (310), potentially improving the capacity of households and individuals to buffer economic shocks associated with the pandemic and associated public health restrictions. Nonetheless, across all countries considered, the proportions of adults and adolescents affected by food insecurity remain high, with worrisome implications for health (14,15,123,155,277).

Direct comparison of food security classification between the HFSSM and Child Food Insecurity Experiences Scale is not possible, as the HFSSM assesses food insecurity at the household level based on manifestations with increasing severity, while the adolescent scale captures the overall number of experiences of food insecurity reported by adolescents (59,92). Nevertheless, in the current study, similar trends in prevalence based on the adult and adolescent surveys were observed in Mexico and the UK. The odds ratios for adults and adolescents in Canada were also similar, though due to the smaller sample size of adolescents, the confidence intervals are wider for the adolescent estimate. In Australia and the US, the trends for adults versus adolescents appear to diverge.

Previous research suggests children may be partially shielded from food insecurity (50,52,84), such that differences in adults' and adolescents' experiences of food insecurity may reflect how household level food insecurity is managed. Given the observed divergence in Australia and the US, however, it is possible that relying on adult-level reporting for the household overlooks children's experiences of food insecurity (85,86,92), underscoring the rationale for including an adolescent-reported measure in this study. The contradictory trends

based on the adult and adolescent surveys in Australia and the US may also relate to household composition, given the differential impact of the COVID-19 pandemic on various subgroups (33,34,36,302). Given the particular vulnerability of households with children to food insecurity (103,274,282,311), increases in the proportion of adults living in food-insecure households in Mexico may relate to the fact that over half of adults in the sample lived in households with children. Household composition data was not available for the adolescent survey, limiting the ability to speculate how compositional differences related to changes in food insecurity experiences.

The present study used measures intended to capture experiences of food insecurity in the prior 12 months, with the reporting period for 2020 thus overlapping with the time periods examined in studies conducted in earlier stages of the pandemic. The measures in the current study theoretically should have captured increases in food insecurity observed in other studies of adults conducted early in the pandemic (34,36,238–240,283). The available data preclude us from examining the dynamics of food insecurity within the 12-month period from late 2019 to late 2020. The lower or unchanged prevalence observed in some countries in late 2020 compared to late 2019 in the current study and other research in Canada and the US (254,302) could reflect a recency effect, which is a cognitive bias such that more recent experiences are recalled more easily than those that are more distal (312). In a comparison of 12-month and 30-day recall periods for assessment of prevalence of food insecurity in the US with the HFSSM, however, the 30-day prevalence was lower than the 12-month prevalence (313), consistent with expectation that a longer recall period captures more experiences and inconsistent with a recency effect.

Differences in estimates from studies conducted during the pandemic may also relate to the use of various versions of the HFSSM, including modules with three, six, ten, or 18-items

and reference periods ranging from 30 days to 12 months (33,34,36,94,240,241,254,283,301,302). Estimates of the prevalence of household food insecurity from before to during the pandemic have also been based on the Food Insecurity Experience Scale and the eight-item Latin American and Caribbean Food Security Scale, with one- and three-month reference periods, respectively (238,239). These differences in measurement make it challenging to directly compare across studies. Heterogeneity in the populations examined may also contribute to differences across studies. The present study used sample quotas and survey weights to reflect the populations of adults and adolescents in each country. Some previous investigations conducted in March/April, May/June, and October/November 2020 focused on subgroups including adults living in a particular state or individuals who identify as women (33,240,283) suggested that the estimated prevalence of adults in food-insecure households increased after the onset of the pandemic relative to pre-pandemic estimates. Future country-specific research using data from the International Food Policy Study will examine changes in food insecurity among subgroups characterized by gender identity, racial/ethnic identity, and perceived income adequacy to provide insight into trends among different subpopulations and the need for targeted policy responses. More broadly, the COVID-19 pandemic has deepened inequities (236,237), underscoring the importance of ongoing monitoring to identify subgroups particularly vulnerable to food insecurity. This is particularly important given overlapping emergencies associated with infectious disease, the climate crisis, and conflicts in various regions of the world, and their potential to continue to undermine food security (4,31).

The repeated cross-sectional data used in this study afforded the opportunity to examine changes in the prevalence and severity of food insecurity over time among adults and adolescents

in several countries. The use of survey weights to account for potential differences in sample composition between years and adjustment for food insecurity status among adults in 2018 strengthened our ability to assess changes over time. The opportunity to conduct longitudinal analyses using data from respondents who participated in more than one year was limited by small cell counts. Further, the findings reflect a snapshot in time and may not be generalizable to future time points given the fluid and everchanging nature of the COVID-19 pandemic, as well as other global crises, such as inflation (314), highlighting the importance of ongoing monitoring.

The HFSSM has been used extensively in North America (53,54); however, it does not capture all experiences of food insecurity, such as relying on food that is considered culturally inappropriate (315). The HFSSM also does not capture how food was obtained, whereas data suggest increasing use of food banks and other emergency programming during the pandemic (316–318). Federal responses to concerns about food insecurity in Canada, for example, focused on supporting food banks, in addition to income supports provided to individuals (281). Given the stigma associated with use of food banks and the constraints in accessing food that meets dietary preferences and restrictions (169,175), important domains of food insecurity that may have implications for health and well-being were not considered here. Further, the categorization of sociodemographic characteristics was shaped by capacity to conduct cross-country comparisons. This resulted in oversimplification of complex social identity factors, such as racial/ethnic identity and cultural diversity, which were consolidated into three categories (319).

5.6 Conclusion

In contrast with observed increases in food insecurity in multiple countries based on data collected early in the pandemic, findings from Canada, Chile, and the UK indicate there were declines or little change in food insecurity from late 2019 to late 2020, possibly suggesting that income support and other program responses to the pandemic may have mitigated vulnerability to food insecurity. In Australia and the US, the trends from 2019 to 2020 diverged among adults and adolescents, and increased prevalence of food insecurity was observed among adults and adolescents in Mexico. Furthermore, in 2020, approximately one-third to three-quarters of adults and adolescents across the countries considered were affected by food insecurity. Ongoing monitoring is needed to assess longer-term trends and the subgroups most affected to enable targeted intervention. Additional research to assess the impact of specific policies on vulnerability to food insecurity during the pandemic may inform interventions to ameliorate food insecurity and its devastating consequences during other emergencies.

6.0 Study 2 – Policy analysis

Title: Characterizing national level economic and social policy responses during the Coronavirus Disease 2019 Pandemic and their relation to known patterns in household food insecurity in Australia, Canada, Chile, Mexico, the United Kingdom, and the United States

Status: Prepared for submission, target journal: Public Health Nutrition.

Authors: Alexandra Peppone¹, Edward A. Frongillo², Warren Dodd¹, Rebecca Lindberg³, Lana Vanderlee⁴, Martin White⁵, Tania C. Aburto Soto⁶, Joel A. Dubin^{1,7}, Michael P. Wallace⁷, Kevin W. Dodd⁸, Navreet Singh¹, Sharon I. Kirkpatrick¹

¹School of Public Health Sciences, University of Waterloo

²Department of Health Promotion, Education, and Behavior, Arnold School of Public Health, University of South Carolina

³Institute for Physical Activity and Nutrition (IPAN), School of Exercise and Nutrition Sciences, Deakin University

⁴École de nutrition, Centre Nutrition, santé et société (NUTRISS), Université Laval

⁵Medical Research Council Epidemiology Unit, University of Cambridge

⁶Centro de Investigación en Nutrición y Salud, Instituto Nacional de Salud Pública

⁷Department of Statistics and Actuarial Science, University of Waterloo

⁸Division of Cancer Prevention, National Cancer Institute, National Institutes of Health

Acknowledgements: AP and SIK: designed the policy analysis; AP, EAF, WD, and SIK: formulated the research questions; all authors provided feedback on the manuscript outline, data analysis plan, and attended working group meetings to guide project development and progress; AP: conducted the analyses and led the drafting of the manuscript; and all authors: provided critical feedback. Thank you to Sejla Isanovic for providing the template for the policy response data extraction. AP held an Ontario Graduate Scholarship and a Social Sciences and Humanities Research Council (SSHRC) Doctoral Fellowship. NS was funded by an Ontario Ministry of Research and Innovation Early Researcher Award held by SIK.

6.1 Overview

Background: The Coronavirus disease 2019 (COVID-19) pandemic differentially impacted the prevalence of food insecurity across countries with indications that economic and social policy responses during the pandemic may underlie these differences.

Objective: The objective was to identify packages of economic and social policy responses implemented or revised by national level governments in six countries and to consider their potential influence on food insecurity.

Methods: Eight policy response trackers were used to identify economic and social policy responses implemented or revised by national level governments between January 2020 and December 2022 in Australia, Canada, Chile, Mexico, the United Kingdom, and the United States. The eligibility criteria and the hypothesized influence that policy responses had on household food insecurity were guided by a theory of change. The collective influence that packages of policy responses and broader events in each country had on household food insecurity were considered.

Results: In total, 142 policy responses were included, with the highest number ($n = 32$) of policy responses identified in the United States and the lowest in the United Kingdom ($n = 10$).

Financial-based policy responses (e.g., unemployment protection) were emphasized in Australia, Canada, and the United Kingdom, while there was a similar number of financial- and resource-based (e.g., food assistance) in Chile, Mexico, and the United States. Countries that emphasized financial-based support and/or expanded existing policy responses appeared to mitigate expected increases, and in some cases, contributed to decreases, in food insecurity during the COVID-19 pandemic. As policy responses expired, the prevalence of household food insecurity increased.

Conclusions: Broad packages of economic and social policy responses implemented or revised during the COVID-19 pandemic appeared to mitigate anticipated increases in household food insecurity in some countries at different time points. Persistent policy responses with the potential to address the financial precarity that underlies household food insecurity are needed to ameliorate this issue during and beyond periods of crisis.

Keywords: COVID-19 pandemic; household food insecurity; policy analysis; cross-country comparison; theory of change.

6.2 Introduction

Household food insecurity—or the inability to access food due to limited financial resources (12)—is a global public health concern (320). In 2022, the global prevalence of individuals experiencing moderate or severe food insecurity, as measured by the Food Insecurity Experience Scale, was 29.6% (1). This estimate has remained unchanged since 2020 and reflects a higher prevalence compared to the prevalence of 25.3% observed before the Coronavirus disease 2019 (COVID-19) pandemic (1). Household food insecurity has serious negative physical and mental health consequences for both adults and children (15,16,122–124,145,151) and has been associated with higher healthcare utilization and costs (133,134,147). Living in food-insecure households during childhood also negatively influences academic achievement and social skills (165,166).

Different patterns in the prevalence, severity, and populations affected by food insecurity occurred after the onset of the COVID-19 pandemic within and across countries. Research drawing upon data collected between two time points: 1) March to August and 2) October to November 2020 suggested the proportions of adults living in households and the prevalence of household food insecurity increased compared to various time points before the COVID-19 pandemic in Australia, Canada, Chile, Mexico, the United Kingdom (UK), and the United States (US) (33–36,238,239). During the latter months of 2020, there were indications of no change or a decrease in household-level food insecurity in Canada and the US compared to rates observed in 2017/2018 in Canada and 2019 in the US (254,302). Context-specific implementation of economic and social policy responses during the COVID-19 pandemic may underlie differences in food insecurity prevalence across countries and over time (254,321,322).

Existing research has examined associations between singular policy responses implemented during the COVID-19 pandemic and household food insecurity and food insufficiency (281,323–325). Countries generally used policy packages, however, to mitigate the spread of COVID-19 and related shocks associated with the COVID-19 pandemic (e.g., income loss) (209). Within packages of policies, responses may have interacted in a complementary and mutually reinforcing manner or negated one another (326,327), demonstrating the importance of considering the collective influence of policy responses on an endpoint, such as household food insecurity. The potential for policy packages to influence household food insecurity was also shaped by broader contextual factors including political preferences that drive the type of policy responses implemented, and the intention and capacity of Government leaders to implement desired policy responses (248,327).

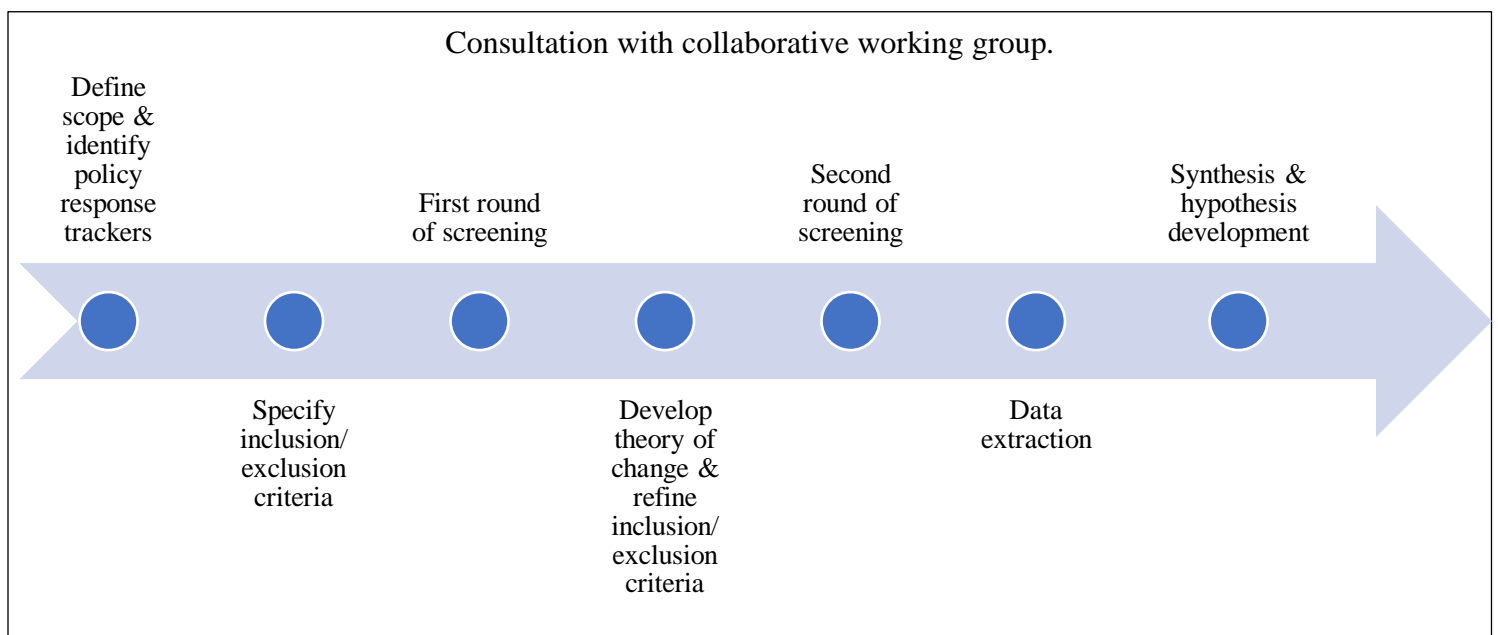
The objective of this study was to identify packages of economic and social policy responses implemented or revised by national level governments in Australia, Canada, Chile, Mexico, the UK, and the US. The potential influence of the policy packages on food insecurity during the COVID-19 pandemic was considered drawing upon prior research. Findings provide insight into characteristics of policy packages (e.g., type of support provided) that can address household food insecurity during and beyond periods of crisis.

6.3 Methods

A policy analysis was conducted to identify and qualitatively compare packages of national level policy responses implemented or revised in Australia, Canada, Chile, Mexico, the UK, and the US during the COVID-19 pandemic. These countries were selected due to their similarities in culture, food environment, and languages spoken and because they are included in the International Food Policy Study, which collects data on food insecurity among adults and

adolescents annually (37). They were also of interest to compare because most were classified as high-income countries, with a federalist government organization, and political regimes that were either an electoral or liberal democracy (41–44). Interpreting changes, or lack thereof, in the national prevalence of household food insecurity in the six countries in the International Food Policy Study through the pandemic motivated the policy analysis (322). Input from a collaborative working group, which included food security and nutrition experts from each country, guided the policy analysis. Working group members were consulted at all stages of the policy analysis (**Figure 6.1**).

Figure 6.1: Flow diagram outlining the stages of the policy analysis and points of consultation with collaborative working group to facilitate consideration of country-specific contexts to support the applicability and relevance of study findings.



6.3.1 Search strategy

The search strategy was based on practices recommended for conducting systematic grey literature searches and developed in consultation with a research librarian at the University of

Waterloo (270). The focus was on grey literature because most information about policy responses during the COVID-19 pandemic was documented outside of peer-reviewed literature (270). Eight policy response trackers (i.e., databases that collect and systematically report on government policy measures) were used to identify policy responses (**Table 6.1**). Six of the trackers were identified *a priori* and two were identified during the policy search (208,212,269,215,262–268). The policy response trackers were developed by authoritative bodies such as the World Bank, International Labor Organization, and International Monetary Fund (212,262,263,266). In one instance, the tracker was specifically designed to enable examination of how COVID-19 policy responses influenced socioeconomic stability, the spread of COVID-19, among other outcomes of interest to researchers and policymakers (208,215).

Table 6.1: Description of policy response trackers used to identify economic and social policy responses implemented or revised by national level governments during the COVID-19 pandemic in Australia, Canada, Chile, Mexico, the United Kingdom, and the United States.

Name of tracker	Description of tracker	Time frame	Regions covered	Sources of information
Eurofound EU PolicyWatch Database of national-level policy measures (267)	Captured social and economic policy responses. Included option to filter by COVID-19 policy responses.	Captured policy responses between 2020 and 2023.	European countries.	Information source was not specified, but appeared to be gathered from government webpages, news outlets, and other non-governmental organizations (267,328).
International Labor Organization Social Protection Monitor (266)	Captured social protection measures. There was the option to narrow the date range and filter by COVID-19 policy responses.	Captured policy responses between 2010 and 2023.	134 countries at the national and sub-national level.	Information was collected from online media and news and periodically from national ministries of labor, social security, welfare, social development, finance, and other ministries. Other sources were used based on area of focus (329). COVID-19 policy responses were collected by the International Social Security Association, the International Labor Organization Social Protection Department and other departments.
International Monetary Fund Policy Responses to COVID-19 (212)	Captured economic responses. Includes background information (e.g., date of first confirmed COVID-19 case) to contextualize policy responses.	Captured policy responses between 2020 and July 2021.	197 economies.	Information was collected from publicly available sources or provided to International Monetary Fund team members from authorities in each country.
Oxford University COVID-19 Government Response Tracker (208,215)	Captured policy response for the purpose of creating indices for data analysis. Data files from the project are publicly available and include commented code outlining the policy responses included in the indices.	Captured policy responses between 2020 and 2023.	180 countries at the national and sub-national level.	Information was collected from publicly available resources including government briefings/press releases, trusted news articles, and international organization reports (215). Information was compiled by trained data collectors. Data collectors include postgraduates from the Blavatnik School of Government, and students/graduates from partner institutions. The review team verified data collected.

<p>United Nations Economic Commission for Latin America and the Caribbean COVID-19 Observatory in Latin America and the Caribbean, Economic and social impact</p> <p>Social Protection Measures to Confront COVID-19 (264,265)</p>	<p>Captured policy responses implemented during the COVID-19 pandemic. Depending on the version reviewed, policy response categories included vaccination, movement within and across countries, health, economy, labor, social protection, education/schools, gender, and education or basic services, cash transfer, in-kind transfer, payment facilities, price control, and tax relief.</p>	<p>Captured policy responses implemented between 2020 and 2021/2022 (depending on country).</p>	<p>Countries in Latin America and the Caribbean.</p>	<p>Information was collected from the Resident Coordinators System of the United Nations in Latin American and the Caribbean, UN Women and Economic Commission for Latin America and the Caribbean.</p>
<p>World Bank Social Protection and Jobs Responses to COVID-19 database (262,263)</p>	<p>Captured planned or implemented social protection and labor policy responses to the COVID-19 pandemic. Policy responses were grouped into three categories: social assistance, social insurance, and labor markets.</p>	<p>Captured policy responses implemented between January 2020 and January 2022.</p>	<p>223 economies at the national and sub-national level.</p>	<p>Information was collected from materials published by governments, global or national public information sources (where needed), and country-based experts from the World Bank Group, United Nations International Children's Emergency Fund, United Nations agencies and governments. Social protection teams at the World Bank verified data collected.</p>
<p>World Trade Organization COVID-19: Support measures (269)</p>	<p>Captured support measures implemented during the COVID-19 pandemic.</p>	<p>The tracker version reviewed was updated on June 22, 2023.</p>	<p>Numerous countries including the six countries of interest.</p>	<p>Information was collected from direct communication between delegations and the World Trade Organization Trade Monitoring Section.</p>
<p>Yale Program on Financial Stability COVID-19 Financial Response Tracker (268)</p>	<p>Captured economic policy responses. Included list of public sources to identify policy responses.</p>	<p>Captured policy responses up to November 8, 2021.</p>	<p>Numerous countries including the six countries of interest.</p>	<p>Information was collected from public communications (e.g., government media releases) and implementing documents. Yale staff verified data collected.</p>

6.3.2 Eligibility criteria

Economic and social policy responses implemented or revised by national level governments between January 2020 and December 2022 in one of the six countries under investigation were examined. The focus on economic and social policy responses aligned with evidence from high-income countries indicating household food insecurity is alleviated by financial-based support (28,98,189,214). National-level government policy responses were selected to align with the level of analysis in the cross-country study (**Chapter 5**) that motivated the policy analysis (322). The date range of January 2020 to December 2022 corresponded with when the World Health Organization declared COVID-19 a Public Health Emergency of International Concern (January 2020) and when policy responses waned in advance of the end of the global emergency in May 2023 (207). This period also aligns with when information about policy responses was recorded by the Oxford University COVID-19 policy response tracker, a comprehensive resource tracking COVID-19 policy responses globally (208,215).

Policy responses were examined if information about the policy was available in English or Spanish. Information available in Spanish was translated using DeepL Translator (<https://www.deepl.com/translator>), Google Translate (<https://translate.google.com/>), or the in-webpage Google Translate feature. The initial scope of policies considered was based on prior research that outlined categories of policy responses (unemployment protection, employment protection, housing, income supports, healthcare) implemented in Canada and the US during the COVID-19 pandemic (213). These categories were used because they have been demonstrated to influence household food insecurity (**Table 6.2**) (28,98,189,214). Two additional categories, food assistance and movement restrictions, were identified as relevant given their potential to influence household food insecurity (18,330).

The inclusion and exclusion criteria were revised after the first round of screening to facilitate the consideration of relevant policies as the initial search returned many policy responses that were assessed by the working group as having little influence on food insecurity. The revision to the criteria was based on a theory of change articulating the hypothesized influence of economic and social policy responses implemented or revised during the COVID-19 pandemic on household food insecurity.

Table 6.2: Inclusion-exclusion criteria for first and second rounds of policy response screening.

Round of screening	Inclusion criteria	Exclusion criteria
First	<ul style="list-style-type: none"> - Policy response related to unemployment protection, employment protection, housing, income supports, food assistance, healthcare policy responses that provide remuneration or other material benefit to an individual, household, or business, or movement restrictions. - Policy response implemented or revised in Australia, Canada, Chile, Mexico, the UK, or the US. - Policy response implemented or revised at the national level. - Policy response implemented or revised between January 2020 and December 2022. - Information about the policy response is available in English or Spanish. 	<ul style="list-style-type: none"> - Policy response related to vaccination, healthcare directives (e.g., halting elective procedures), allocation of personal protective equipment, or alterations to practice requirements for healthcare professionals. - Policy response related to additional powers provided to government entities (e.g., allocation funds by ministers without approval process), or financial support directed to a province, state, or territory. - Policy response was planned but not implemented. - Policy response was not implemented or revised in Australia, Canada, Chile, Mexico, the UK, or the US. - Policy response was implemented or revised at the sub-national level or by a non-governmental organization.
Second	<ul style="list-style-type: none"> - High impact policy types: employment protection; unemployment protection; paid leave; unpaid leave; wage subsidies and (re)hiring incentives; caregiver benefits; birth and parental benefits; subsidies for individuals and households; moratorium on loan repayment, deferral of taxes or other payments; social housing and housing assistance; housing and mortgage policies; 	<ul style="list-style-type: none"> - Low impact policy types: labor-based income tax benefits; digital platforms to sell goods and create businesses; career training and other advancement opportunities; business financing/business tax measures; staple item provision. - Recommended to exclude by working group: movement restrictions.

	<p>eviction bans; utility subsidies; protection from utility cessation; targeted financial assistance; food assistance.</p> <ul style="list-style-type: none"> - Identified as relevant by working group despite having a low impact: healthcare coverage, health insurance, and other insurance. 	<ul style="list-style-type: none"> - Additional reasons for exclusion: sector specific support, small target population, funding directed to businesses/ community/ organization/ government different classification than policy type, online processing vs payment, and not COVID-related policy.
--	--	--

6.3.3 Theory of change

The theory of change articulated how economic and social policy responses may have influenced household food insecurity during the COVID-19 pandemic and included four policy categories—labor, individual and family, housing, and welfare (also referred to as social assistance) (**Supplemental figure 6.1**)—that were adapted from a framework outlining economic and social policy interventions to address household food insecurity (168). Policy types reflect a more granular level of policy response classification than the policy categories. Development of the 22 policy types (nine in the labor category, four in the individual and family category, five in the housing category, and four in the welfare category) was based on the framework (168), food insecurity research from high income countries (28,98,189,214), insights from the first round of screening, and consultation with working group members. To further characterize the policy types, the mechanism of influence was specified as financial-based or resource-based support. Financial-based support included policy responses that provided replacement for lost income or additional sources of income. Resource-based support covered policy responses with the potential to avail resources for food by reducing expenditures on non-food necessities (e.g., housing support). Food-based assistance was considered a resource-based support, except for the US Supplemental Nutrition Assistance Program, which was considered financial-based support because of the distribution of monetary assistance to aid with the

purchase of food (331). **Supplemental table 6.1** and **Supplemental figure 6.1** provide a detailed description and visual representation of the theory of change and its components.

To inform the revised inclusion and exclusion criteria, the hypothesized magnitude of impact on household food insecurity was identified for each policy type. Because information about policy uptake among population subgroups was not available, policy responses were assumed to have the same impact on food insecurity regardless of sociodemographic characteristics, such as income. High impact policy types had the potential to 1) address the financial insecurity that underlies household food insecurity by providing additional or replacement income on a continual basis (i.e., at least twice over the three-year study period); 2) enable reallocation of existing income (e.g., reallocation from paying rent to food); or 3) provide food to individuals or households. Low impact policy types had the potential to address the financial insecurity that underlies household food insecurity but were only provided once and/or the benefit was not primarily directed to individuals or households (e.g., rent subsidies for businesses). Drawing upon the targeted financial assistance policy type as an example, policy responses classified within this policy type were anticipated to provide financial-based support to individuals. Because financial-based support may address the financial precarity that underlies household food insecurity (28,98,189,214), this policy type was considered to have high impact.

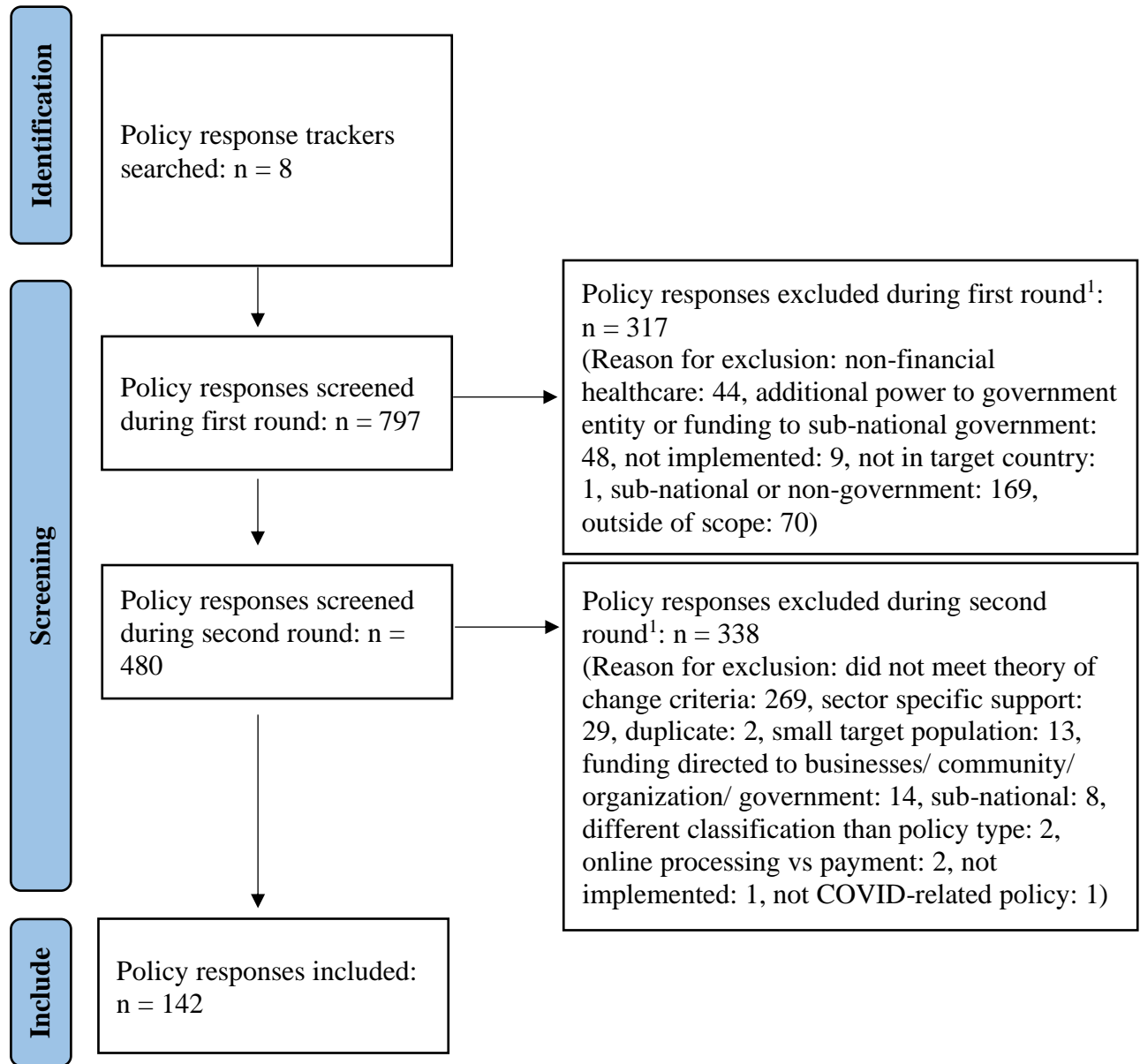
Policy responses considered to have high impact were included. In some instances, policy responses were assigned to multiple policy categories and/or types, which resulted in policy responses classified as having both high and low impact. If these policy responses met all other inclusion criteria, they were included. Despite being hypothesized to have a low impact, healthcare coverage, health insurance, and other insurance were identified by collaborative working group members as important to consider because financial resources that would have

been otherwise used for healthcare could be used to purchase food (139,332,333). Business-related policy responses were considered low impact and excluded because they did not provide direct support to individuals and households. Movement restrictions were also excluded as most restrictions were implemented by sub-national governments and more closely related to the physical rather than financial access to food. Policy responses that provided sector-specific support (e.g., bonuses provided to frontline healthcare workers) or had small target populations were also excluded as they were anticipated to have a limited impact relative to policy responses applicable to broader population subgroups (e.g., households with children) or the entire population (e.g., protection from utility cessation).

6.3.4 Policy response screening

Policy response trackers were searched by one researcher (AP) between March and July 2023 for policy responses that met the first-round screening inclusion criteria (**Table 6.2**). If trackers cited COVID-19 specific government webpages (e.g., Government of Canada COVID-19 response page) and government news articles, these secondary sources were searched for economic and social policy responses that were screened relative to the first-round inclusion and exclusion criteria. Policy responses that met the inclusion criteria were recorded in an Excel spreadsheet, with information about excluded policy responses, including the reason for exclusion, recorded on a separate tab. Subsequently, based on the theory of change and revised inclusion and exclusion criteria, a second round of screening was conducted by AP, including only policy responses hypothesized as high impact or assigned to the healthcare coverage, health insurance, and other insurance policy type (**Table 6.2**). **Figure 6.2** outlines the number of policy responses included and excluded during both rounds of screening.

Figure 6.2: Flow diagram outlining the number of policy responses included and excluded, with reason for exclusion, during the identification process.



¹More than one reason for exclusion was noted for some policy responses during screening, such that the total across reasons for exclusion does not align with the number of excluded policy responses.

6.3.5 Data extraction

For the policy responses that met the inclusion criteria, the country of implementation, policy name, brief description, and the policy tracker(s) or other resources used to identify the policy response were recorded in an Excel spreadsheet by AP (**Supplemental table 6.2**). Policy responses that were implemented or revised in the same piece of legislation and were complementary to each other or reflected multiple changes to the same policy (e.g., changes to healthcare policies implemented in the Coronavirus Aid, Relief, and Economic Security Act (CARES Act) in the US) were grouped into singular entries. Two researchers (AP and NS) verified the data extracted for each policy response for accuracy and completeness against government webpages, non-academic reports, and/or peer-reviewed publications. The Wayback Machine (<https://archive.org/web/>), a webpage archiving resource, was used to facilitate access to inactive webpages. Details for the policy responses were verified to the depth at which information was available on government webpages, non-academic reports, and/or peer-reviewed publications. In a few instances, policy responses were excluded during the verification process because after details about the policy response were clarified, the policy responses no longer aligned with one of the policy types of interest. For example, a policy response related to maternity leave was initially noted for inclusion on the basis that it aligned with the birth and parental benefits policy type. After verifying the details of this policy response, it became clear that the policy response was related to shifting to an online application process rather than providing additional financial benefit, which meant it likely had little influence on food insecurity and was excluded.

6.3.6 Synthesis and hypothesis development

Policy responses were considered collectively by country. Responses were descriptively summarized by indicating the proportions of policy responses in each country by policy categories, policy types, mechanism of influence, and magnitude of impact on household food insecurity as outlined in the theory of change. Policy response timelines were developed to visualize the package of policies implemented or revised in each country (**Figure 6.3**). For additional context, the timelines included a visualization of the Stringency Index, a metric developed by Oxford University that indicates the strictness of government safety measures during the COVID-19 pandemic (215,216).

Figure 6.3: Timelines indicating when economic and social policy responses were implemented or revised by national level governments during the COVID-19 pandemic, by country, (n = 142).

Legend

Policy number fill colors reflect the policy categories they are classified into:

- Labor: blue
- Individual and family: yellow
- Housing: green
- Welfare grey
- Mixed: purple

Policy response duration bar

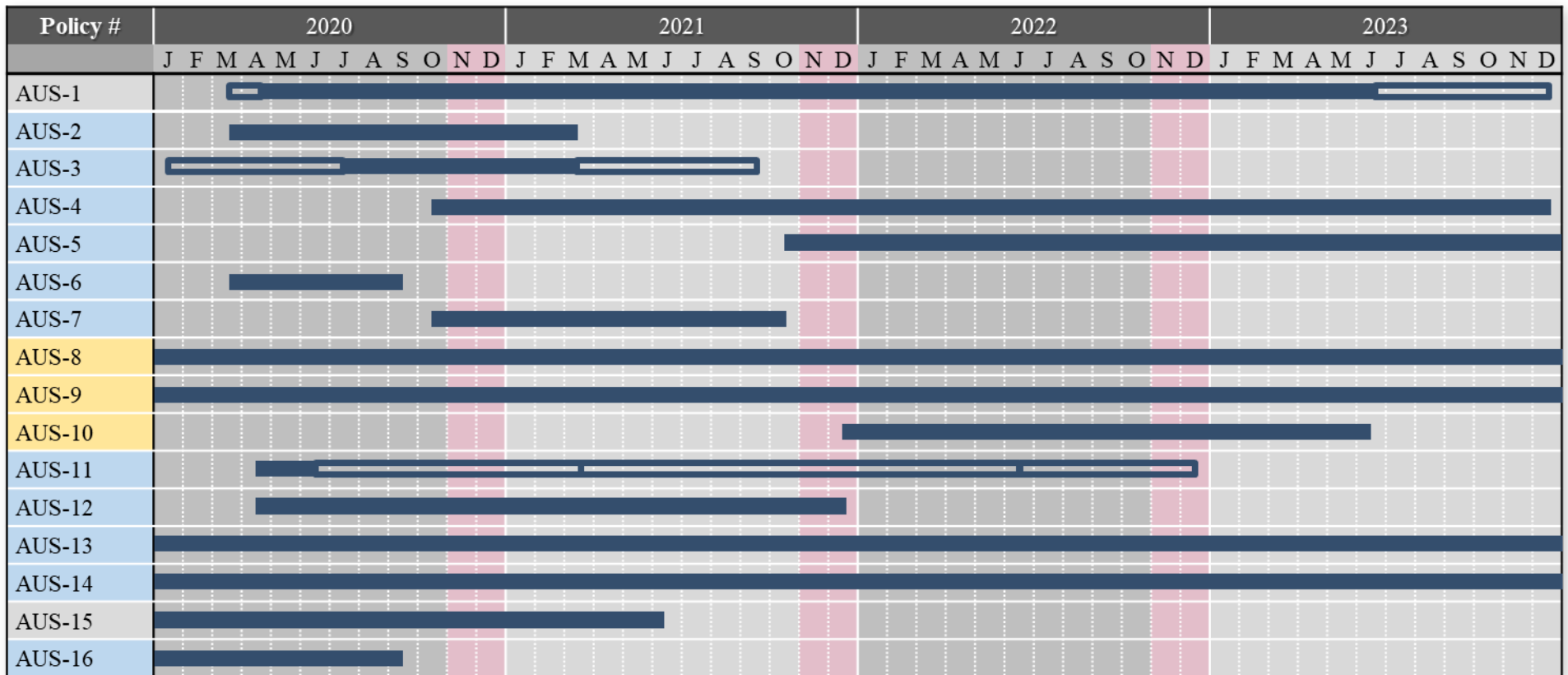
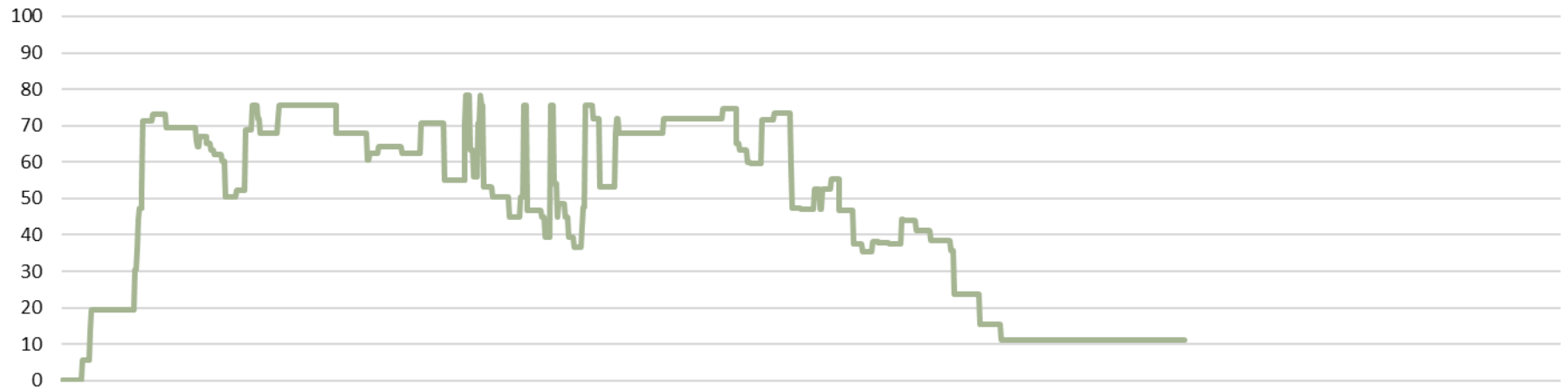
- Solid bar reflects when the policy response was in place.
- Bars with no fill and an outline reflects when components of a policy response started or ended. E.g., policy ended for half of eligible recipients in June 2020 and ended for the other half in September 2020.
- The question mark icon indicates the policy response end date was not specified.

Data for the Stringency Index were drawn from the Oxford COVID-19 Government Response Tracker (215), CC BY.

Data collection periods for the International Food Policy Study, the data source for the study which motivated the present investigation, are noted on the timelines.

Australia

Stringency index



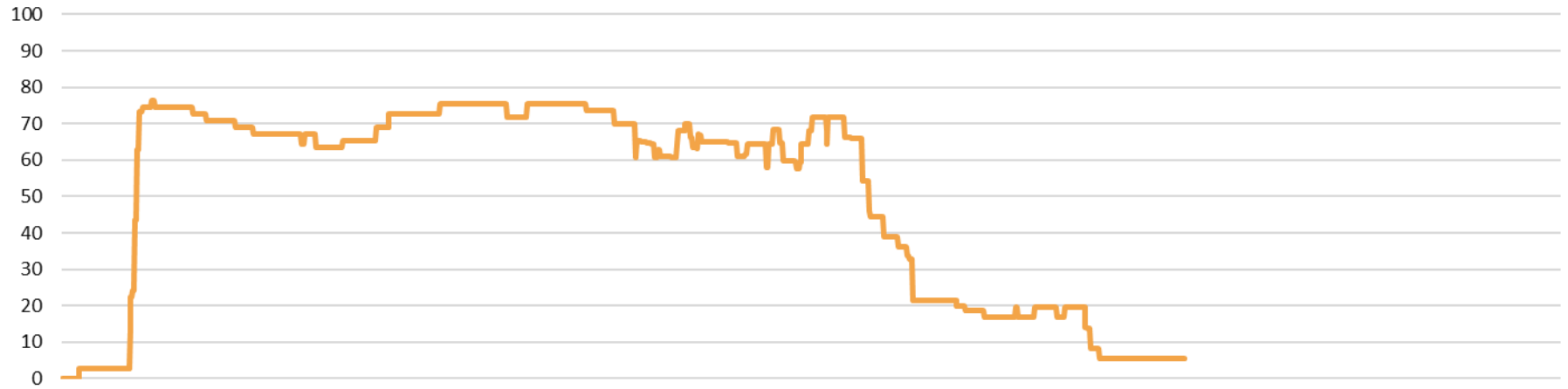
2020 data collection

2021 data collection

2022 data collection

Canada

Stringency index



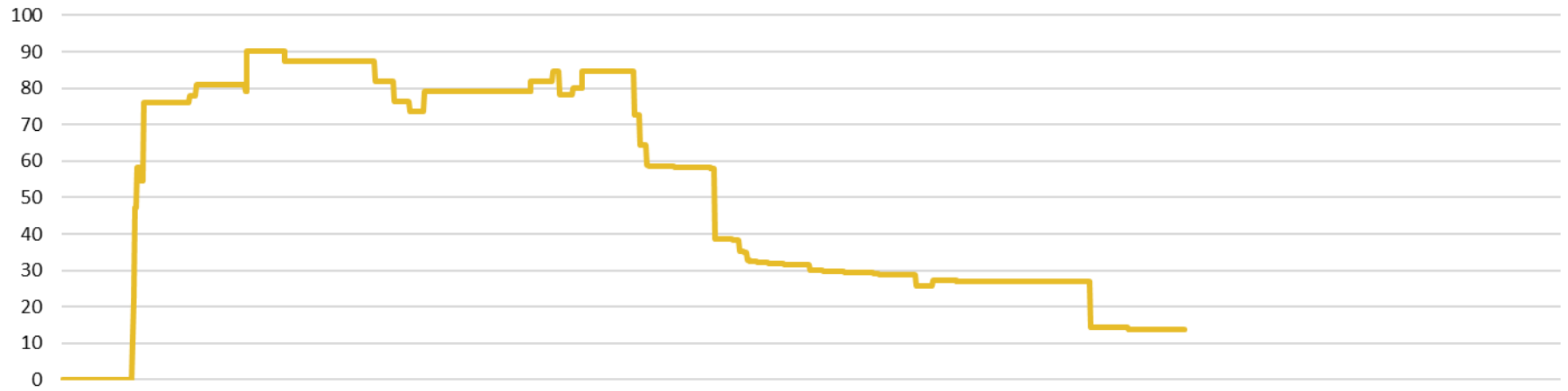
2020 data collection

2021 data collection

2022 data collection

Chile

Stringency index

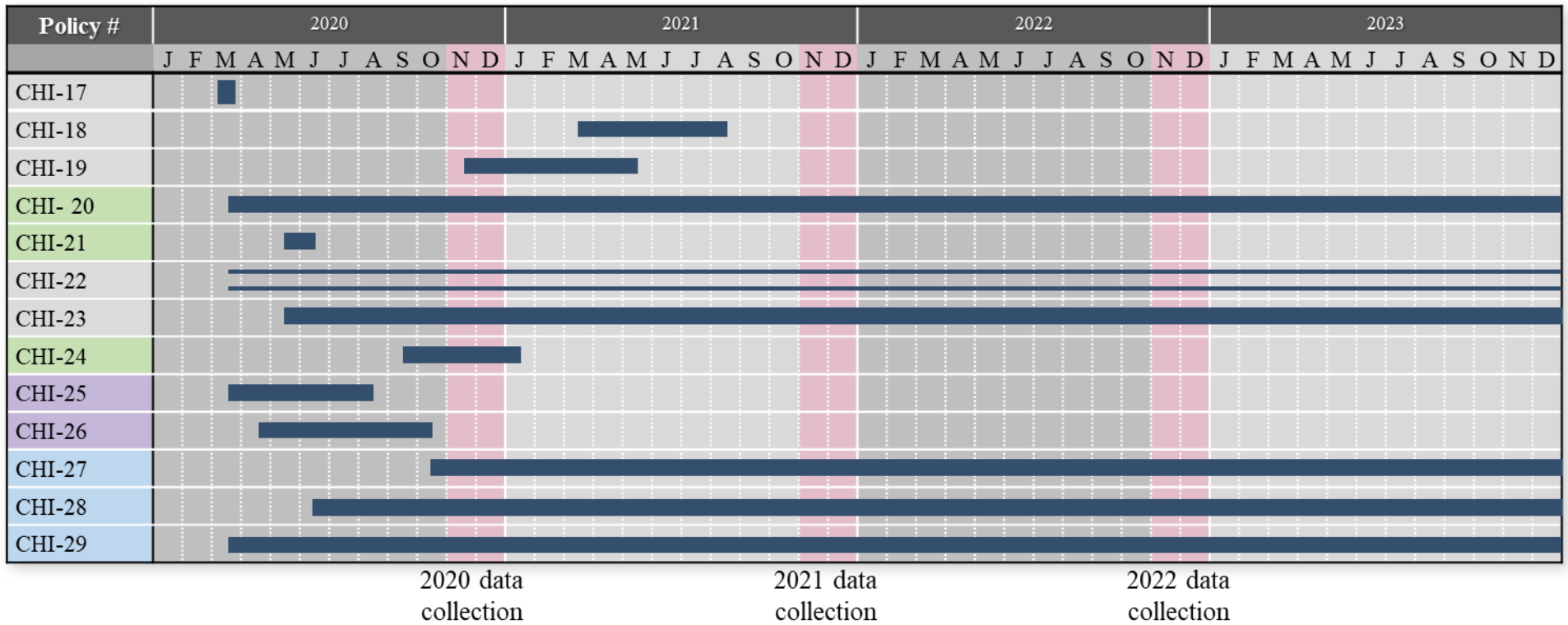
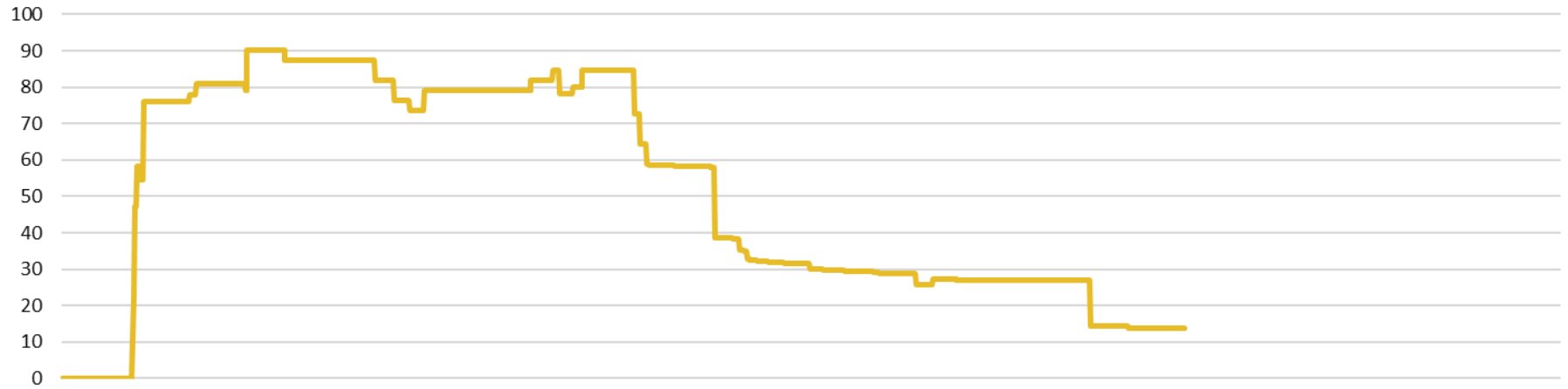


Policy #	2020												2021												2022												2023												
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	
CHI-1																																																	
CHI-2																																																	
CHI-3																																																	
CHI-4																																																	
CHI-5																																																	
CHI-6																																																	
CHI-7																																																	
CHI-8																																																	
CHI-9																																																	
CHI-10																																																	
CHI-11																																																	
CHI-12																																																	
CHI-13																																																	
CHI-14																																																	
CHI-15																																																	
CHI-16																																																	

2020 data collection

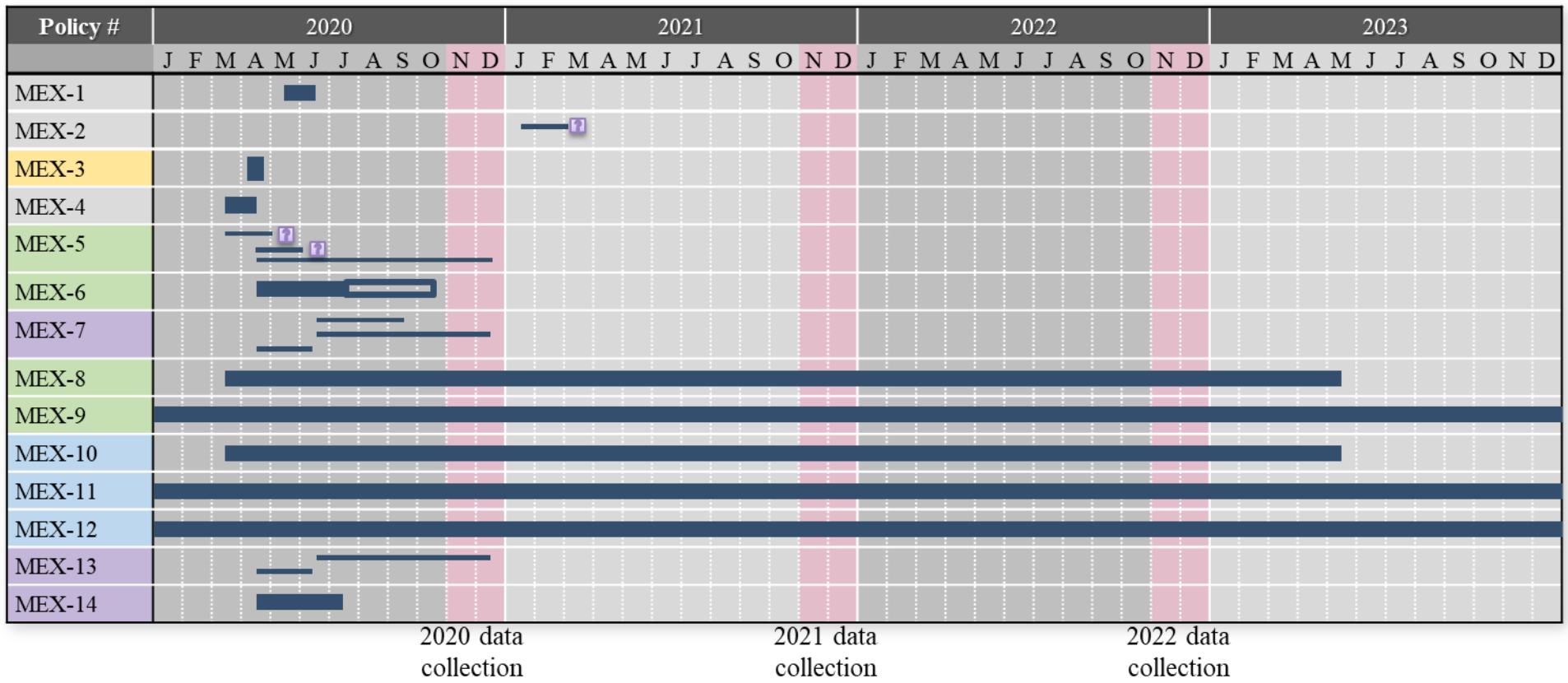
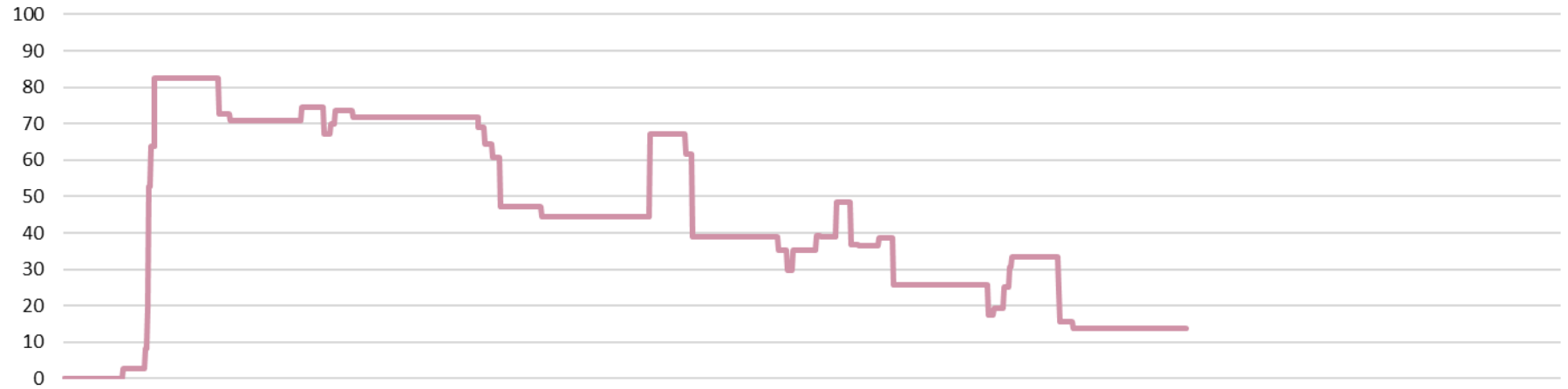
2021 data collection

2022 data collection



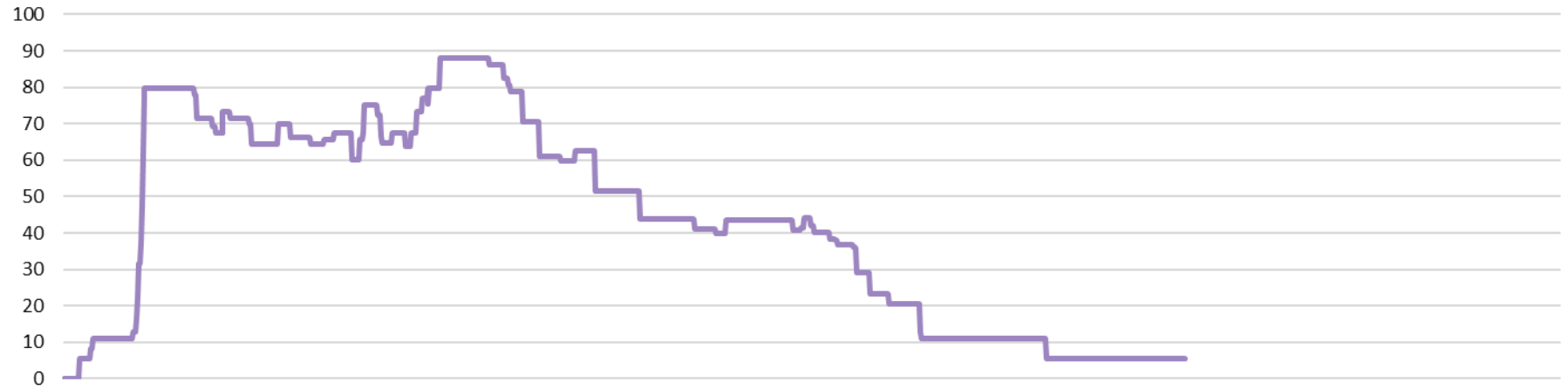
Mexico

Stringency index



United Kingdom

Stringency index



Policy #	2020												2021												2022												2023											
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
UK-1																																																
UK-2																																																
UK-3																																																
UK-4																																																
UK-5																																																
UK-6																																																
UK-7																																																
UK-8																																																
UK-9																																																
UK-10																																																

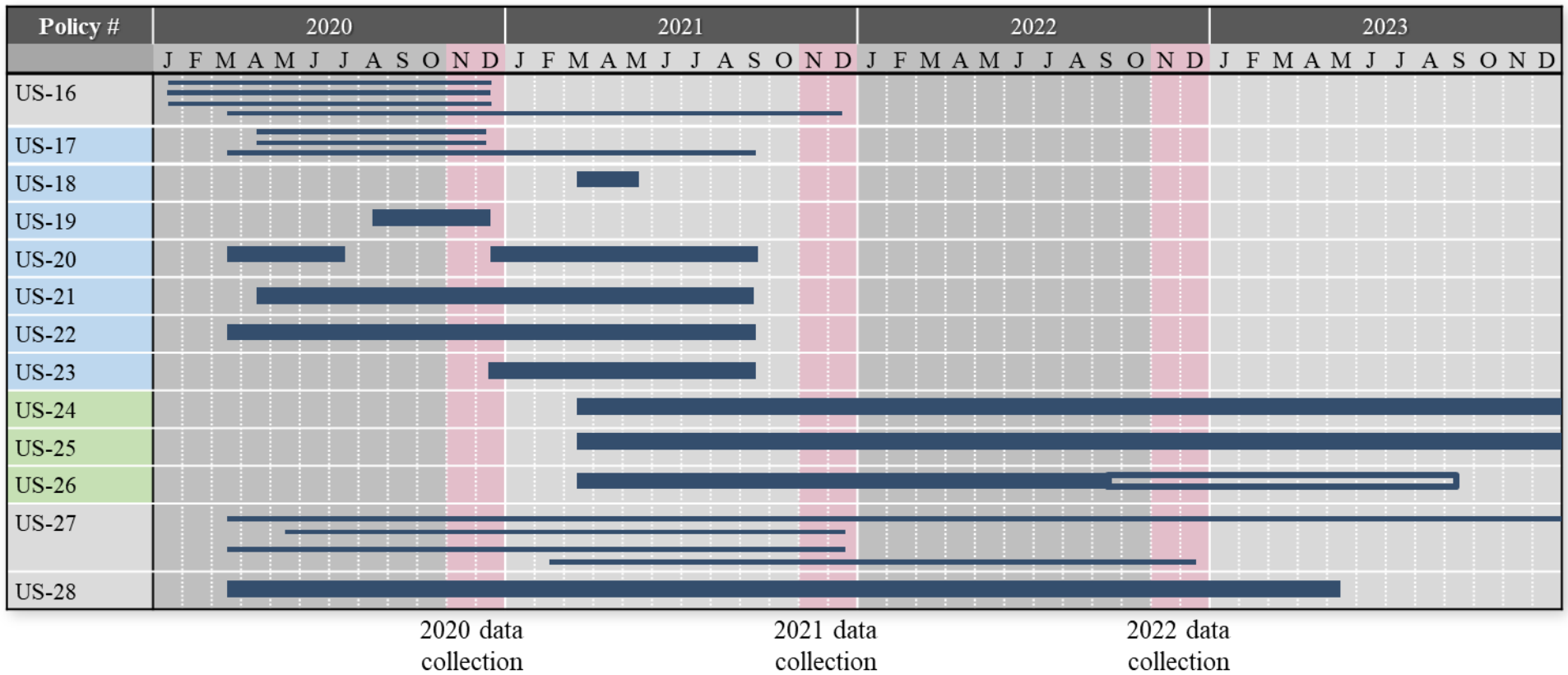
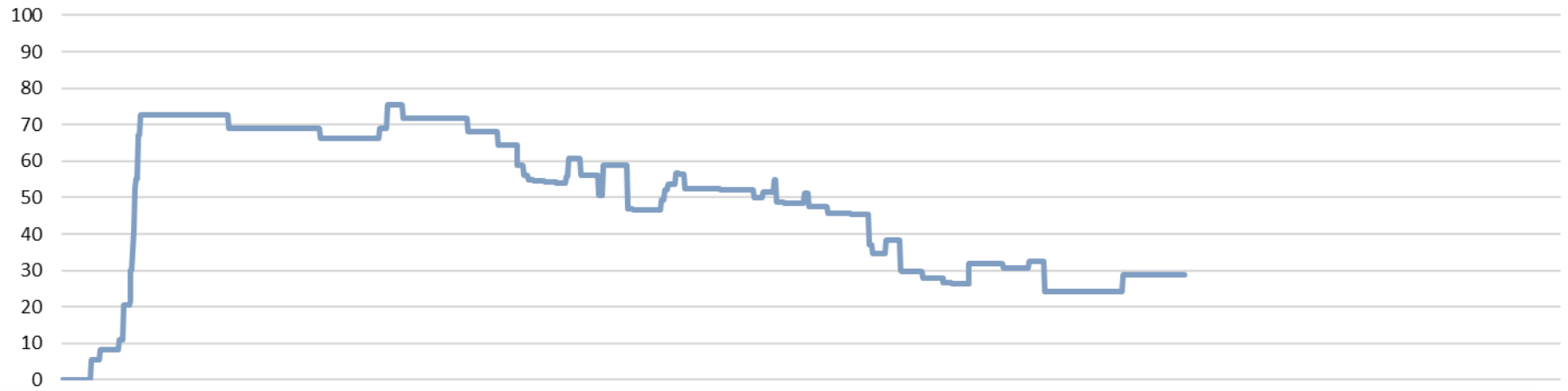
2020 data collection

2021 data collection

2022 data collection

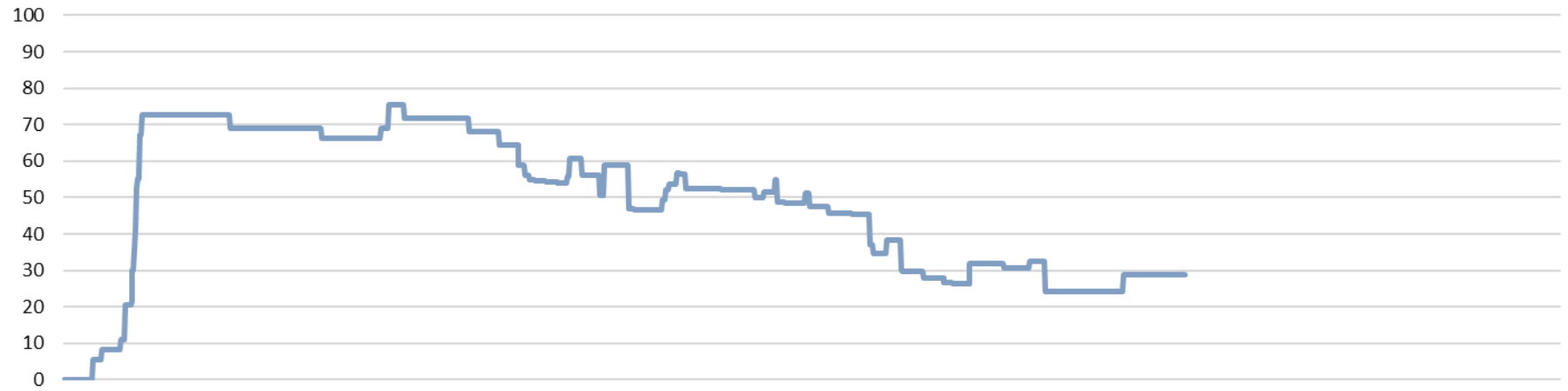
United States

Stringency index



United States

Stringency index



Policy #	2020												2021												2022												2023											
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
US-29																																																
US-30																																																
US-31																																																
US-32																																																

2020 data collection

2021 data collection

2022 data collection

The theory of change, policy response timelines, findings from prior research that examined changes in household food insecurity or adults living in food-insecure households in the six countries of interest, and information on broader events with the potential to influence household food insecurity were used to develop hypotheses about how packages of policy responses may have mitigated potential increases in household food insecurity in 2020, 2021, and 2022 relative to the prior year in each country (215,222,238,322). Prior to the consideration of policy packages, household food insecurity was anticipated to increase in 2021 and 2022 relative to the prior year because the COVID-19 pandemic was ongoing and there were numerous country-specific (e.g., Brexit in the UK) and global events (e.g., inflation) with the potential to undermine food insecurity (334–336).

Packages with numerous policy responses that provided long periods (six months or more) of coverage were hypothesized to mitigate or alleviate household food insecurity to a greater extent than packages with responses that were short in duration given the breaks in policy coverage. No change or potentially a decrease in household food insecurity prevalence were hypothesized for years with numerous overlapping policy responses compared to years when policy responses did not overlap or when there were few policy responses overall. Policy packages that emphasized financial-based support were also anticipated to more effectively mitigate or alleviate household food insecurity compared to packages that emphasized resource-based support given the ability of financial-based support to address the root cause of household food insecurity (28,98,189,214). Discussions with collaborative working group members with country-specific expertise occurred to confirm the hypotheses were reasonable. **Table 6.3** outlines the hypotheses developed and their rationale and summarizes year-to-year changes in food insecurity from prior research. Changes in food insecurity were specified at the individual-

level, household level, and as the proportion of adults in food-insecure households. Estimate sources include reports commissioned by non-governmental organizations, national level government publications, and peer-reviewed literature.

Table 6.3: Hypotheses for how food insecurity changed, or not, on a year-to-year basis relative to the prior year or available time point from before the COVID-19 pandemic in 2020 to 2022, by country.

Country	Year	Hypothesis	Policy package rationale	Additional events	Change observed
Australia	2020	No change or decrease	Numerous policy responses provided long periods of support. Many policy responses overlapped. Primarily financial-based support.	Bushfires, record rainfall and drought in portions of the country	Increase and decrease (33,322)
Australia	2021	No change	Numerous policy responses provided long periods of support. Highest number of active policy responses compared to the other two years, however, greater number of policy responses end compared to previous year. Policy responses overlapped but to a lesser extent than in the previous year. Primarily financial-based support.	Mouse plague, incorrectly sought debt repayment from some individuals who accessed welfare payments	No comparable data between 2020 and 2021.
Australia	2022	Increase	Numerous policy responses provided long periods of support. Lowest number of active policy responses. Primarily financial-based support.	Inflation, flooding in portions of the country, new Prime Minister elected	Increase (256,337)
Canada	2020	No change or decrease	Numerous policy responses provided long periods of support. Many policy responses overlapped. Highest number of active policy responses compared to the other two years. Primarily financial-based support.	Federal level government confidence vote	Increase and decrease (36,254,322)
Canada	2021	No change or increase	Numerous policy responses provided long periods of support. Almost half of identified policy responses ended during the year. Policy responses overlapped but to a lesser extent than in the previous year.	Federal level government election, flooding and wildfires in portions of the country	No change (70)

			Primarily financial-based support with a greater number of resource-based policy responses compared to the previous year.		
Canada	2022	Increase	Numerous policy responses provided long periods of support. Lowest number of active policy responses. Primarily financial-based support.	Inflation, protest of COVID-19 safety measures	Increase (12)
Chile	2020	No change or increase	Numerous policy responses provided long periods of support. Some policy responses overlapped. Highest number of active policy responses compared to the other two years. Almost equal number of financial-based and resource-based support.	One-year anniversary of anti-government protests, voted in favor of drafting a new constitution	Increase ¹ (67,238)
Chile	2021	No change or increase	Numerous policy responses provided long periods of support. Some policy responses overlapped. Greater number of financial-based policy responses than the previous year.	Presidential, parliamentary, constitutional convention, municipal, and regional governor elections	Increase ¹ (67)
Chile	2022	Increase	Numerous policy responses provided long periods of support. Lowest number of active policy responses. Almost equal number of financial-based and resource-based support.	Inflation, rejection of the new constitution	Increase ¹ (67)
Mexico	2020	Increase	In general, lower capacity to respond to the pandemic than in other countries as it was the only upper-middle income country considered. Mix of policy responses that provide long and short periods of support.	Federal level government not meeting expectation related to reducing disparities between high government salaries and	Increase ¹ (67,239,322)

			Highest number of active policy responses compared to other two years but overall low number of active policy responses. Almost equal number of financial-based and resource-based support.	individuals living in poverty	
Mexico	2021	Increase	In general, lower capacity to respond to the pandemic than other countries as it was the only upper-middle income country considered. Numerous policy responses provided long periods of support. Low number of active policy responses. Almost equal number of financial-based and resource-based support.	Continued discontentment with federal government, federal level government midterm election	Increase ¹ (67)
Mexico	2022	No change	In general, lower capacity to respond to the pandemic than other countries as it was the only upper-middle income country considered. Numerous policy responses provided long periods of support. Low number of active policy responses. Equal number of financial-based and resource-based support.	Inflation (Highlighted by working group member to be less of an issue than other contexts examined.) Attempted to reform electoral system, which was unsuccessful and resulted in protests	Increase ¹ (67)
United Kingdom	2020	No change or increase	All policy responses provided long periods of support. All policy responses overlapped. Low number of active policy responses. Primarily financial-based support.	Severe storms in portions of the country, Brexit finalized by the end of the year	No change and increase (34,322)
United Kingdom	2021	No change or increase	All policy responses provided long periods of support. All policy responses overlapped.	Brexit took effect	No change (94)

			Highest number of active policy responses compared to the other two years but overall low number of active policy responses. Primarily financial-based support.		
United Kingdom	2022	Increase	Few policy responses provided long periods of support. Low number of active policy responses. Primarily financial-based support.	Inflation, multiple changes in political leadership	Increase (94)
United States	2020	No change	Numerous policy responses provided long periods of support. Many policy responses overlapped. Almost equal number of financial-based and resource-based support.	Stock market crashed, federal level government election	No change and increase (35,302,322)
United States	2021	No change	Numerous policy responses provided long periods of support. Many policy responses overlapped. Highest number of active policy responses compared to the other two years. Almost equal number of financial-based and resource-based support.	Capitol was stormed, wildfires in portions of the country	No change (255)
United States	2022	Increase	All policy responses provided long periods of support. All policy responses overlapped. Primarily resource-based support.	Inflation, hurricanes in portions of the country	Increase (13)

¹Increase observed in reference 60 based on comparison of three-year average of food insecurity prevalence in 2020 to 2022 compared to 2014 to 2016.

6.4 Results

Review of the eight policy response trackers resulted in the identification of 797 (Australia: 101, Canada: 164, Chile: 141, Mexico: 71, UK: 163, US: 157) potentially relevant policy responses (**Figure 6.2**). After the first round of screening, 480 policy responses (Australia: 74, Canada: 114, Chile: 98, Mexico: 45, UK: 64, US: 85) were identified as potentially relevant based on the inclusion criteria. Fifty-three percent of excluded policy responses were implemented or revised at the sub-national level or by a non-governmental organization. Reasons for excluding the remaining policy responses included the lack of alignment with the policy scope or the policy responses were proposed but not implemented. The number of responses was reduced to 142 policy responses (Australia: 30, Canada: 27, Chile: 29, Mexico: 14, UK: 10, US: 32) after the second round of screening. Reasons for excluding policy responses during the second round of screening included they did not meet inclusion criteria related to the theory of change, they provided sector specific support, and they were implemented at the sub-national level. Of the 142 responses included, the highest number of policy responses was captured in the US (n = 32), while the lowest number (n = 10) of policy responses was recorded for the UK (**Table 6.4**). Approximately 40% of policy responses in the UK were excluded because they were implemented at the sub-national level (results not shown).

Table 6.4: Breakdown of included policy responses in Australia, Canada, Chile, Mexico, the United Kingdom, and the United States during the COVID-19 pandemic by policy category, mechanism of influence and magnitude of impact on food insecurity, 2020 to 2022.

	All countries N = 142 (%)	Australia N = 30 (%)	Canada N = 27 (%)	Chile N = 29 (%)	Mexico N = 14 (%)	United Kingdom N = 10 (%)	United States N = 32 (%)
Labor category	51 (36%)	15 (50%)	14 (52%)	8 (28%)	3 (21%)	4 (40%)	7 (22%)
Individual and family category	24 (17%)	5 (17%)	4 (15%)	7 (24%)	1 (7%)	3 (30%)	4 (13%)
Housing category	22 (15%)	2 (6%)	1 (4%)	4 (14%)	4 (29%)	3 (30%)	8 (25%)
Welfare category	38 (27%)	7 (23%)	8 (30%)	7 (24%)	3 (21%)	0 (0%)	13 (41%)
Mixed policy category ¹	7 (5%)	1 (3%)	0 (0%)	3 (10%)	3 (21%)	0 (0%)	0 (0%)
Mechanism of influence	Resource: 49 (35%) Financial: 87 (61%) Both: 6 (4%)	Resource: 7 (23%) Financial: 23 (77%) Both: 0 (0%)	Resource: 5 (19%) Financial: 22 (81%) Both: 0 (0%)	Resource: 12 (41%) Financial: 15 (52%) Both: 2 (7%)	Resource: 6 (43%) Financial: 7 (50%) Both: 1 (7%)	Resource: 3 (30%) Financial: 7 (70%) Both: 0 (0%)	Resource: 16 (50%) Financial: 13 (41%) Both: 3 (9%)
Magnitude of impact	Low: 12 (8%) High: 126 (89%) Both: 4 (3%)	Low: 3 (10%) High: 26 (87%) Both: 1 (3%)	Low: 1 (4%) High: 26 (96%) Both: 0 (0%)	Low: 2 (7%) High: 24 (83%) Both: 3 (10%)	Low: 0 (0%) High: 14 (100%) Both: 0 (0%)	Low: 0 (0%) High: 10 (100%) Both: 0 (0%)	Low: 6 (19%) High: 26 (81%) Both: 0 (0%)
Active policy responses by year ²	2020: 116 (82%) 2021: 115 (81%) 2022: 69 (49%)	2020: 25 (83%) 2021: 28 (93%) 2022: 17 (57%)	2020: 23 (85%) 2021: 19 (70%) 2022: 11 (41%)	2020: 26 (90%) 2021: 21 (72%) 2022: 11 (38%)	2020: 13 (93%) 2021: 6 (43%) 2022: 5 (36%)	2020: 8 (80%) 2021: 10 (100%) 2022: 5 (50%)	2020: 21 (66%) 2021: 31 (97%) 2022: 20 (63%)

¹The mixed policy category reflects that some policy responses aligned with one or more of the four different policy types.

²Some policy responses were active for more than one year which is why the number and proportion of responses sums to more than the total number of policy responses and the proportion sums to more than 100%.

All countries had packages of policy responses that provided long (e.g. six months or more) periods of coverage across 2021 and 2022. In 2020, Mexico had a mix of policy responses that provided long and short periods of coverage, while all other countries had responses with long periods of coverage (**Figure 6.3 and Table 6.3**). Australia and Canada had numerous policy responses that overlapped in 2020 with fewer overlapping policy responses observed in 2021, and a low overall number of responses in 2022. Chile had some policy responses that overlapped in 2020 and 2021 with a low overall number of policy responses in 2022. Mexico and the UK had a low number of policy responses across all years examined. In the UK, however, all policy responses overlapped across all years. The US had many policy responses that overlapped in 2020 and 2021 with all remaining policy responses overlapping in 2022.

Policy packages in Australia, Canada, and the UK largely provided financial-based support, pertaining to approximately 70% to 80% of individual policy responses (**Tables 6.3 and 6.4**). Chile and Mexico had policy packages consisting of responses that were approximately 50% financial-based (e.g., unemployment protection, wage subsidies and (re)hiring incentives), approximately 40% resource-based (e.g., healthcare coverage, health insurance and other insurance, housing and mortgage policies), and 7% of responses provided both financial- and resource-based support. The US was the only country where 50% of policy responses were considered to provide resource-based support.

The highest proportions of policy responses implemented or revised in Australia (50%), Canada (52%), Chile (28%), and the UK (40%) were assigned to the labor policy category (**Table 6.4**). All labor-based policy responses provided financial support and included unemployment protection, paid leave, and wage subsidies and (re)hiring benefits (**Table 6.5**). Twenty-nine percent of policy responses in Mexico were assigned to the housing policy

category, which provided resource-based support and included housing and mortgage policies and utility subsidies. In the US, 41% of policy responses were assigned to the welfare category, which reflected policy responses classified as providing food assistance and healthcare coverage, health insurance, and other insurance. Welfare-based policy responses included a mix of financial-based and resource-based support. All countries except Mexico and the UK had food assistance policy responses in their package of responses. Healthcare-related policy responses, the only included policy type with a low impact, made up between 4% and 7% of policy responses in Australia, Canada, and Chile, while 19% of responses in the US were assigned to this policy type (**Table 6.5**).

Table 6.5: Breakdown of included policy responses in Australia, Canada, Chile, Mexico, the United Kingdom, and the United States during the COVID-19 pandemic by policy category and policy type, 2020 to 2022.

	Australia N = 30 (%)	Canada N = 27 (%)	Chile N = 29 (%)	Mexico N = 14 (%)	United Kingdom N = 10 (%)	United States N = 32 (%)
Policy category	Policy type					
Labor policy category	Unemployment protection: 4 (13%) Paid leave: 3 (10%) Unpaid leave: 1 (3%) Wage subsidies and (re)hiring incentives: 6 (20%)	Employment protection: 1 (4%) Unemployment protection: 5 (19%) Paid leave: 2 (7%) Wage subsidies and (re)hiring incentives: 5 (19%)	Employment protection: 1 (3%) Unemployment protection: 3 (10%) Paid leave: 1 (3%) Wage subsidies and (re)hiring incentives: 3 (10%)	Employment protection: 1 (7%) Paid leave: 2 (14%)	Paid leave: 2 (20%) Wage subsidies and (re)hiring incentives: 2 (20%)	Unemployment protection: 5 (16%) Paid leave: 1 (3%) Wage subsidies and (re)hiring incentives: 1 (3%)
Individual and family policy category	Caregiver benefits: 1 (3%) Birth and parental benefits: 3 (10%) Subsidies for individual and households: 1 (3%)	Caregiver benefits: 1 (4%) Birth and parental benefits: 1 (4%) Subsidies for individual and households: 1 (4%) Moratorium on loan repayment, deferral of tax or other payments: 1 (4%)	Birth and parental benefits: 2 (7%) Subsidies for individual and households: 3 (10%) Moratorium on loan repayment, deferral of tax or other payments: 2 (7%)	Subsidies for individual and households: 1 (7%)	Subsidies for individual and households: 3 (30%)	Birth and parental benefits: 1 (3%) Subsidies for individual and households: 1 (3%) Moratorium on loan repayment, deferral of tax or other payments: 2 (6%)

Housing policy category	Housing and mortgage policies: 2 (7%)	Housing and mortgage policies: 1 (4%)	Housing and mortgage policies: 2 (7%) Utility subsidies: 1 (3%)	Housing and mortgage policies: 2 (14%) Utility subsidies: 2 (14%)	Housing and mortgage policies: 2 (20%)	Housing and mortgage policies: 6 (19%) Eviction bans: 1 (3%) Utility subsidies: 1 (3%)
Welfare policy category	Targeted financial assistance: 3 (10%) Food assistance: 1 (3%) Healthcare coverage, health insurance and other insurance: 3 (10%)	Targeted financial assistance: 4 (15%) Food assistance: 3 (11%) Healthcare coverage, health insurance and other insurance: 1 (4%)	Targeted financial assistance: 1 (3%) Food assistance: 3 (10%) Healthcare coverage, health insurance and other insurance: 2 (7%)	Targeted financial assistance: 3 (21%)		Targeted financial assistance: 1 (3%) Food assistance: 6 (19%) Healthcare coverage, health insurance and other insurance: 6 (19%)
Mixed policy category ¹	Mixed: 2 (7%)	Mixed: 1 (4%)	Mixed: 5 (17%)	Mixed: 3 (21%)	Mixed: 1 (10%)	Mixed: 0 (0%)

¹Mixed reflects that some policy responses aligned with more than one policy category and/or policy type.

6.5 Discussion

The breadth and nature of policy responses implemented or revised by national level governments during the COVID-19 pandemic differed across Australia, Canada, Chile, Mexico, the UK, and the US. Most countries had policy responses that were long in duration (six months or more) across all years examined. In 2020, Mexico was an exception, with a similar number of responses that provided short- and long-term coverage. Policy responses overlapped to varying degrees across countries, while there was a low overall number of policy responses in Mexico and the UK. Financial-based support was emphasized in Australia, Canada, and the UK, with an almost equal distribution of financial-based and resource-based supports in Chile, Mexico, and the US. The US had a similar number of policy responses in 2020 and 2022 with the highest number in 2021. In all other countries, combinations of policy responses were the most active in 2020 and 2021 with waning coverage into 2022.

6.5.1 Food insecurity and policy responses

Based on prior research (33–36,238,239), the prevalence of food insecurity among adults living in households or household-level food insecurity increased in 2020 compared to selected time points from before the COVID-19 pandemic in all countries. There was also some indication that the proportion of adults in food-insecure households or the prevalence of household-level food insecurity did not change or decreased in 2020 compared to 2019 in Australia, Canada, the UK, and the US. In 2021 relative to 2020, the prevalence of food insecurity among adults living in households or household-level food insecurity did not change in Canada, the UK, and the US (70,94,255). There was a lack of comparable data in Australia, while in Chile and Mexico, three-year averages suggested the prevalence of individual-level food

insecurity was higher in 2020-2022 than in 2014-2016 (67). In 2022, the proportion of adults in food-insecure households or prevalence of household-level food insecurity was higher than in 2021 in Australia, Canada, the UK and the US (12,13,94,256,337). Year-to-year household food insecurity prevalence estimates were not available in Chile and Mexico (67).

The decrease or lack of change in the proportion of adults in food-insecure households and the prevalence of household-level food insecurity by the end of 2020, relative to various time points before the pandemic, in Australia, Canada, the UK, and the US contrasts expected increases in household food insecurity prevalence (254,302,322). Policy responses in these countries were provided for long periods and overlapped with each other. In Australia and Canada, where declines in food insecurity among adults living in households were observed (254,322), financial-based support was emphasized, indicating the value of implementing or revising financially oriented policy responses. Although the UK also implemented or revised financial-based supports, the overall number of policy responses was low. This low number of responses may have diminished the ability for these responses to contribute to a decrease in the proportion of adults in food-insecure households like what was observed in Australia and Canada (322). The lack of change, rather than decrease, in the prevalence of household-level food insecurity in the US may be a consequence of equally emphasizing financial- and resource-based support rather than focusing on financial-based support. Resource-based policy responses included alterations to healthcare coverage and food assistance, two of the most prevalent policy responses in the US. Healthcare-related policy responses may have mitigated increases in household food insecurity as financial resources that are otherwise used for healthcare could be used to purchase food (139,332,333), while food assistance is a longstanding policy response (179). Thus, the provision of financial-based support and/or scaling up existing policy responses,

such as food assistance in the US, appeared to mitigate expected increases in the proportion of adults in food-insecure households and the prevalence of household-level food insecurity during 2020 in Australia, Canada, the UK, and the US.

Chile and Mexico also implemented or revised similar proportions of financial- and resource-based policy responses in 2020. These countries, however, experienced an increase in the proportions of adults in food-insecure households and prevalence of household-level food insecurity in 2020 compared to 2017, 2018 or 2019 (238,239,322). Differences in food insecurity trends between the US and Chile and Mexico, despite equally emphasizing financial- and resource-based support, are likely related to broader country-specific characteristics. Protests in Chile between October 2019 and March 2020 occurred after an increase in metro fees but more broadly, reflected discontent with inequality, a driver of food insecurity, in the country (8,338,339). Mexico was the only upper middle-income country examined (41). When considering spending on COVID-19-related expenses (e.g., healthcare, and social protection measures), Mexico had lower levels of spending relative to other countries considered (309). Overall, an increase in the proportions of adults in food-insecure households and household-level food insecurity prevalence in Chile and Mexico in 2020 suggests that the packages of policies were insufficient to address COVID-19-related and broader country-specific challenges with the potential to influence household food insecurity in both countries (238,239,322).

National level government responses to the COVID-19 pandemic in 2021 followed the same pattern of responses as 2020. Household food insecurity was hypothesized to not change or increase, even among countries that experienced a decrease in household food insecurity during 2020 relative to prior years. Both Australia and Canada, where decreases were observed in 2020, experienced a rolling back of policy responses by the end of 2021. Evidence on trends in

household food insecurity in Australia from 2020 to 2021 is lacking. Research in Canada, however, suggests the prevalence of household-level food insecurity did not change between 2020 and 2021 (70). Moreover, food insecurity among adults living in households and at the household-level in the UK and the US did not change from 2020 to 2021, conceivably because of the consistency in the package of policy response between 2020 and 2021 (94,255). Additional challenges associated with Brexit in the UK likely mitigated any opportunity for a reduction in household food insecurity to occur in 2021 relative to 2020 (335,336). Policy packages in Chile and Mexico were, similarly, relatively unchanged between 2020 and 2021. Drawing upon a three-year average, the prevalence of individual-level food insecurity was higher in 2020-2022 in Chile and Mexico than in 2014-2016, but this estimate provides little insight into year-to-year changes (67).

By 2022, household food insecurity prevalence was hypothesized to increase in all countries except for Mexico due to the limited number of policy responses and inflation (334). In Mexico, opportunities to engage in paid work increased, as highlighted by a decrease in the unemployment rate, and a similar rate of inflation in 2021 (7.4%) compared to 2022 (7.8%) (340,341). Thus, no change in household food insecurity prevalence was expected for 2022 compared to 2021. Based on available evidence, the proportions of adults in food-insecure households or prevalence of household-level food insecurity increased in 2022 compared to prior years in Australia, Canada, the UK, and the US (12,13,94,256,337), suggesting negative consequences of waning policy response coverage and inflation for household food insecurity. Accuracy of the hypotheses developed for Chile and Mexico could not be assessed given the lack of year-to-year household food insecurity prevalence estimates (67). Nevertheless, the present analysis suggests that differences in packages of policy responses, with consideration of broader

contextual factors such as country-specific (e.g., Brexit in the UK) and global events (e.g., inflation), likely shaped differences in food insecurity trends observed during the COVID-19 pandemic (1,12,13,33,94,238,239,322).

6.5.2 Policy implications

Overall, findings reinforce the value of implementing or revising packages of policy responses that emphasize financial-based support to address household food insecurity (28,98,189,214), while recognizing that combinations of policy responses and their interactions contributed to a lack of change and even declines in household food insecurity in some contexts (326,327). Expansion of existing social assistance systems, e.g., food assistance and healthcare coverage in the US, shaped the type of economic and social assistance provided during the COVID-19 pandemic. Thus, developing and maintaining minimum levels of funding and procedures for rapid enactment of policy responses will be invaluable during future crises, such as subsequent pandemics, war, or challenges instigated by the climate emergency (342). It is also important to consider factors that contribute to the uptake of policy responses while balancing eligibility criteria. For example, beneficiaries of some policy responses were erroneously provided benefits that they should not have received and are required to repay after the emergency has passed (343). Moreover, portions of the population were deemed ineligible for the Canada Emergency Response Benefit and the UK's Coronavirus Job Retention Scheme due to narrow eligibility criteria, precluding gig workers or individuals who started a new job several months before safety measures were implemented from accessing benefits (344,345). These eligibility criteria, therefore, resulted in a lack of support for individuals who may have benefitted from these policies. In contrast, some individuals were initially assessed as eligible for

the Canada Emergency Response Benefit but subsequent re-assessment resulted in required repayments (343). Both scenarios created gaps that may have undermined the reach of these policy responses, potentially contributing to experiences of food insecurity during the pandemic and beyond.

More broadly, a basic income guarantee and expansion of established financial-based social assistance policies have been central in calls to end household food insecurity (12,22). Critics argue it is not possible to implement these policy responses due to high cost and suggestions they could disincentivize work and/or exacerbate existing inequities (203,346–348). Although implementing broad economic and social policy responses is complicated, actions taken during the COVID-19 pandemic demonstrate it is possible to implement far reaching economic and social policy responses with the potential to ameliorate food insecurity, at least in some contexts and in the short-term. In Canada and the US, for example, a decrease or no change in the proportions of adults in food-insecure households or household-level food insecurity occurred during 2020 compared to prior years but by 2022, the prevalence had risen once again (12,13,254,302). Similarly, a prior examination of household-level food insecurity trends in the Canadian province of Newfoundland and Labrador found that after a poverty reduction strategy was introduced in 2006, there was a decline in household-level food insecurity prevalence between 2007 and 2011 (25). Household food insecurity was not assessed again at the provincial level until 2017/18, by which time changes to the policy landscape had occurred and the odds of experiencing household-level food insecurity in 2017/18 were greater than in 2011/12 (349). These findings indicate the need for persistent financial-based support to address household food insecurity. It is likely that the upfront costs of these policy responses will contribute to long-term

savings, as evidenced by the range of negative health implications and related costs of household food insecurity (15,16,122–124,145,151), even with short-term experiences (166).

The engagement of a collaborative working group provided invaluable insight into all stages of this research. The development and use of the theory of change, as recommended by the working group, guided the policy scope, increasing confidence that key national level policy responses were considered. Policy responses implemented or revised at the sub-national level during the COVID-19 pandemic were outside the scope, resulting in the exclusion of some responses with the potential to influence household food insecurity (e.g., Universal Credit in the UK). Within countries, more granular analysis could identify which responses most likely contributed to national level trends, as well as differences in trends across states or provinces, in household food insecurity and inform actions taken to address household food insecurity during and beyond future periods of crisis.

This work primarily drew information from existing policy response trackers and is subject to limitations in the breadth of the policy responses they captured. The trackers generally provided extensive coverage on policy responses implemented in 2020 and 2021, with waning coverage into 2022. This pattern may reflect when relevant policy responses were implemented or revised but could also reflect a reduced capacity to continue documenting policy responses for the duration of the period during which COVID-19 was classified as a Public Health Emergency of International Concern (207). Further, policy responses were assumed to be implemented as intended and to reach their target audience. If these assumptions are unfounded, it is possible that evidence for the hypotheses about how the packages of policy responses contributed to the changes, or lack thereof, in household food insecurity are erroneous.

6.6 Conclusion

Examination of packages of policy responses and country-specific contextual factors in Australia, Canada, Chile, Mexico, the UK, and the US adds nuance to our understanding of changes, or lack thereof, in the prevalence of food insecurity during the COVID-19 pandemic. Across most countries, labor and/or welfare-related policy responses to the COVID-19 pandemic were prioritized at the national level with the highest number of policy responses active in 2020 and 2021. Based on the existing research documenting rates of household food insecurity from before to during the pandemic, national level governments that implemented or revised packages of policy responses emphasizing financial-based support and/or expanded existing policy responses fared better with respect to rates of household food insecurity than countries that did not. The COVID-19 pandemic has left a lasting mark on society, and the lessons gleaned from this crisis can be used to help address household food insecurity.

7.0 Study 3 – Attribution analysis

Title: Determining whether economic and social policy responses mitigated anticipated increases in food insecurity among adults and adolescents in Australia, Canada, Chile, Mexico, the United Kingdom, and the United States before and during the Coronavirus Disease 2019 Pandemic, 2018-2022

Status: Prepared for submission, target journal: Journal of Nutrition.

Authors: Alexandra Peppone¹, Edward A. Frongillo², Warren Dodd¹, Lana Vanderlee³, Rebecca Lindberg⁴, Michael P. Wallace⁵, Joel A. Dubin^{1,5}, Christine M. White¹, Kevin W. Dodd⁶, David Hammond¹, Sharon I. Kirkpatrick¹

¹School of Public Health Sciences, University of Waterloo

²Department of Health Promotion, Education, and Behavior, Arnold School of Public Health, University of South Carolina

³École de nutrition, Centre Nutrition, santé et société (NUTRISS), Université Laval

⁴Institute for Physical Activity and Nutrition (IPAN), School of Exercise and Nutrition Sciences, Deakin University

⁵Department of Statistics and Actuarial Science, University of Waterloo

⁶Division of Cancer Prevention, National Cancer Institute, National Institutes of Health

Acknowledgements: DH: designed the International Food Policy Study; AP, EAF, and SIK: formulated the research questions; all authors provided feedback on the manuscript outline and data analysis plan; AP: conducted the analyses and led the drafting of the manuscript; and all authors: provided critical feedback. AP held an Ontario Graduate Scholarship and a Social Sciences and Humanities Research Council (SSHRC) Doctoral Fellowship. Funding for the International Food Policy Study was provided by a CIHR Project Grant (PJT-162167), with an additional support for the adult survey from the National Institute of Diabetes and Digestive and Kidney Disorders of the National Institutes of Health (R01 DK128967), for the adolescent survey from Health Canada, and for the adult and adolescent surveys from the National Institute for Health Research (NIHR13059), the Public Health Agency of Canada (PHAC), and a CIHR-PHAC Applied Public Health Chair held by DH.

7.1 Overview

Background: Changes in the prevalence of food insecurity during the Coronavirus disease 2019 (COVID-19) pandemic differed over time and by country. Assessment of whether patterns in food insecurity can be explained by policy responses during the COVID-19 pandemic are limited.

Objective: To determine whether economic and social policy responses during the pandemic mitigated anticipated increases in food insecurity among adults living in households and adolescents.

Methods: Data were collected as part of the International Food Policy Study from 104,418 adults aged 18 to 100 years in five countries in November-December 2018 to 2022 and 44,759 adolescents aged 10 to 17 years in six countries in November-December 2019 to 2022 using repeat cross-sectional surveys. Food security status was queried using the 18-item Household Food Security Survey Module among adults and the 10-item Child Food Insecurity Experiences Scale among adolescents. Sociodemographic and health-related information was also collected. Alignment between year-to-year changes in food insecurity and known determinants (e.g., difficulty making ends meet) and consequences (e.g., poor quality diets) was examined among adults and adolescents. Among adults living in households, weighted proportions of food insecurity were estimated and compared to predicted proportions had the pandemic not occurred. Weighted and adjusted regression models with year-by-sociodemographic characteristic interactions assessed changes in the magnitude of the association between subgroups with selected characteristics that indicate high risk of experiencing food insecurity (e.g., households with children) and food insecurity among adults living in households and adolescents during (2020 to 2022) compared to before (2019) the COVID-19 pandemic.

Results: In most instances, year-to-year changes in the prevalence of food insecurity among adults and adolescents aligned with changes in the proportion of selected determinants and consequences of food insecurity. Across most years and countries, the observed and predicted proportions of adults living in food-insecure households did not differ. In Australia, Canada, and the United States, the observed proportions of food insecurity among adults living in households were lower than the predicted proportion during the pandemic. Most population subgroups anticipated to be more likely to experience food insecurity during the COVID-19 pandemic were not.

Conclusions: Based on three lines of inquiry, economic and social policy responses during the pandemic appeared to mitigate anticipated increases in food insecurity.

Keywords: COVID-19 pandemic; household food insecurity; adolescent food security; equity-deserving populations; cross-country comparison.

7.2 Introduction

Household food insecurity, the inability to access food due to limited financial resources (12), is a major public health concern (1,28). Household food insecurity research has largely focused on the United States (US) and Canadian contexts given ongoing monitoring of food insecurity in national level surveys (12,13). In contrast, national-level food insecurity data in other countries are collected inconsistently, presented in three-year averages, or have only begun to be collected on a routine basis, which limits the assessment of trends in food insecurity (63,64,67,350). Having country-specific yearly food insecurity prevalence estimates overall and by population subgroups before and during periods of crisis, such as the Coronavirus disease 2019 (COVID-19) pandemic, is important for understanding who was impacted and what interventions are suitable for ameliorating food insecurity in each country.

Addressing food insecurity is imperative given its devastating consequences for nutritional, mental, and physical health observed in prior research. Food insecurity has been linked to poor diet quality, anxiety, asthma, depression, diabetes, hypertension, poor or fair mental health, and stress (15,16,351,352,118–125). Moreover, eliminating food insecurity is directly related to the Sustainable Development Goals (SDGs), including SDG 2, “End hunger, achieve food security and improved nutrition and promote sustainable agriculture” (28,29), and the interconnection between food insecurity, poverty, and health also lends to the attainment of SDG 1, “End poverty in all its forms everywhere” and SDG 3, “Ensure healthy lives and promote well-being for all at all ages” (29).

During the COVID-19 pandemic, the global prevalence of individual-level food insecurity, as measured by the Food Insecurity Experience Scale, increased from 25.3% in 2019 to 29.4% in 2020 (1). This prevalence level remained steady at 29.6% in 2021 and 2022 (1). In

contrast, prior examination of food insecurity using the Household Food Security Survey Module and Child Food Insecurity Experiences Scale in a subset of countries, including Australia, Canada, Chile, Mexico, the United Kingdom (UK), and the US, suggested that increases in food insecurity were not consistently observed from 2019 to 2020, as may have been expected (322). A policy analysis characterizing packages of economic and social policy responses during the pandemic suggested that the provision of financial-based support and/or scaling up of existing policy responses may have contributed to patterns in food insecurity after the onset of the COVID-19 pandemic (**Chapter 6**). This work, however, drew upon existing food insecurity prevalence estimates from various data sources that, at times, used different food insecurity measures. Moreover, the lack of annual food insecurity measurement in some countries precluded consideration of how policy responses may have mapped onto patterns of food insecurity observed in prior research.

The aim of this study was to determine whether economic and social policy responses during the pandemic mitigated anticipated increases in the prevalence of food insecurity among adults and adolescents in six countries. This aim was addressed using three lines of inquiry. First, alignment of year-to-year changes, or lack thereof, in food insecurity with year-to-year changes in known determinants (e.g., difficulty making ends meet) and consequences (e.g., poor quality diets) was examined. It was expected that year-to-year changes in food insecurity would align with year-to-year changes in known determinants and consequences. Alignment would instill confidence that the nature of food insecurity did not change in the context of the COVID-19 pandemic and set the foundation to undertake inquiries two and three, which sought to determine whether policy responses mitigated anticipated increases in food insecurity. The second inquiry compared the observed proportions of adults in food-insecure households in 2020, 2021, and

2022 in each country to the predicted proportions had the pandemic not occurred. The policy analysis (**Chapter 6**) guided expectations of whether the observed proportions of adults living in food-insecure households were expected to be higher, lower, or the same as the predicted proportion. Instances in which it was expected and confirmed that the observed proportion of adults in food-insecure households was lower or did not differ from the predicted proportion would suggest that policy responses mitigated anticipated increases in food insecurity. The third line of inquiry assessed the consistency of associations between characteristics that indicate high risk of experiencing food insecurity (e.g., difficulty making ends meet) among adults and adolescents and food insecurity across years. It was expected that subgroups with selected characteristics would be more likely to experience food insecurity during compared to before the pandemic based on previous evidence from before (12,77,78,101,103,110,112,353,354) and during (33,36,94,238,239,283,302,355,356) the COVID-19 pandemic and given the disproportionate impacts of the pandemic on certain groups (229–232). If subgroups with selected characteristics were no more or less likely to experience food insecurity during the pandemic, then it is likely that policy responses mitigated anticipated increases in food insecurity.

7.3 Methods

Repeat cross-sectional data were drawn from the International Food Policy Study (IFPS) (37). Data were collected via online surveys from adults aged 18 to 100 years and adolescents aged 10 to 17 years living in Australia, Canada, Chile (adolescent sample only), Mexico, the UK, and the US.

Adult respondents were recruited by Nielsen Consumer Insights Global Panel and their partners' panels in November to December of each of 2018, 2019, 2020, 2021, and 2022. Sample quotas and targets facilitated the recruitment of proportions of respondents that aligned with the population distribution of each country. Quotas were applied for age, sex at birth, and language spoken (i.e., proportion of English- and French-speaking respondents in Canada and proportion of Spanish-speaking respondents in the US), with additional "soft" targets for level of educational attainment. Unique survey access links were used to invite a random sub-set of panelists in each country. Invitations were not shared with panelists known to be ineligible. Possible respondents were screened to confirm eligibility (age 18-100 years and device screen size (2018 sample only)). Screen size was an eligibility criterion in 2018 to facilitate completion of survey questions that included larger images but was removed as a criterion in subsequent years as the survey was adapted for use with smaller mobile devices.

Adolescent respondents were recruited indirectly through their parents/guardians using the same panels as the adult surveys in November to December of each of 2019, 2020, 2021, and 2022. Survey links were shared with adults who confirmed that they lived with a child aged 10 to 17 years. Only one child per household was invited to complete the survey. Quotas for age group and sex at birth were used to facilitate recruitment of a diverse sample in the UK and the US; these quotas were not applied in the other countries due to more limited panel sizes.

Eligible respondents were provided information about the study and given the opportunity to consent (adults) or assent (adolescents) to survey completion. Adult respondents and the parents/guardians of adolescent respondents were provided compensation in accordance with their panel's usual incentive structure (e.g., chances to win prizes, points-based, or monetary rewards). These incentives have been demonstrated to decrease response bias and increase

response rates (285–287). IFPS was reviewed and received ethics clearance through a University of Waterloo Research Ethics Committee (ORE# 30829 and ORE# 41477).

Adult and adolescent respondents completed the surveys in English in Australia and the UK, English or French in Canada, Spanish in Chile and Mexico, and English or Spanish in the US. The surveys were independently reviewed by bilingual research team members fluent in English as well as French or Spanish for accuracy.

The adult and adolescent samples included both repeat and new respondents in 2019 (adult sample only), 2020 (adult sample only), 2021, and 2022. To mitigate the influence of remembering prior responses on survey data, only the first instance of survey completion by a given respondent was retained (288). Consequently, for the adult sample, data were excluded from 1,684 respondents in 2019, 342 respondents in 2020, 453 respondents in 2021, and 372 respondents in 2022. For the adolescent sample, data were excluded for 240 respondents in 2021 and 5 in 2022. The adolescent survey was not conducted in 2018 and information about adolescent respondents who participated in both 2019 and 2020 was not available at the time of analysis.

Respondents with missing food security data were also excluded (adult sample: $n = 77$ in 2018, $n = 59$ in 2019, $n = 105$ in 2020, $n = 96$ in 2021, $n = 126$ in 2022; adolescent sample: $n = 18$ in 2019, $n = 14$ in 2020, $n = 29$ in 2021, $n = 25$ in 2022). A breakdown of adult and adolescent respondents and the final analytic sample sizes by year are provided in **Table 7.1**.

Table 7.1: Number of adults aged 18 to 100 years and adolescents aged 10 to 17 years who completed the surveys, whose data were excluded, whose data were available for analysis, and whose data were included in the analytic samples from the International Food Policy Study survey in 2018, 2019, 2020, 2021, or 2022 in Australia, Canada, Chile, Mexico, the United Kingdom, or the United States.

Adult surveys					
Sample type	2018 (year 2)	2019 (year 3)	2020 (year 4)	2021 (year 5)	2022 (year 6)
Completed	28,684	29,290	30,131	33,892	35,214
Excluded ¹	5,860	8,322	8,378	7,607	8,941
Available for analysis	22,824	20,968	21,753	26,285	26,273
Analytic ^{2,3}	22,747	19,225	21,306	20,589	20,551
Adolescent surveys					
Sample type	2018	2019 (year 1)	2020 (year 2)	2021 (year 3)	2022 (year 4)
Completed	Not applicable	11,491	12,489	10,894	11,948
Excluded ¹	Not applicable	383	458	435	456
Available for analysis	Not applicable	11,108	12,031	10,459	11,492
Analytic ^{2,3}	Not applicable	11,090	12,017	10,190	11,462

¹Data were excluded by the IFPS study team because the respondent was ineligible or due to missing information on region, inadequate sample size to reliably construct sample weights (e.g., respondents in the Canadian territories), invalid response to a data quality question, survey completion time under 15 minutes for adults in 2018 to 2020 or 10 minutes (15 minutes in the Canada French, Mexico or US Spanish samples) for adults in 2021 and 2022 and 10 minutes for adolescents in 2019 and 2020 or 8 minutes in Australia, Canada, UK or US English sample or 10 minutes in Chile, Mexico or US Spanish sample, and/or invalid responses to at least three of the between 16 to 20 open-ended measures (adult sample only) depending on year.

²Only the first instance that respondents answered the survey were retained, excluding 1,684 adults in 2019, 342 adults in 2020, 453 adults in 2021, 372 adults in 2022 and 240 adolescents in 2021, 5 adolescents in 2022.

³Data were excluded for respondents with missing food security data: adults: n = 77 in 2018, n = 59 in 2019, n = 105 in 2020, n = 96 in 2021, n = 126 in 2022; adolescents: n = 18 in 2019, n = 14 in 2020, n = 29 in 2021, n = 25 in 2022. Oversampled respondents in 2021 (n = 5,147) and 2022 (5,289) in Mexico and the US were excluded because they were not asked the child-oriented food security questions in 2021, and the cleaning practice was adopted for 2022 to align with 2021 cleaning practices.

7.3.1 Measures

The adult survey included the 18-item Household Food Security Survey Module (HFSSM) (58,59). The HFSSM queries experiences of food insecurity in the past 12 months

among adults and when applicable, children in the household. Items capture increasingly severe experiences of food insecurity ranging from worrying about running out of food, making compromises to food quality, reducing meal size, to going a whole day without eating (61). Household food security classification was based on Health Canada's coding method (61). The adult and child scales were assigned a food security status based on the number of affirmations. When there was discordance between the household and child classifications, the more severe classification was used. Adults were classified as living in households that were food secure (0 affirmations), marginally food insecure (1 affirmation), moderately food insecure (2 to 5 affirmations adult scale, 2 to 4 affirmations child scale), or severely food insecure (6 or more affirmations adult scale, 5 or more affirmations child scale) (61). A dichotomous variable was also constructed, considering adults to live in food-insecure households if their household was classified in the marginal, moderate, or severely food insecure categories. Marginal food insecurity was classified as food insecure given its implications for health (294).

The Child Food Insecurity Experiences Scale was included in the adolescent survey (92). This scale queries the number of food insecurity experiences during the previous 12 months. Ten items assess experiences including worrying about running out of food, compromises to diet quality, eating less, going hungry, and experiencing emotional elements of food insecurity, such as shame (92). Response options for each item included never (scored value of 0), 1 or 2 times (scored value of 1), and many times (scored value of 2). The resulting numeric score was used to classify adolescents as having no (0 affirmations), few (1 to 6 affirmations), several (7 to 10 affirmations), or many (11 to 20 affirmations) experiences of food insecurity (92). A dichotomous variable was also constructed, considering adolescents with few to many experiences of food insecurity as food insecure.

Adult respondents entered their age using an open-ended response option (258). Based on the high concordance between sex at birth and gender identity in the IFPS sample, sex was used in place of gender to avoid analyses with cell sizes that would be too small to produce reliable estimates. Response options for sex at birth were female and male. Racial/ethnic identity and cultural diversity options were country-specific and grouped into three categories to enable cross-country comparisons with consistent groupings (258). The first category included respondents who identified as Black, Indigenous, People of Color (BIPOC), and/or speaks a language other than English at home (BIPOC and/or speaks language other than English at home). The second category included respondents who identified as White, not Indigenous, and/or English-speaking at home (White and/or English-speaking). The final category encompassed respondents who selected don't know or refuse to answer (not stated). In Australia, the White and/or English-speaking category included respondents who only spoke English at home and did not identify as Indigenous (Aboriginal or Torres Strait). Language is a component of cultural diversity in Australia (298). Respondents who did not identify as Indigenous in Mexico or identified as White only in Canada, the UK, and the US were included in the White and/or English-speaking category. All other response options, except for those which corresponded to the not stated category, were grouped into the BIPOC and/or speaks language other than English at home category.

Highest educational attainment was also country-specific. To facilitate consistency across countries and enable cross-country comparisons, responses were categorized as low (secondary education or less), medium (some post-secondary education), high (university degree or above), and not stated based on country-specific response options. Employment status was derived from a question asking respondents what their main activity was in the last week. Respondents shared

their main activity in the last week, herein employment status, by selecting one of the 14 pre-populated options or adding a response using the open-ended response option (258). Responses were grouped into working (e.g., part- or full-time), not working (e.g., parental leave, in school), unemployed (e.g., unemployed, seeking a job), and not stated. Perceived income adequacy was gauged by asking respondents how easy or difficult it is to make ends meet (258). Options ranged from very difficult to very easy, with the opportunity to select don't know or refuse to answer. These categories were combined into very difficult/difficult (difficult), neither easy nor difficult (neither), easy/very easy (easy), and not stated (103). Respondent living arrangement was queried using 11 response options. To align with prior research and minimize small cell sizes, living arrangement were consolidated into no other adults or children, other adults but no children, no other adults but children, other adults with children, and not stated (103).

Adolescents selected their age from the pre-populated list that ranged from 10 to 17 years (258). Adolescents reported their sex as male or female (the adolescent survey did not include gender identity). Racial/ethnic identity and cultural diversity were reported and combined into the same categories as those used for the adult survey (258). Perceived income adequacy was gauged using an adolescent appropriate question: "Does your family have enough money to pay for things your family needs?" (258). Possible responses ranged from not enough to more than enough money, which was condensed into not enough/barely enough money (not enough) and enough/more than enough money (enough) to align with the adult conceptualization of perceived income adequacy. Respondents who selected the don't know and refuse to answer options were grouped into a not stated category.

Based on prior research (15,16,121), select health-related variables were of interest to examine in relation to food insecurity: self-reported general health (adult sample only), self-

reported mental health (adult sample only), perceived stress (adult sample only), and perceived diet healthfulness (adult and adolescent samples). Adult respondents were asked to rate their general and mental health using a Likert scale with response options including poor, fair, good, very good, excellent, don't know, and refuse to answer (258,259). Response options were categorized as poor/fair (poor), good/very good/excellent (good), and not stated (103). Perceived stress was reported by adults using options ranging from not at all stressful to extremely stressful as well as don't know and refuse to answer (258,357). Response options were grouped into not at all/not very/a bit stressful (low stress), very/extremely stressful (high stress) and not stated (103). Among adults, perceived diet healthfulness response options ranged from poor to excellent, along with don't know and refuse to answer (258,261). These options were grouped into poor/fair (poor), good/very good/excellent (good), and not stated (103). Perceived diet healthfulness among adolescents was captured by asking "Overall, how unhealthy or healthy is the food you usually eat?", with response options ranging from very unhealthy to very healthy and including don't know and refuse to answer (258). To create a three-level variable like the adult conceptualization of perceived diet healthfulness, responses were grouped into very unhealthy/unhealthy (unhealthy), in the middle/healthy/very healthy (healthy), and not stated.

7.3.2 Statistical analyses

Analyses were completed using SAS version 9.4 (Cary, NC) and Microsoft Excel (Excel, Version 2403, Redmond, WA). Commands were used in SAS to allow for the application of sample weights. Post-stratification sample weights were created using a raking algorithm, with population estimates drawn from the census in each country based on age group, sex, region, ethnicity (except in Canada), and education (except in Mexico) (37).

Adult and adolescent sample characteristics for each year by country were characterized using weighted frequency tables. The weighted proportions and associated 95% confidence intervals of adults living in households with any level of food insecurity (dichotomous variable) and adolescents experiencing any level of food insecurity (dichotomous variable) in each country in each year were estimated, overall and for subgroups defined by sex, racial-ethnic identity, educational attainment (adult sample only), employment status (adult sample only), perceived income adequacy, and living arrangement (adult sample only).

Assessment of whether policy responses mitigated anticipated increases in food insecurity involved three lines of inquiry. First, to instill confidence that the nature of food insecurity among adults living in households and adolescents did not change in the context of the COVID-19 pandemic, alignment of changes in food insecurity and known determinants and consequences (12,103,112,351,352) was assessed on a year-by-year basis. Weighted proportions and 95% confidence intervals were estimated for food insecurity among adults living in households and adolescents and the categories for each of the known determinants and consequences. To limit the number of comparisons, inferences focused on comparing the consistency of changes in food insecurity across years with changes in the proportions of participants in specific subgroups at risk of food insecurity, identified *a priori* based on prior research. These subgroups included adults considered to be unemployed (e.g., unemployed, seeking a job), adults and adolescents reporting it was difficult to make ends meet or not having enough money, adults reporting poor general health, adults reporting poor mental health, adults reporting high stress, and adults and adolescents reporting poor or unhealthy diets (12,103,112,351,352). Examination of changes from year-to-year in food insecurity among adults and adolescents and the determinants and consequences were based on the 95%

confidence intervals. In the absence of known thresholds for assessing consistency in year-to-year changes, alignment of changes in food insecurity and the determinants and consequences were examined by assessing consistency in the directionality and magnitude of changes from year-to-year (**Table 7.2**). To consider magnitude, year-to-year changes in the proportion of food insecurity and the determinants and consequences were considered to be aligned if the difference in one was not more than two times the difference in the other. Combinations of directionality and magnitude of changes were classified as alignment, ambiguous, or discrepant (**Table 7.2**). Only combinations of directionality and magnitude of changes classified as discrepant were considered to denote discrepancies between changes in food insecurity and the determinants and consequences. All other categories were considered to reflect alignment.

Table 7.2: Possible combinations of alignment and discrepancies between year-to-year changes in the proportion of food insecurity and specific categories of determinants and consequences.

Overall alignment	Directionality (Year-to-year change in food insecurity AND Year-to-year change in specific categories of determinants and consequences)	Alignment in directionality	Magnitude (Difference between change in food insecurity AND change in specific categories of determinants and consequences)	Alignment in magnitude
Alignment	Increase AND Increase	Yes	$\leq 2x$ difference	Yes
Alignment	Increase AND No change	Maybe	$\leq 2x$ difference	Yes
Alignment	No change AND Increase	Maybe	$\leq 2x$ difference	Yes
Alignment	No change AND No change	Yes	$\leq 2x$ difference	Yes
Alignment	No change AND Decrease	Maybe	$\leq 2x$ difference	Yes
Alignment	Decrease AND No change	Maybe	$\leq 2x$ difference	Yes
Alignment	Decrease AND Decrease	Yes	$\leq 2x$ difference	Yes
Ambiguous	Increase AND Increase	Yes	$> 2x$ difference	No
Ambiguous	Increase AND Decrease	No	$\leq 2x$ difference	Yes
Ambiguous	No change AND No change	Yes	$> 2x$ difference	No
Ambiguous	Decrease AND Increase	No	$\leq 2x$ difference	Yes
Ambiguous	Decrease AND Decrease	Yes	$> 2x$ difference	No
Discrepant	Increase AND No change	Maybe	$> 2x$ difference	No
Discrepant	Increase AND Decrease	No	$> 2x$ difference	No
Discrepant	No change AND Increase	Maybe	$> 2x$ difference	No

Discrepant	No change AND Decrease	Maybe	> 2x difference	No
Discrepant	Decrease AND Increase	No	> 2x difference	No
Discrepant	Decrease AND No change	Maybe	> 2x difference	No

Second, to examine whether economic and social policy responses during the pandemic mitigated anticipated increases in food insecurity, the observed proportions of adults in food-insecure households in each country in 2020, 2021, and 2022 were compared to the predicted proportions had the pandemic not occurred. Similar analysis was not conducted among adolescents given the lack of multiple pre-pandemic data points to establish trends. Formulas for predicting food insecurity among adults living in households in each country by year from 2020 on were based on the observed proportions in 2018 and 2019 and applied in Excel. Predicted and observed proportions in each of 2020, 2021, and 2022 were compared using 95% confidence intervals. Inferences were based on *a priori* hypotheses (**Table 7.3**), with the influence of the COVID-19 pandemic and related economic and social policy responses anticipated to differentially impact rates of household food insecurity across countries and over time from 2020 to 2022. The hypotheses were informed by research examining changes in food insecurity in 2020 relative to 2019 (**Chapter 5**), estimates of food insecurity among adults in 2018 and 2019 (present investigation), and an examination of packages of economic and social policy responses implemented or revised during the COVID-19 pandemic in Australia, Canada, Chile, Mexico, the UK, and the US (**Chapter 6**). Hypotheses also considered broader country-specific (e.g., Brexit in the UK) and global events (e.g., inflation) by building from hypotheses developed in a prior policy analysis (**Chapter 6**).

For example, in Australia the odds of adults living in food-insecure households was lower in 2020 than 2019 and coincided with the implementation of a policy package that emphasized financial-based based support and policy responses that provided six months of coverage or more

(**Chapters 5 and 6**). Visual inspection of the trajectory of adults in food-insecure households from 2018 to 2019 suggested the proportion of adults in food-insecure households was going upwards. This information led to the hypothesis that the observed proportion of adults in food-insecure households would be lower than the predicted proportion had the pandemic not occurred in 2020. The package of policy responses in 2021 was similar to the 2020 policy package and was anticipated to mitigate change in food insecurity from 2020 to 2021 (**Chapter 6**). The upward trajectory of food insecurity from 2018 to 2019 was anticipated to continue into 2021. Thus, in 2021, the observed proportion was hypothesized to be lower than the predicted prediction of adults in food-insecure households. The observed proportion of adults in food-insecure households was also hypothesized to be lower than the predicted proportion in 2022 even though the number of policy responses in the 2022 policy package was lower than prior years and inflation was a concern. The rationale behind this hypothesis was that the upward trajectory of food insecurity from 2018 to 2019 would continue to hold into 2022 and any year-to-year increase in food insecurity from 2021 to 2022 would nonetheless result in a lower observed than predicted proportion of adults in food-insecure households. Reasoning behind the latter statement was based on the observed decrease in food insecurity from 2019 to 2020 and hypothesized lack of change from 2020 to 2021 in prior research (**Chapters 5 and 6**).

Table 7.3: Hypotheses for observed compared to predicted proportion of adults living in food-insecure households by country in 2020, 2021, and 2022.

Country	Hypothesis: observed vs predicted proportion of adults living in food-insecure households
Australia	2020: observed < predicted proportion 2021: observed < predicted proportion 2022: observed < predicted proportion
Canada	2020: observed ≤ predicted proportion 2021: observed ≤ predicted proportion 2022: observed ≤ predicted proportion

Mexico	2020: observed > predicted proportion 2021: observed > predicted proportion 2022: observed > predicted proportion
United Kingdom	2020: observed = predicted proportion 2021: observed ≤ predicted proportion 2022: observed ≤ predicted proportion
United States	2020: observed = predicted proportion 2021: observed < predicted proportion 2022: observed < predicted proportion

Third, the consistency of associations between sex, racial/ethnic identity and cultural diversity, educational attainment (adult sample only), employment status (adult sample only), perceived income adequacy, and living arrangement (adult sample only) and food insecurity over waves was examined to further determine if economic and social policy responses during the pandemic mitigated anticipated increases in food insecurity. Inference focused on specific characteristics associated with high risk of experiencing food insecurity (12,77,78,101,103,110,112,353,354) and hypothesized to be associated with disproportionate impacts of the pandemic, identified *a priori*. These characteristics included identifying as female compared to male, identifying as BIPOC and/or speaking a language other than English at home compared to White and/or English-speaking, low compared to high levels of educational attainment (adults only), being unemployed (e.g., unemployed, seeking a job) compared to working (e.g., part- or full-time) (adults only), reporting it was difficult compared to easy to make ends meet (adults) or not having enough compared to having enough money (adolescents), and living with children with and without other adults compared to living with no other adults or children (adults only) (12,77,78,101,103,110,112,353,354). Weighted multinomial or binary logistic regression models stratified by country assessed the consistency of associations between selected characteristics and food insecurity as a four-category (adult sample) or dichotomous (adolescent sample) variable in 2020, 2021, and 2022 compared to 2019. Because the model with

four categories did not converge in the adolescent sample in the US, the dichotomous variable was used in binary logistic regression models. Interaction terms between year and characteristics were used to assess changes in the strength of the associations from 2019 to each of 2020, 2021, and 2022. Age, sex, racial/ethnic identity and cultural diversity, educational attainment (adult sample only), employment status (adult sample only), perceived income adequacy, living arrangement (adult sample only), and food security status in 2018 (adult sample only) were included in the models to adjust for potential confounding and strengthen inferences drawn. 95% confidence intervals were used to assess whether the strength of associations changed from year-to-year. Due to the large number of estimates, the results of the full year-by-characteristics interaction models for adults and adolescents are not shown.

All analyses were conducted at the within-country-level and inferences considered the strength of the evidence from point estimates and 95% confidence intervals in a holistic manner (299). Sensitivity analyses including repeat respondents were conducted to examine changes in food insecurity over time because data from the same respondents can strengthen estimates by reducing within-person variability.

7.4 Results

Adult sample characteristics from 2018 to 2022 and adolescent sample characteristics from 2019 to 2022 are summarized in **Tables 7.4 and 7.5** for each country. The proportion of adults living in food-insecure households ranged between approximately 40% and 50% in Australia, Canada, the UK, and the US in 2018 to 2022, except in the US in 2022 when this percentage was 60.1% (**Figure 7.1**). The proportion of food insecurity among adults in Mexico was the lowest (69.6%) in 2021 and highest (74.6%) in 2020. Among adolescents, the proportion who reported at least one experience of food insecurity also ranged from approximately 40% to

50% in Australia, the UK, and the US in 2019 to 2022 (**Figure 7.2**). In Canada, the proportions of adolescents experiencing food insecurity ranged from 35.0% in 2020 to 40.9% in 2022. Chile and Mexico had estimates of food insecurity among adolescents ranging from approximately 60% to almost 75% across the study period. Differential estimates of food insecurity among adults and adolescents were observed among population subgroups across all countries and years (**Supplemental tables 7.1 to 7.9**).

Table 7.4: Sociodemographic characteristics of adults aged 18 to 100 years participating in the International Food Policy Study in 2018, 2019, 2020, 2021, and 2022, by country (n = 104,418)^{1,2}.

Country	Australia (n = 19,742)	Canada (n = 21,417)	Mexico (n = 20,884)	United Kingdom (n = 21,484)	United States (n = 21,161)
	n (%)	n (%)	n (%)	n (%)	n (%)
Year					
2018	4,083 (21.0%)	4,386 (20.5%)	4,132 (19.8%)	5,516 (25.7%)	4,630 (21.9%)
2019	3,479 (17.9%)	3,908 (18.2%)	4,210 (20.2%)	3,703 (17.2%)	3,925 (18.5%)
2020	4,083 (21.0%)	4,276 (20.0%)	4,279 (20.5%)	4,075 (19.0%)	4,593 (21.7%)
2021	3,784 (19.4%)	4,537 (21.2%)	4,165 (19.9%)	4,032 (18.8%)	4,071 (19.2%)
2022	4,043 (20.8%)	4,310 (20.1%)	4,098 (19.6%)	4,158 (19.4%)	3,942 (18.6%)
Age³, years	46.3 (17.2)	47.9 (17.2)	40.1 (14.3)	48.0 (17.2)	47.0 (17.1)
Sex					
Male	9,456 (48.9%)	10,481 (49.4%)	10,609 (47.7%)	10,538 (48.5%)	10,168 (48.5%)
Female	10,016 (51.1%)	10,936 (50.6%)	10,275 (52.3%)	10,946 (51.5%)	10,993 (51.5%)
Racial-ethnic identity and cultural diversity					
BIPOC and/or speaks language other than English at home ⁴	3,211 (27.1%)	4,519 (21.4%)	3,462 (19.7%)	2,239 (12.0%)	5,908 (36.0%)
White and/or English speaking	16,204 (72.6%)	16,542 (76.8%)	16,995 (78.4%)	19,092 (87.4%)	15,106 (63.1%)
Not stated	57 (0.3%)	356 (1.9%)	427 (2.0%)	153 (0.7%)	147 (0.9%)
Educational attainment⁵					
Low	6,555 (40.7%)	5,626 (42.0%)	4,401 (21.5%)	6,579 (47.5%)	7,632 (56.4%)
Medium	6,676 (32.2%)	8,384 (32.9%)	2,685 (13.6%)	5,822 (22.0%)	4,490 (9.9%)
High	6,167 (26.7%)	7,323 (24.7%)	13,764 (64.7%)	8,946 (29.7%)	8,960 (33.4%)
Not stated	74 (0.4%)	84 (0.4%)	34 (0.2%)	137 (0.7%)	79 (0.4%)
Employment status					
Working	9,668 (49.7%)	10,513 (45.9%)	14,360 (66.1%)	10,603 (48.2%)	9,806 (42.5%)
Not working	7,689 (38.4%)	8,729 (41.5%)	5,025 (26.5%)	8,896 (40.4%)	8,988 (43.6%)
Unemployed	1,907 (10.7%)	1,850 (10.7%)	1,271 (6.2%)	1,811 (10.4%)	1,841 (10.5%)

Not stated	208 (1.3%)	325 (2.0%)	228 (1.2%)	174 (0.9%)	526 (3.3%)
Perceived income adequacy					
Difficult	4,987 (26.0%)	5,404 (28.2%)	8,833 (44.2%)	4,771 (24.4%)	5,829 (29.7%)
Neither	7,131 (37.4%)	7,877 (37.2%)	8,156 (38.6%)	7,704 (37.1%)	6,808 (33.7%)
Easy	7,171 (35.4%)	7,937 (33.5%)	3,744 (16.6%)	8,815 (37.4%)	8,309 (35.4%)
Not stated	183 (1.2%)	199 (1.1%)	151 (0.7%)	194 (1.0%)	215 (1.3%)
Living arrangement					
No other adults or children	4,027 (19.6%)	5,054 (24.2%)	1,090 (5.8%)	4,587 (21.5%)	4,391 (20.7%)
Other adults but no children	8,730 (44.9%)	10,172 (47.6%)	7,139 (34.8%)	9,595 (43.4%)	8,955 (43.1%)
No other adults but children	1,430 (7.5%)	1,214 (5.7%)	1,405 (7.6%)	1,337 (7.1%)	1,477 (7.5%)
Other adults with children	5,210 (27.6%)	4,914 (22.1%)	11,186 (51.5%)	5,908 (27.7%)	6,248 (28.0%)
Not stated	75 (0.4%)	63 (0.4%)	64 (0.3%)	57 (0.3%)	90 (0.6%)

¹Cell sizes are unweighted and may not align with the percentages, which are weighted using sample weights.

²Percentages may not sum to 100% due to rounding.

³Mean and standard deviation for age. Sample size is equivalent to the sample size noted by country.

⁴Abbreviation: BIPOC, Black, Indigenous, People of Color.

⁵Low educational attainment includes secondary education or less, medium includes some post-secondary education, high educational attainment includes university degree or above.

Table 7.5: Sociodemographic characteristics of adolescents aged 10 to 17 years participating in the International Food Policy Study in 2019, 2020, 2021, and 2022, by country (n = 44,759)^{1,2}.

Country	Australia (n = 5,232)	Canada (n = 14,479)	Chile (n = 5,545)	Mexico (n = 6,656)	United Kingdom (n = 6,196)	United States (n = 6,651)
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Year						
2019	1,431 (27.4%)	3,674 (25.4%)	1,252 (22.6%)	1,616 (24.3%)	1,518 (24.5%)	1599 (24.0%)
2020	1,590 (30.4%)	3,890 (26.9%)	1,615 (29.1%)	1,822 (27.4%)	1,518 (24.5%)	1582 (23.8%)
2021	831 (15.9%)	3,352 (23.2%)	1,095 (19.7%)	1,615 (24.3%)	1,563 (25.2%)	1734 (26.1%)
2022	1,380 (26.4%)	3,563 (24.6%)	1,583 (28.5%)	1,603 (24.1%)	1,597 (25.8%)	1736 (26.1%)
Age³, years	13.4 (2.3)	13.5 (2.3)	13.5 (2.3)	13.5 (2.2)	13.4 (2.2)	13.5 (2.2)
Sex						
Male	2,778 (51.3%)	7,525 (51.0%)	3,134 (51.1%)	3,788 (50.7%)	3,073 (51.3%)	3,362 (51.2%)
Female	2,454 (48.7%)	6,954 (49.0%)	2,411 (48.9%)	2,868 (49.3%)	3,123 (48.7%)	3,289 (48.8%)
Racial-ethnic identity and cultural diversity						
BIPOC and/or speaks language other than English at home ⁴	1,148 (26.5%)	3,996 (29.0%)	589 (14.5%)	902 (19.9%)	768 (18.8%)	2,031 (48.5%)
White and/or English speaking	4,065 (73.1%)	10,253 (69.4%)	4,815 (83.2%)	5,567 (77.1%)	5,384 (80.5%)	4,600 (51.0%)
Not stated	19 (0.4%)	230 (1.6%)	141 (2.3%)	187 (3.0%)	44 (0.7%)	20 (0.5%)
Perceived income adequacy						
Not enough	1,214 (22.7%)	2,736 (19.1%)	1,692 (31.7%)	2,011 (32.5%)	1,544 (24.9%)	1,763 (28.4%)
Enough	3,957 (76.1%)	11,545 (79.5%)	3,775 (67.0%)	4,595 (66.8%)	4,560 (73.5%)	4,812 (70.4%)
Not stated	61 (1.2%)	198 (1.4%)	78 (1.4%)	50 (0.7%)	92 (1.6%)	76 (1.2%)

¹Cell sizes are unweighted and may not align with the percentages, which are weighted using sample weights.

²Percentages may not sum to 100% due to rounding.

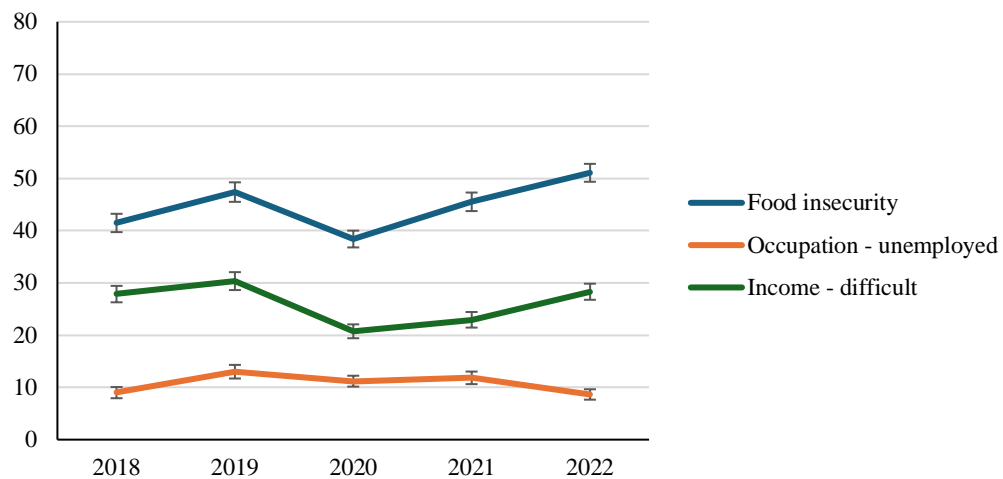
³Mean and standard deviation for age. Sample size is equivalent to the sample size noted by country.

⁴Abbreviation: BIPOC, Black, Indigenous, People of Color.

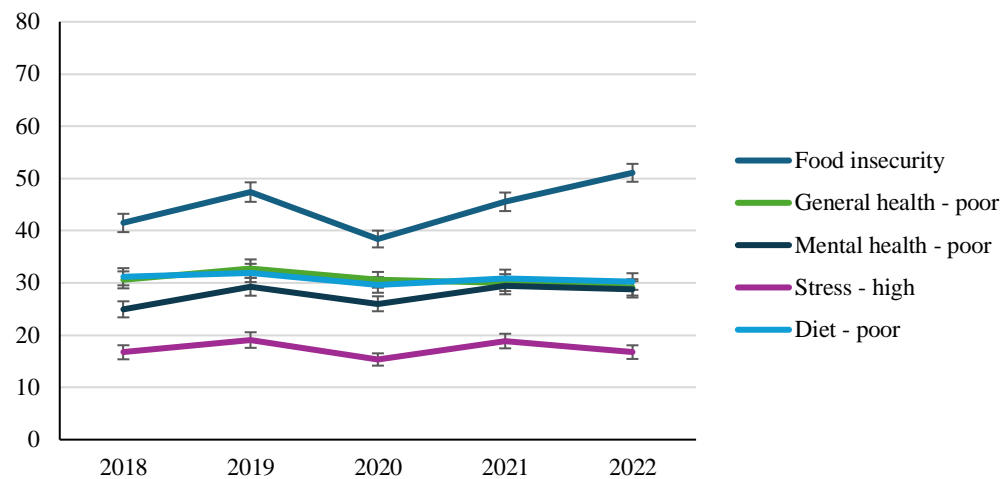
Among adults in all countries except the US, the alignment between year-to-year changes in food insecurity and all determinants and consequences overall ranged from 33% to 54%. In the US, 71% of the year-to-year changes aligned (**Figure 7.1**). The percentage of alignment was higher for determinants than consequences in all countries except the UK. For example, in Mexico, there was alignment in the year-to-year changes in food insecurity among adults and its determinants 88% of the time compared to 38% for consequences. When examining consistency of year-to-year changes in food insecurity among adolescents and the known determinant and consequence available, overall alignment ranged from 67% to 100% across all countries (**Figure 7.2**). Alignment between food insecurity and its consequence was observed among adolescents 33% of the time in Chile and Mexico, 67% of the time in the UK, and 100% of the time in Australia, Canada, and the US. **Supplemental tables 7.10 to 7.20** provides the results of the alignment analysis for all categories of the known determinants and consequences.

Figure 7.1: Proportion of adults aged 18 to 100 years living in food-insecure households and proportion of adults reporting selected determinants and consequences of food insecurity in 2018 to 2022, by country, International Food Policy Study (n = 104,418).

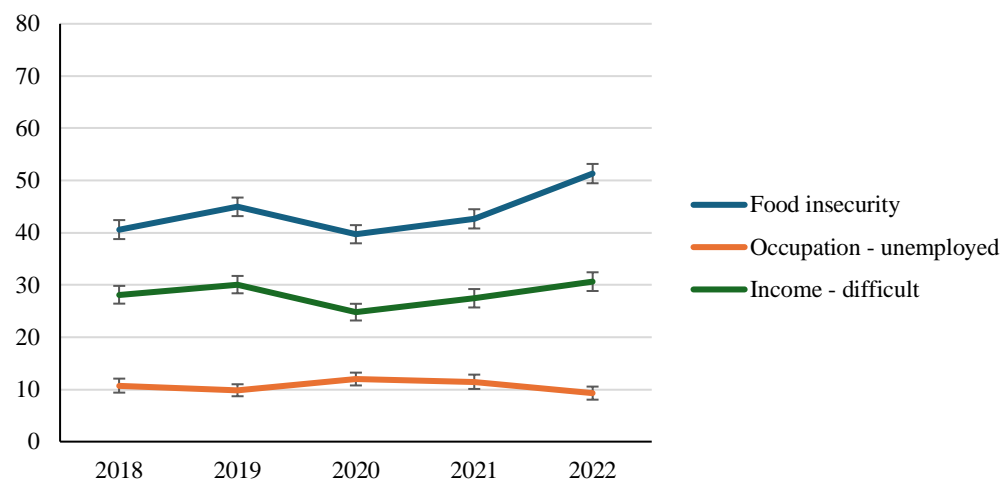
A1. Australia - adult determinants



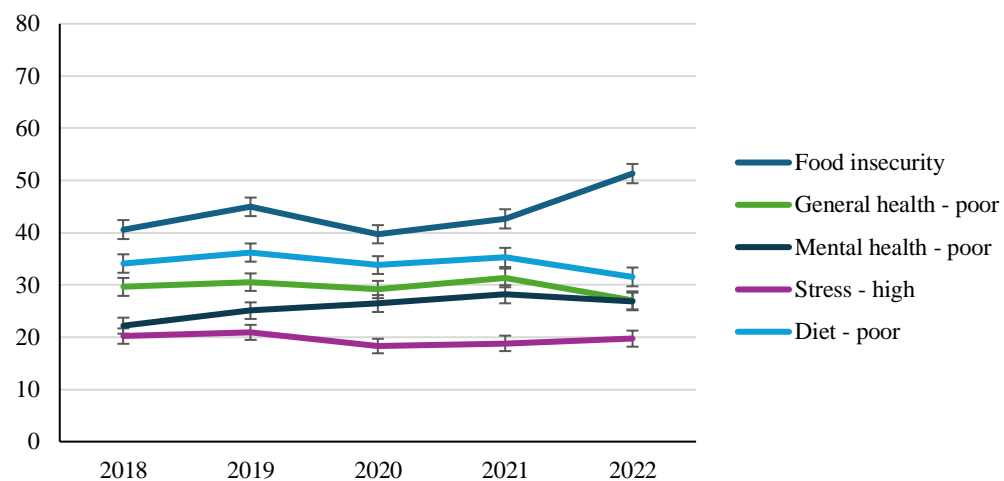
A1. Australia - adult consequences



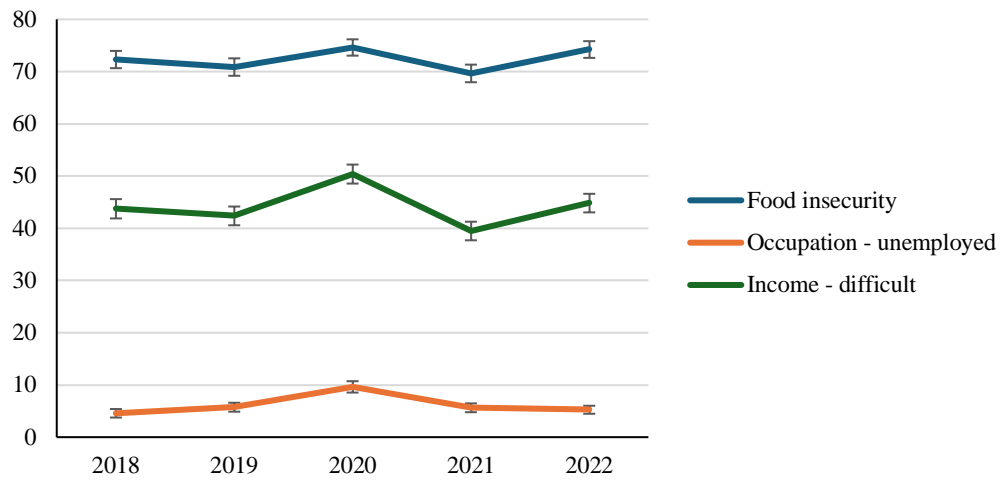
B1. Canada - adult determinants



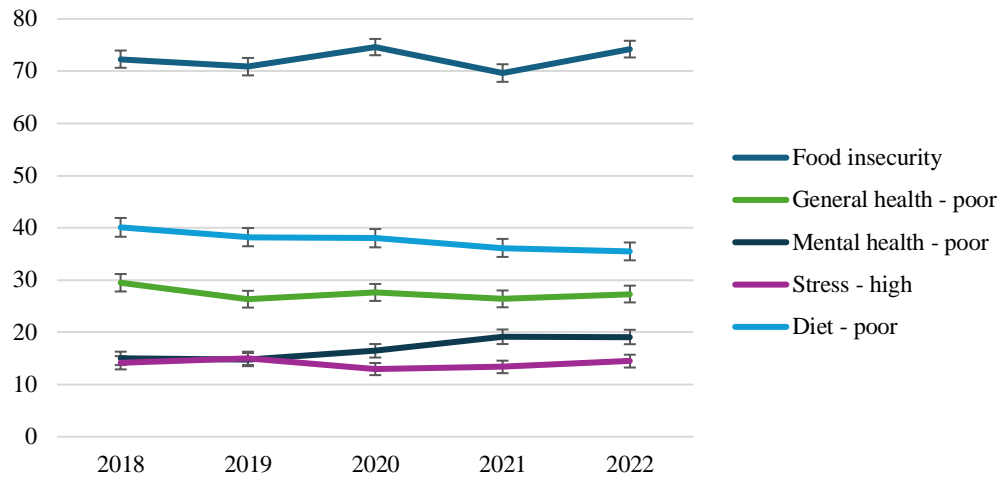
B1. Canada - adult consequences



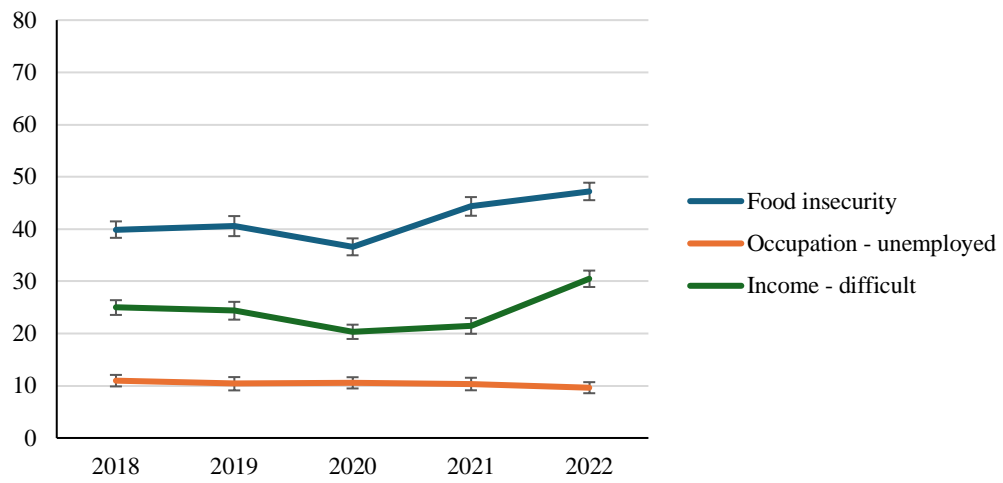
C1. Mexico - adult determinants



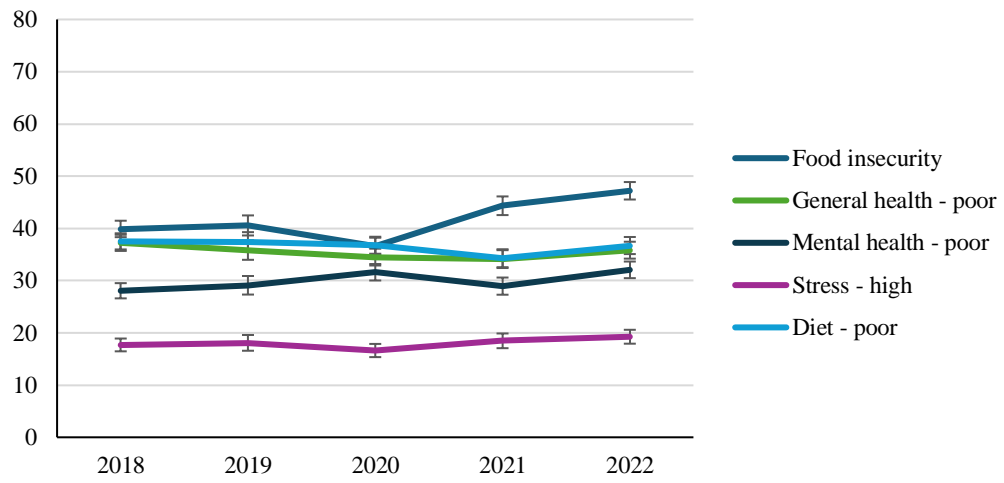
C2. Mexico - adult consequences



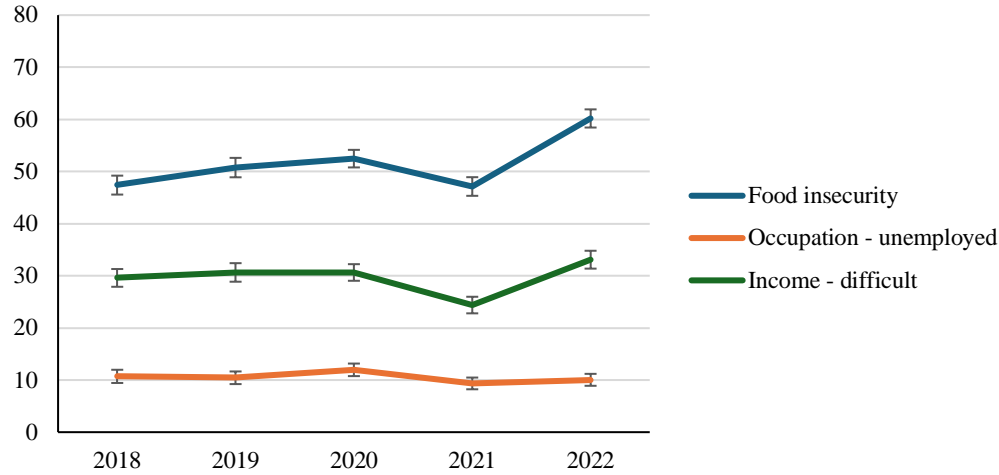
D1. United Kingdom - adult determinants



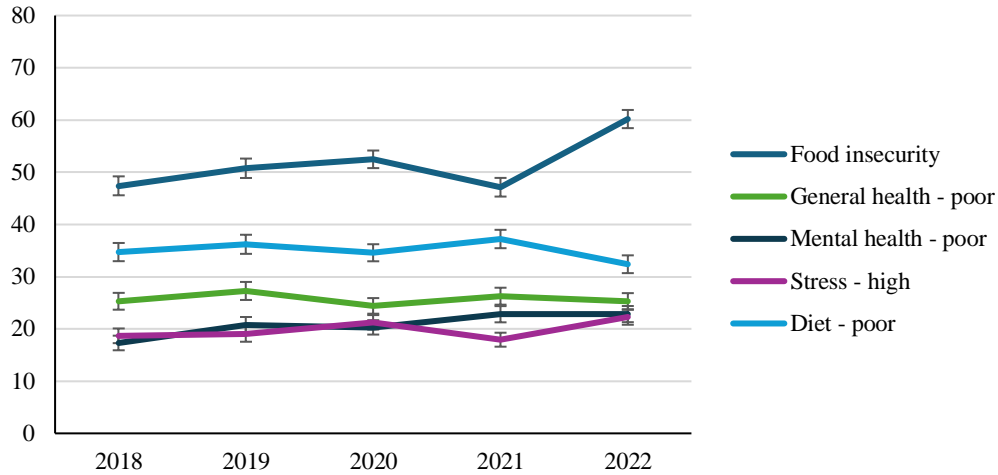
D2. United Kingdom - adult consequences



E1. United States - adult determinants



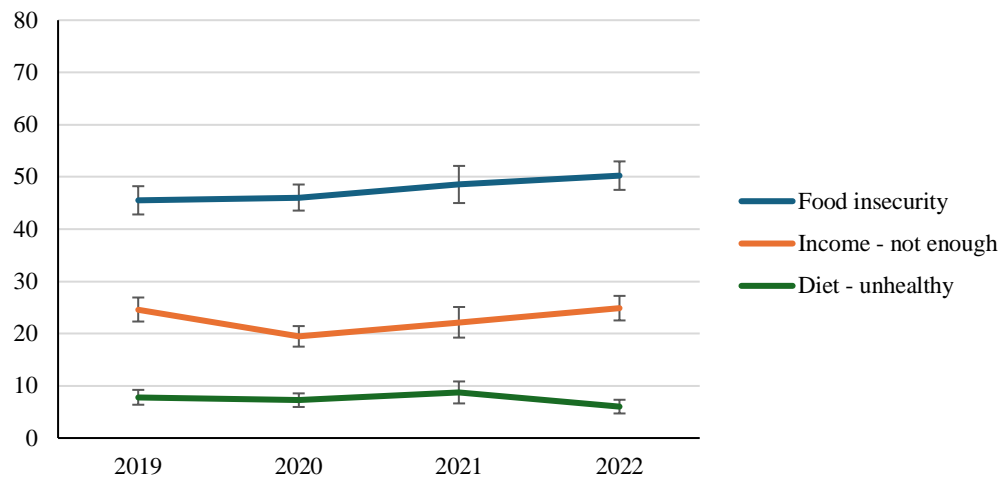
E2. United States - adult consequences



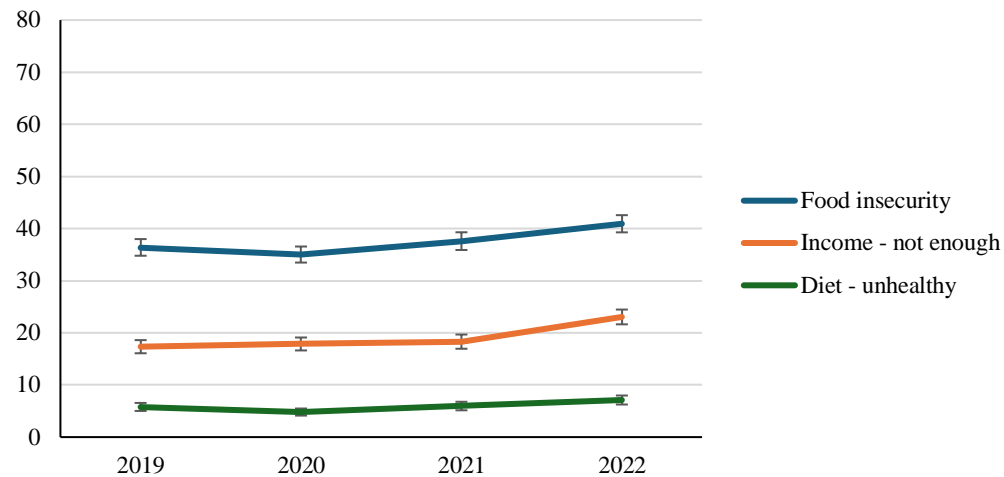
Weighted percentages of the proportions of adults living in food-insecure households, selected determinants and consequences of food insecurity in 2018 to 2022: (A) Australia (n = 19,742), (B) Canada (n = 21,417), (C) Mexico (n = 20,884), (D) the United Kingdom (n = 21,484), and (E) the United States (n = 21,161).

Figure 7.2: Proportion of adolescents aged 10 to 17 years experiencing food insecurity and proportion of adolescents reporting selected determinant and consequence of food insecurity in 2019 to 2022, by country, International Food Policy Study (n = 44,759).

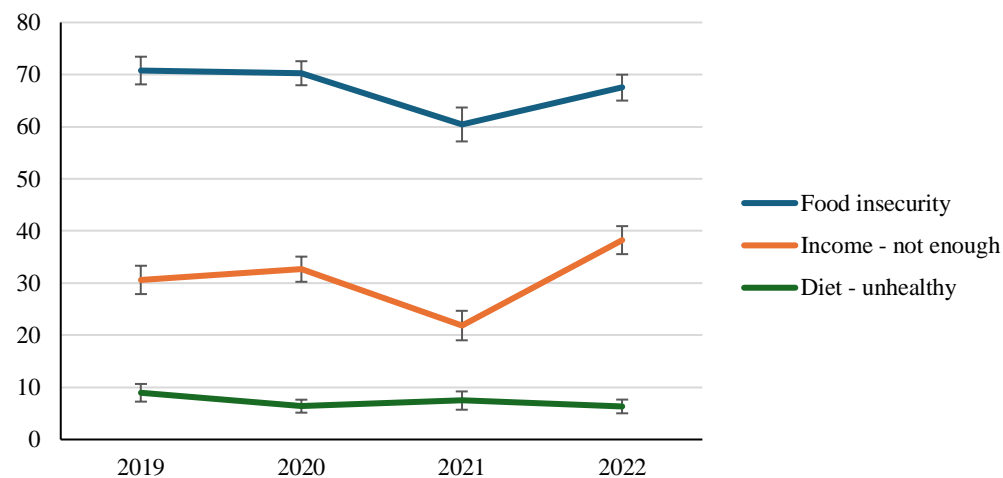
A. Australia - adolescent determinant and consequence



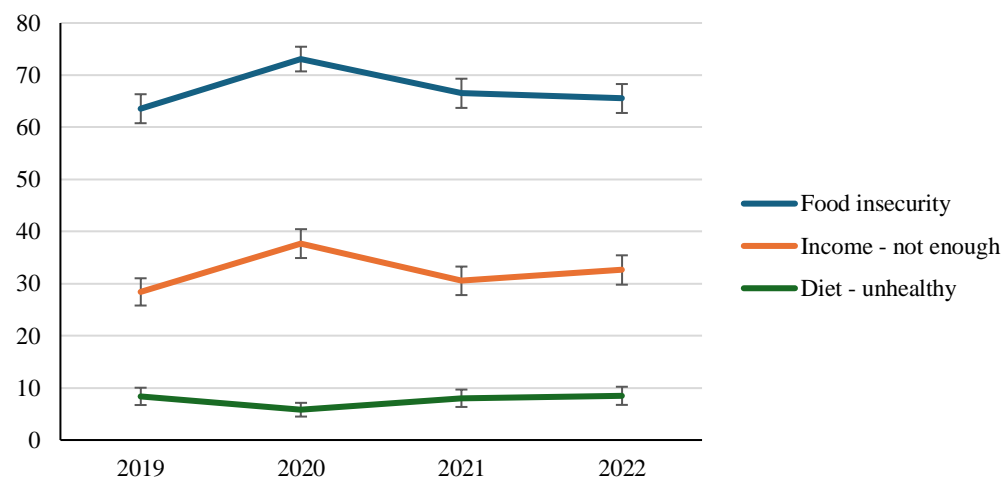
B. Canada - adolescent determinant and consequence



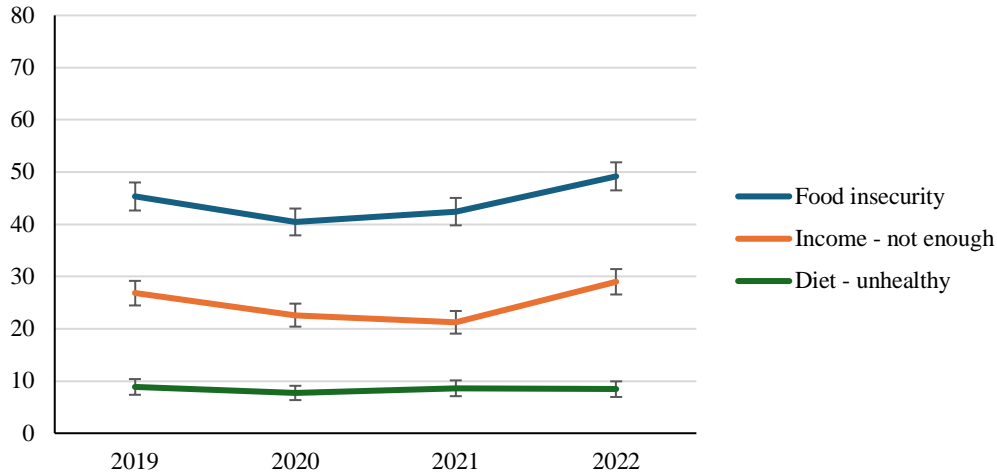
C. Chile - adolescent determinant and consequence



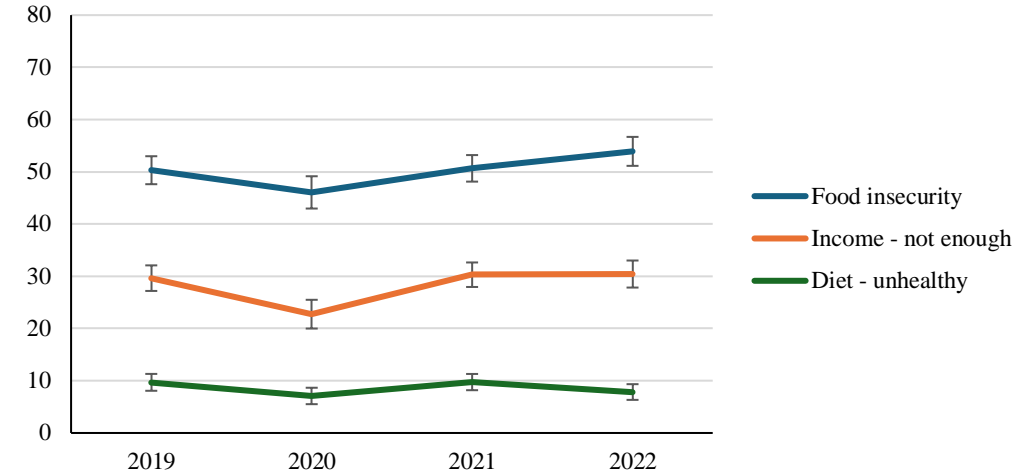
D. Mexico - adolescent determinant and consequence



E. United Kingdom - adolescent determinant and consequence



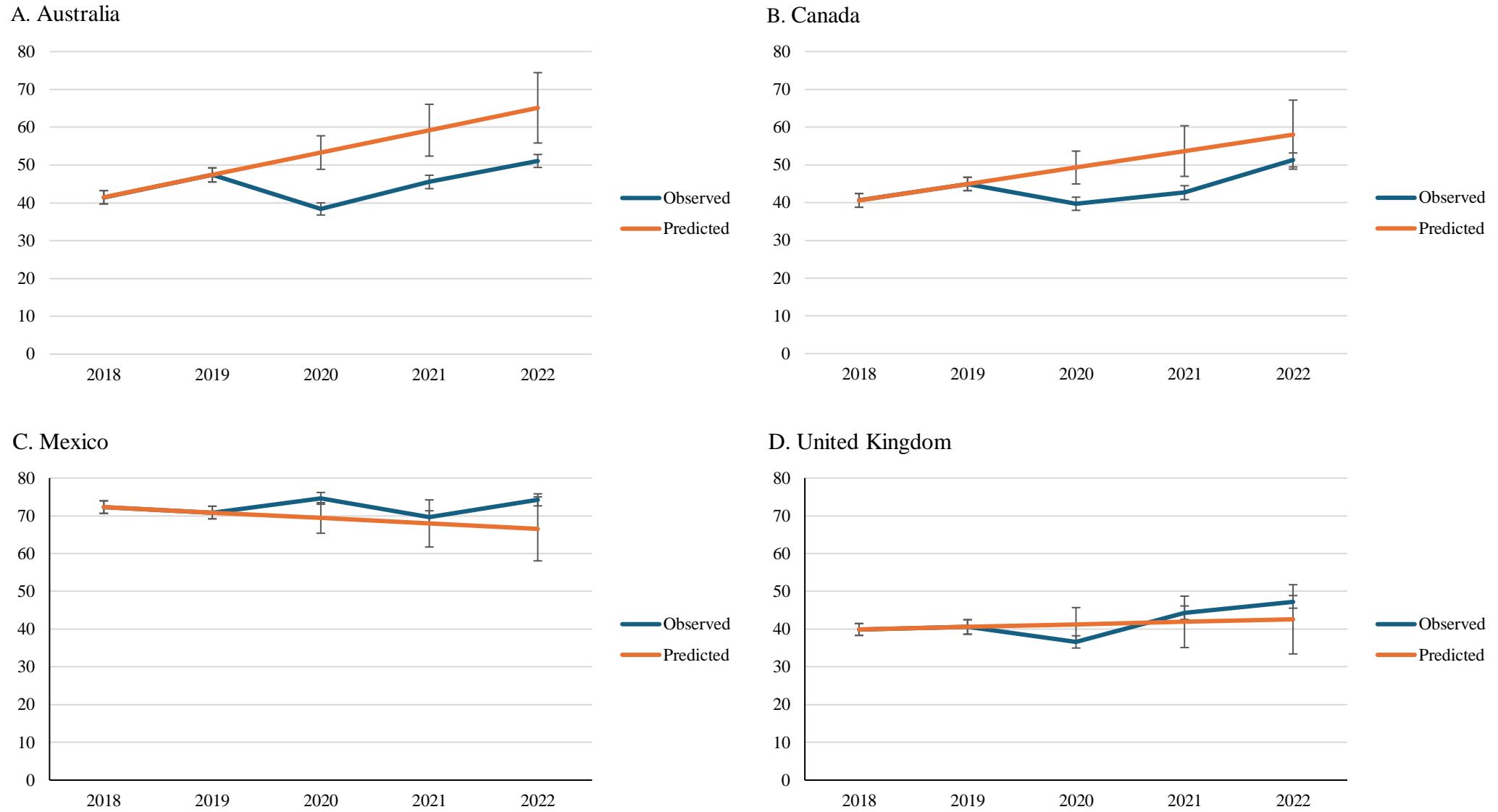
F. United States - adolescent determinant and consequence



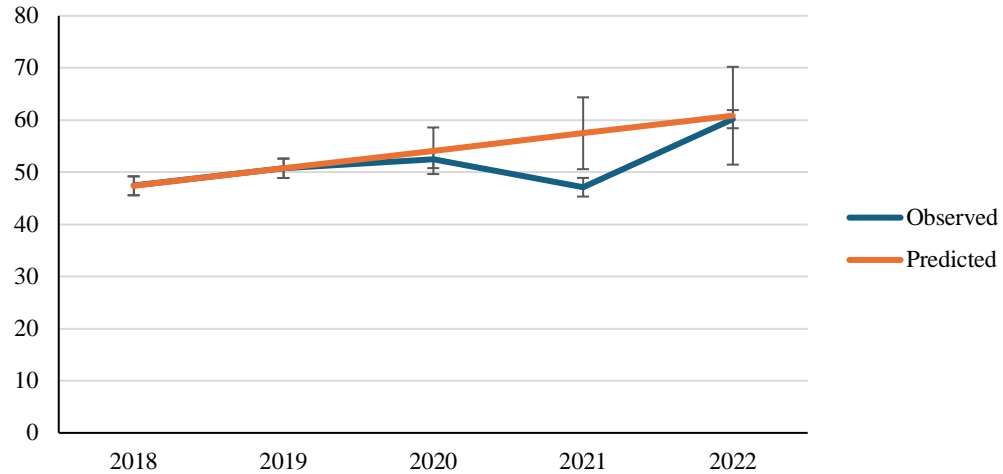
Weighted percentages of the proportions of adolescents experiencing food insecurity and selected determinant and consequence of food insecurity in 2019 to 2022: (A) Australia (n = 5,232), (B) Canada (n = 14,479), (C) Chile (n = 5,545), (D) Mexico (n = 6,656), (E) the United Kingdom (n = 6,196), and (F) the United States (n = 6,651).

The proportions of adults living in food-insecure households in Australia and Canada were lower in 2020 and 2021 than anticipated had the COVID-19 pandemic not occurred (**Figure 7.3**). This pattern was also evident in Australia for 2022 but there was no difference between the observed and predicted prevalence of adults living in food-insecure households in Canada in 2022. In Mexico and the UK, the observed proportions of adults living in food-insecure households did not differ from the proportions predicted for 2020, 2021, and 2022. There was no difference between the observed and predicted prevalence of food insecurity in 2020 and 2022 in the US. The observed proportion was, however, lower in 2021 than expected had the COVID-19 pandemic not occurred.

Figure 7.3: Observed versus predicted proportions of adults aged 18 to 100 years living in food-insecure households in 2018 to 2022, by country, International Food Policy Study (n = 104,418)¹.



E. United States



Weighted proportions of adults living in food-insecure households 2018 to 2022: (A) Australia (n = 19,742), (B) Canada (n = 21,417), (C) Mexico (n = 20,884), (D) the United Kingdom (n = 21,484), and (E) the United States (n = 21,161).

¹The 95% confidence intervals for the observed and predicted proportions of adults living in food-insecure households overlap at most time points in most countries. Exceptions are as follows: Australia in 2020, 2021, and 2022; Canada in 2020, and 2021; and the US in 2021.

There was little indication of changes in associations between selected characteristics and living in food-insecure households during (2020, 2021, and 2022) compared to before (2019) the COVID-19 pandemic among adults (**Tables 7.6a and 7.6b**). Differences during compared to before the pandemic in the relative risk ratio of adults living in food-insecure households in relation to low educational attainment and difficulty making ends meet were most common. Low compared to high educational attainment was associated with lower risk of adults living in moderately and severely food-insecure households in 2020 (Australia, moderately food-insecure: adjusted relative risk ratio (ARRR): 0.65; 95% CI: 0.44-0.94; Australia, severely food-insecure: ARRR: 0.52; 95% CI: 0.33-0.82); Canada, moderately food-insecure: ARRR: 0.62; 95% CI: 0.42-0.89; Canada, severely food-insecure: ARRR: 0.46; 95% CI: 0.29-0.72), 2021 (Australia, severely food-insecure: ARRR: 0.45; 95% CI: 0.29-0.71; Canada, moderately food-insecure: ARRR: 0.60; 95% CI: 0.41-0.87; Canada, severely food-insecure: ARRR: 0.51; 95% CI: 0.33-0.80; UK, severely food-insecure: ARRR: 0.66; 95% CI: 0.44-0.99), and 2022 (US, moderately food-insecure: ARRR: 0.70; 95% CI: 0.51-0.97) than in 2019. In the UK, lower risk of living in marginally (ARRR: 0.42; 95% CI: 0.22-0.81), moderately (ARRR: 0.51; 95% CI: 0.32-0.83), and severely (ARRR: 0.45; 95% CI: 0.28-0.74) food-insecure households in 2021 than 2019 was observed among adults who reported difficulty making ends meet compared to adults who found it easy to make ends meet. In Australia (ARRR: 1.75; 95% CI: 1.14-2.70) and the US (ARRR: 1.55; 95% CI: 1.01-2.38), adults who reported it was difficult to make ends meet compared to those who reported it was easy to make ends meet had a higher relative risk ratio of living in moderately food-insecure compared to food-secure households in 2021 than 2019.

Table 7.6a: Adjusted relative risk ratio of living in households with marginal, moderate, or severe food insecurity in 2020, 2021, or 2022 compared to 2019 among adults aged 18 to 100 years, by country and year-by-characteristics interaction for levels of the characteristics selected *a priori*, International Food Policy Study (n = 104,418)¹.

	Australia (n = 19,472)			Canada (n = 21,417)			Mexico (n = 20,884)		
	Adjusted relative risk ratio (95% CI)			Adjusted relative risk ratio (95% CI)			Adjusted relative risk ratio (95% CI)		
Year x sex (ref= 2019, male)	2020 x female	2021 x female	2022 x female	2020 x female	2021 x female	2022 x female	2020 x female	2021 x female	2022 x female
Marginally food insecure ²	1.44 (0.98-2.11)	1.05 (0.70-1.57)	0.98 (0.66-1.44)	0.97 (0.67-1.40)	1.14 (0.78-1.68)	1.13 (0.78-1.64)	1.15 (0.84-1.58)	1.09 (0.80-1.48)	0.97 (0.70-1.33)
Moderately food insecure ²	0.99 (0.73-1.34)	0.94 (0.69-1.27)	1.05 (0.78-1.43)	0.89 (0.65-1.20)	1.05 (0.78-1.43)	0.79 (0.58-1.07)	0.99 (0.75-1.32)	0.96 (0.73-1.26)	1.04 (0.79-1.38)
Severely food insecure ²	0.86 (0.60-1.23)	0.71 (0.50-1.01)	0.94 (0.67-1.33)	1.03 (0.71-1.50)	0.99 (0.69-1.43)	0.90 (0.64-1.28)	0.99 (0.71-1.39)	0.92 (0.66-1.29)	1.10 (0.79-1.52)
Year x racial-ethnic identity and cultural diversity (ref= 2019, White and/or English-speaking)	2020 x BIPOC and/or speaks language other than English at home ³	2021 x BIPOC and/or speaks language other than English at home	2022 x BIPOC and/or speaks language other than English at home	2020 x BIPOC and/or speaks language other than English at home	2021 x BIPOC and/or speaks language other than English at home	2022 x BIPOC and/or speaks language other than English at home	2020 x BIPOC and/or speaks language other than English at home	2021 x BIPOC and/or speaks language other than English at home	2022 x BIPOC and/or speaks language other than English at home
Marginally food insecure	0.72 (0.46-1.14)	0.60 (0.37-0.98)	0.85 (0.54-1.34)	0.84 (0.55-1.30)	0.82 (0.53-1.28)	0.80 (0.53-1.23)	1.15 (0.71-1.85)	1.00 (0.63-1.59)	0.90 (0.55-1.47)
Moderately food insecure	1.16 (0.79-1.71)	1.01 (0.68-1.49)	1.08 (0.73-1.60)	1.20 (0.84-1.72)	1.19 (0.83-1.71)	0.82 (0.58-1.18)	1.27 (0.83-1.96)	1.69 (1.12-2.56)	1.49 (0.97-2.28)
Severely food insecure	1.39 (0.88-2.19)	1.47 (0.93-2.30)	1.41 (0.91-2.19)	1.24 (0.80-1.92)	1.40 (0.91-2.16)	1.01 (0.67-1.54)	1.31 (0.81-2.12)	2.04 (1.27-3.26)	1.62 (1.02-2.58)

Year x educational attainment (ref= 2019, high ⁴)	2020 x low ⁴	2021 x low	2022 x low	2020 x low	2021 x low	2022 x low	2020 x low	2021 x low	2022 x low
Marginally food insecure	0.99 (0.62-1.58)	0.94 (0.58-1.53)	0.72 (0.45-1.15)	1.19 (0.75-1.89)	1.27 (0.78-2.04)	1.00 (0.62-1.62)	1.42 (0.94-2.13)	1.20 (0.80-1.80)	0.94 (0.61-1.43)
Moderately food insecure	0.65 (0.44-0.94)	0.90 (0.61-1.31)	0.97 (0.66-1.42)	0.62 (0.42-0.89)	0.60 (0.41-0.87)	0.77 (0.53-1.12)	1.30 (0.92-1.84)	1.12 (0.79-1.59)	1.19 (0.84-1.69)
Severely food insecure	0.52 (0.33-0.82)	0.45 (0.29-0.71)	1.04 (0.67-1.62)	0.46 (0.29-0.72)	0.51 (0.33-0.80)	0.67 (0.43-1.04)	1.44 (0.96-2.16)	1.19 (0.79-1.79)	1.48 (0.99-2.20)
Year x employment status (ref= 2019, working)	2020 x unemployed	2021 x unemployed	2022 x unemployed	2020 x unemployed	2021 x unemployed	2022 x unemployed	2020 x unemployed	2021 x unemployed	2022 x unemployed
Marginally food insecure	1.03 (0.57-1.87)	1.04 (0.56-1.96)	0.72 (0.36-1.46)	0.82 (0.42-1.62)	1.30 (0.61-2.75)	0.86 (0.39-1.90)	1.23 (0.58-2.58)	1.24 (0.58-2.69)	0.94 (0.43-2.09)
Moderately food insecure	1.06 (0.65-1.71)	0.98 (0.59-1.63)	1.09 (0.63-1.87)	0.74 (0.44-1.24)	0.96 (0.55-1.67)	0.69 (0.37-1.27)	0.86 (0.47-1.57)	1.04 (0.54-2.02)	0.86 (0.44-1.66)
Severely food insecure	1.01 (0.60-1.70)	0.77 (0.45-1.30)	1.23 (0.71-2.12)	0.75 (0.43-1.32)	0.84 (0.47-1.52)	0.65 (0.35-1.20)	0.96 (0.50-1.87)	1.27 (0.63-2.57)	0.80 (0.39-1.63)
Year x perceived income adequacy (ref= 2019, easy)	2020 x difficult	2021 x difficult	2022 x difficult	2020 x difficult	2021 x difficult	2022 x difficult	2020 x difficult	2021 x difficult	2022 x difficult
Marginally food insecure	1.19 (0.69-2.05)	1.33 (0.74-2.37)	0.95 (0.55-1.65)	1.12 (0.65-1.93)	1.26 (0.73-2.17)	1.44 (0.85-2.44)	1.22 (0.78-1.90)	1.17 (0.77-1.79)	1.32 (0.85-2.05)
Moderately food insecure	0.98 (0.64-1.49)	1.75 (1.14-2.70)	1.34 (0.88-2.05)	0.98 (0.63-1.54)	1.25 (0.80-1.93)	0.92 (0.59-1.42)	1.06 (0.70-1.61)	0.95 (0.63-1.41)	1.46 (0.96-2.23)
Severely food insecure	0.71 (0.43-1.16)	1.14 (0.69-1.88)	1.03 (0.64-1.67)	0.87 (0.51-1.48)	0.94 (0.57-1.55)	1.06 (0.64-1.75)	1.18 (0.68-2.06)	1.02 (0.60-1.71)	0.98 (0.60-1.62)

Year x living arrangement (ref= 2019, no other adults or children)	2020 x other adults with children	2021 x other adults with children	2022 x other adults with children	2020 x other adults with children	2021 x other adults with children	2022 x other adults with children	2020 x other adults with children	2021 x other adults with children	2022 x other adults with children
Marginally food insecure	1.07 (0.68-1.69)	1.47 (0.91-2.37)	1.42 (0.90-2.26)	1.01 (0.66-1.55)	0.99 (0.63-1.56)	1.09 (0.70-1.68)	0.71 (0.51-1.00)	0.95 (0.68-1.32)	1.11 (0.79-1.57)
Moderately food insecure	1.17 (0.81-1.69)	1.06 (0.73-1.53)	0.95 (0.66-1.36)	1.77 (1.21-2.58)	1.26 (0.86-1.84)	1.42 (0.98-2.06)	0.72 (0.53-0.97)	0.86 (0.64-1.15)	1.01 (0.75-1.37)
Severely food insecure	1.64 (1.05-2.56)	1.91 (1.23-2.96)	1.03 (0.68-1.58)	1.89 (1.18-3.03)	1.33 (0.83-2.14)	1.17 (0.75-1.83)	0.77 (0.53-1.13)	0.82 (0.56-1.20)	0.73 (0.51-1.06)
Year x living arrangement (ref= 2019, no other adults or children)	2020 x no other adults but children	2021 x no other adults but children	2022 x no other adults but children	2020 x no other adults but children	2021 x no other adults but children	2022 x no other adults but children	2020 x no other adults but children	2021 x no other adults but children	2022 x no other adults but children
Marginally food insecure	0.66 (0.32-1.36)	1.41 (0.69-2.90)	0.79 (0.38-1.62)	1.31 (0.51-3.36)	2.30 (1.01-5.22)	1.37 (0.58-3.24)	1.24 (0.61-2.51)	1.38 (0.69-2.77)	1.17 (0.57-2.41)
Moderately food insecure	0.70 (0.41-1.22)	0.64 (0.37-1.13)	0.61 (0.35-1.08)	1.37 (0.69-2.73)	1.68 (0.93-3.05)	1.47 (0.78-2.77)	1.00 (0.52-1.92)	1.05 (0.56-1.96)	1.31 (0.71-2.42)
Severely food insecure	1.27 (0.68-2.36)	1.00 (0.52-1.89)	1.02 (0.56-1.87)	1.42 (0.67-3.02)	1.33 (0.68-2.60)	1.20 (0.64-2.25)	0.54 (0.27-1.09)	0.90 (0.45-1.79)	0.55 (0.29-1.06)

Table 7.6b: Adjusted relative risk ratio of living in households with marginal, moderate, or severe food insecurity in 2020, 2021, or 2022 compared to 2019 among adults aged 18 to 100 years, by country and year-by-characteristics interaction for levels of the characteristics selected *a priori*, International Food Policy Study (n = 104,418)¹.

	United Kingdom (n = 21,484)			United States (n = 21,161)		
	Adjusted relative risk ratio (95% CI)			Adjusted relative risk ratio (95% CI)		
Year x sex (ref= 2019, male)	2020 x female	2021 x female	2022 x female	2020 x female	2021 x female	2022 x female
Marginally food insecure ²	1.23 (0.82-1.86)	1.28 (0.83-1.96)	1.89 (1.24-2.86)	0.84 (0.58-1.23)	0.73 (0.50-1.08)	0.64 (0.43-0.95)
Moderately food insecure ²	1.07 (0.77-1.48)	0.98 (0.70-1.37)	1.12 (0.81-1.55)	0.87 (0.64-1.17)	0.88 (0.64-1.20)	0.82 (0.60-1.13)
Severely food insecure ²	1.16 (0.80-1.68)	1.04 (0.71-1.51)	0.97 (0.67-1.38)	0.77 (0.56-1.07)	0.86 (0.62-1.21)	0.80 (0.58-1.11)
Year x racial-ethnic identity and cultural diversity (ref= 2019, White and/or English-speaking)	2020 x BIPOC and/or speaks language other than English at home ³	2021 x BIPOC and/or speaks language other than English at home	2022 x BIPOC and/or speaks language other than English at home	2020 x BIPOC and/or speaks language other than English at home	2021 x BIPOC and/or speaks language other than English at home	2022 x BIPOC and/or speaks language other than English at home
Marginally food insecure	0.89 (0.47-1.69)	1.14 (0.59-2.18)	0.90 (0.48-1.67)	0.75 (0.51-1.11)	0.83 (0.55-1.25)	0.72 (0.47-1.11)
Moderately food insecure	1.07 (0.67-1.71)	0.82 (0.50-1.33)	0.96 (0.61-1.52)	0.64 (0.47-0.88)	0.92 (0.66-1.29)	0.69 (0.49-0.97)
Severely food insecure	0.87 (0.50-1.49)	0.95 (0.55-1.66)	0.60 (0.35-1.02)	0.63 (0.44-0.89)	0.73 (0.51-1.05)	0.75 (0.53-1.08)

Year x educational attainment (ref= 2019, high ⁴)	2020 x low ⁴	2021 x low	2022 x low	2020 x low	2021 x low	2022 x low
Marginally food insecure	1.00 (0.63-1.59)	0.75 (0.47-1.21)	0.63 (0.39-1.01)	0.94 (0.64-1.39)	1.14 (0.77-1.69)	0.97 (0.64-1.46)
Moderately food insecure	1.15 (0.80-1.65)	1.20 (0.83-1.72)	1.24 (0.86-1.77)	0.81 (0.59-1.10)	0.86 (0.62-1.20)	0.70 (0.51-0.97)
Severely food insecure	1.18 (0.78-1.80)	0.66 (0.44-0.99)	1.01 (0.67-1.51)	0.73 (0.52-1.02)	1.21 (0.85-1.71)	0.77 (0.55-1.07)
Year x employment status (ref= 2019, working)	2020 x unemployed	2021 x unemployed	2022 x unemployed	2020 x unemployed	2021 x unemployed	2022 x unemployed
Marginally food insecure	1.09 (0.56-2.13)	0.67 (0.30-1.46)	0.71 (0.34-1.48)	2.42 (1.21-4.84)	2.26 (1.12-4.59)	2.71 (1.27-5.78)
Moderately food insecure	1.07 (0.61-1.87)	1.17 (0.65-2.09)	1.28 (0.71-2.29)	1.41 (0.82-2.43)	1.01 (0.57-1.78)	1.37 (0.77-2.46)
Severely food insecure	1.09 (0.62-1.93)	0.71 (0.40-1.28)	1.06 (0.59-1.88)	1.44 (0.83-2.50)	1.80 (1.04-3.13)	1.43 (0.80-2.55)
Year x perceived income adequacy (ref= 2019, easy)	2020 x difficult	2021 x difficult	2022 x difficult	2020 x difficult	2021 x difficult	2022 x difficult
Marginally food insecure	0.53 (0.28-0.99)	0.42 (0.22-0.81)	0.28 (0.15-0.51)	0.48 (0.28-0.81)	0.95 (0.55-1.63)	0.68 (0.39-1.17)
Moderately food insecure	0.97 (0.59-1.57)	0.51 (0.32-0.83)	0.61 (0.38-0.96)	0.86 (0.57-1.30)	1.09 (0.70-1.69)	0.59 (0.39-0.90)
Severely food insecure	1.07 (0.64-1.79)	0.45 (0.28-0.74)	0.78 (0.48-1.27)	0.97 (0.65-1.44)	1.55 (1.01-2.38)	0.79 (0.53-1.16)

Year x living arrangement (ref= 2019, no other adults or children)	2020 x other adults with children	2021 x other adults with children	2022 x other adults with children	2020 x other adults with children	2021 x other adults with children	2022 x other adults with children
Marginally food insecure	0.77 (0.47-1.26)	1.13 (0.68-1.88)	0.91 (0.56-1.48)	0.70 (0.45-1.09)	0.80 (0.50-1.26)	0.63 (0.39-1.01)
Moderately food insecure	1.03 (0.71-1.51)	0.94 (0.63-1.39)	0.89 (0.61-1.29)	0.97 (0.68-1.39)	0.57 (0.39-0.83)	0.81 (0.55-1.19)
Severely food insecure	1.20 (0.76-1.89)	1.30 (0.82-2.08)	1.03 (0.66-1.61)	0.82 (0.56-1.21)	0.57 (0.38-0.85)	0.77 (0.52-1.14)
Year x living arrangement (ref= 2019, no other adults or children)	2020 x no other adults but children	2021 x no other adults but children	2022 x no other adults but children	2020 x no other adults but children	2021 x no other adults but children	2022 x no other adults but children
Marginally food insecure	0.76 (0.33-1.74)	0.94 (0.41-2.14)	0.70 (0.29-1.69)	0.52 (0.24-1.16)	0.91 (0.42-2.00)	0.86 (0.38-1.94)
Moderately food insecure	1.20 (0.63-2.27)	1.30 (0.69-2.47)	0.86 (0.44-1.68)	1.19 (0.67-2.11)	0.67 (0.35-1.26)	1.36 (0.73-2.53)
Severely food insecure	1.24 (0.63-2.45)	1.10 (0.55-2.19)	1.02 (0.51-2.02)	0.75 (0.41-1.35)	0.78 (0.42-1.44)	1.15 (0.62-2.11)

¹Sample sizes by year are as follows: 22,747 in 2018; 19,225 in 2019; 21,306 in 2020; 20,589 in 2021; and 20,551 in 2022.

²Marginally food-insecure corresponds to 1 affirmation on the HFSSM, moderately food-insecure corresponds to 2–3 affirmations on the adult scale and/or 2–4 affirmations on the child scale, or severely food-insecure corresponds to 6 or more affirmations adult scale and/or 5 or more affirmations on the child scale.

³Abbreviation: BIPOC, Black, Indigenous, People of Color.

⁴High educational attainment: university degree or above; low educational attainment: secondary education or less.

Among adolescents, most associations between food insecurity and selected characteristics were consistent across years during (2020, 2021, and 2022) compared to before (2019) the pandemic (**Tables 7.7a and 7.7b**). When comparing 2020 to 2019 in Canada, the odds of food insecurity were higher (adjusted odds ratio (AOR): 1.43; 95% CI: 1.12-1.82) among adolescents who identified as BIPOC and/or speaks language other than English at home compared to White and/or English-speaking. Within the same year-to-year comparison, 2020 to 2019, adolescents in the US who identified as BIPOC and/or speaks language other than English at home compared to White and/or English-speaking were less likely (AOR: 0.60; 95% CI: 0.41-0.86) to report any compared to no experiences of food insecurity. Adolescents who identified as female in the US had lower odds (AOR: 0.61; 95% CI: 0.43-0.85) of experiencing food insecurity in 2022 versus 2019 when compared to adolescents who identified as male. In Chile, adolescents were more likely (AOR: 1.98; 95% CI: 1.11-3.54) to experience food insecurity in 2022 than 2019 if they reported their family did not have enough money for the they needed compared to adolescents who shared their family had enough money. Results for countries for which the four-level variable model converged using the adolescent sample are available in **Supplemental tables 7.21a and 7.21b**.

Sensitivity analyses including repeat respondents yielded similar findings among adults and adolescents (results not shown). Any differences observed suggest repeat respondents were living in food-secure households and likely had higher social capital relative to non-repeat respondents.

Table 7.7a: Adjusted odds of any experiences of food insecurity 2020, 2021, or 2022 compared to 2019 among adolescents aged 10 to 17 years, by country and year-by-characteristics interaction for levels of the characteristics selected *a priori*, International Food Policy Study (n = 44,759)¹.

	Australia (n = 5,232)			Canada (n = 14,479)			Chile (n = 5,545)		
	Adjusted odds ratio (95% CI)			Adjusted odds ratio (95% CI)			Adjusted odds ratio (95% CI)		
Year x sex (ref= 2019, male)	2020 x female	2021 x female	2022 x female	2020 x female	2021 x female	2022 x female	2020 x female	2021 x female	2022 x female
Any experiences ²	1.00 (0.72-1.39)	0.77 (0.52-1.15)	0.96 (0.67-1.36)	0.97 (0.78-1.20)	0.89 (0.71-1.10)	1.14 (0.91-1.41)	1.03 (0.71-1.49)	0.69 (0.46-1.04)	0.88 (0.60-1.27)
Year x racial-ethnic identity and cultural diversity (ref= 2019, White and/or English-speaking)	2020 x BIPOC and/or speaks language other than English at home ³	2021 x BIPOC and/or speaks language other than English at home	2022 x BIPOC and/or speaks language other than English at home	2020 x BIPOC and/or speaks language other than English at home	2021 x BIPOC and/or speaks language other than English at home	2022 x BIPOC and/or speaks language other than English at home	2020 x BIPOC and/or speaks language other than English at home	2021 x BIPOC and/or speaks language other than English at home	2022 x BIPOC and/or speaks language other than English at home
Any experiences	1.46 (0.95-2.25)	1.24 (0.75-2.06)	1.15 (0.74-1.78)	1.43 (1.12-1.82)	0.97 (0.75-1.25)	1.19 (0.93-1.52)	1.33 (0.72-2.45)	1.66 (0.85-3.25)	1.38 (0.72-2.63)
Year x perceived income adequacy (ref= 2019, enough)	2020 x not enough	2021 x not enough	2022 x not enough	2020 x not enough	2021 x not enough	2022 x not enough	2020 x not enough	2021 x not enough	2022 x not enough
Any experiences	1.18 (0.72-1.92)	1.25 (0.70-2.25)	0.85 (0.53-1.38)	0.95 (0.70-1.29)	0.99 (0.72-1.37)	0.84 (0.62-1.13)	1.41 (0.80-2.49)	1.12 (0.60-2.10)	1.98 (1.11-3.54)

Table 7.7b: Adjusted odds of any experiences of food insecurity 2020, 2021, or 2022 compared to 2019 among adolescents aged 10 to 17 years, by country and year-by-characteristics interaction for levels of the characteristics selected *a priori*, International Food Policy Study (n = 44,759)¹.

	Mexico (n = 6,656)			United Kingdom (n = 6,196)			United States (n = 6,651)		
	Adjusted odds ratio (95% CI)			Adjusted odds ratio (95% CI)			Adjusted odds ratio (95% CI)		
Year x sex (ref= 2019, male)	2020 x female	2021 x female	2022 x female	2020 x female	2021 x female	2022 x female	2020 x female	2021 x female	2022 x female
Any experiences ²	1.04 (0.72-1.50)	1.27 (0.87-1.86)	0.95 (0.66-1.36)	1.13 (0.81-1.58)	0.94 (0.67-1.33)	0.98 (0.69-1.38)	0.77 (0.54-1.11)	0.75 (0.54-1.04)	0.61 (0.43-0.85)
Year x racial-ethnic identity and cultural diversity (ref= 2019, White and/or English-speaking)	2020 x BIPOC and/or speaks language other than English at home ³	2021 x BIPOC and/or speaks language other than English at home	2022 x BIPOC and/or speaks language other than English at home	2020 x BIPOC and/or speaks language other than English at home	2021 x BIPOC and/or speaks language other than English at home	2022 x BIPOC and/or speaks language other than English at home	2020 x BIPOC and/or speaks language other than English at home	2021 x BIPOC and/or speaks language other than English at home	2022 x BIPOC and/or speaks language other than English at home
Any experiences	1.66 (0.89-3.11)	0.84 (0.46-1.55)	1.03 (0.58-1.82)	1.52 (0.91-2.54)	1.00 (0.60-1.69)	1.11 (0.67-1.86)	0.60 (0.41-0.86)	1.08 (0.78-1.50)	0.76 (0.54-1.06)
Year x perceived income adequacy (ref= 2019, enough)	2020 x not enough	2021 x not enough	2022 x not enough	2020 x not enough	2021 x not enough	2022 x not enough	2020 x not enough	2021 x not enough	2022 x not enough
Any experiences	0.65 (0.38-1.12)	0.58 (0.33-1.02)	1.58 (0.87-2.87)	1.34 (0.86-2.10)	0.96 (0.62-1.49)	0.83 (0.55-1.25)	0.76 (0.47-1.23)	0.98 (0.66-1.48)	0.95 (0.62-1.46)

¹Sample sizes by year are as follows: 11,090 in 2019; 12,017 in 2020; 10,190 in 2021; and 11,462 in 2022.

²Any experiences of food insecurity corresponds to 1 or more affirmations to questions on the Child Food Insecurity Experiences Scale.

³Abbreviation: BIPOC, Black, Indigenous, People of Color.

7.5 Discussion

The prevalence of food insecurity in the countries of interest changed throughout the COVID-19 pandemic (2020 to 2022), emphasizing the value of consistent annual measurement. In most instances, year-to-year changes in the proportions of food insecurity among adults living in households and adolescents aligned more closely with changes in the determinants than consequences of this phenomena. Across most or all years examined in Mexico, the UK, and the US, the observed proportions of adults in food-insecure households did not differ from what was predicted had the pandemic not occurred. In Australia and Canada, the observed prevalence of food insecurity among adults living in households was lower than expected in most years. Subgroups with characteristics expected to have a higher risk of experiencing food insecurity relative to selected reference subgroups during (2020 to 2022) compared to before (2019) the pandemic largely did not. In some instances, subgroups of the population were less impacted by food insecurity during compared to before the COVID-19 pandemic. These findings, however, do not negate the higher prevalence of food insecurity among subgroups of the population during the pandemic. Broadly, food insecurity was an issue during the COVID-19 pandemic that may have been worse had economic and social policy responses not been implemented.

Alignment in year-to-year changes in the proportions of food insecurity among adults living in households and known determinants varied across countries. In contrast, there were few discrepancies between year-to-year changes in the proportions of adolescents having any experiences of food insecurity and the single determinant and single consequence examined. In cases in which there were discrepancies, changes in food insecurity were typically larger than changes in the determinants and consequences. For example, in Canada, the proportion of adults living in food-insecure households was higher by approximately 9% in 2022 compared to 2021,

whereas the corresponding change in the proportion of adults reporting it was difficult to make ends meet was 3%. Similarly, the proportion of adults living in food-insecure households in Australia was 9% lower in 2020 compared to 2019 whereas the change in the proportion of adults reporting high stress differed by approximately 4%. Due to the range of factors that could influence food insecurity and the categorical nature of the variables for the determinants and consequences, it is unlikely that a one percent change in the proportion of food insecurity would equate to a one percent change in a given category for the determinants and consequences. For example, the perceived income adequacy measure, which asked about ease of making ends meet, did not capture actual changes in income nor fully consider factors such as assets and debt and access to resources, including food or money from family and friends, that can influence food insecurity (105,107,358). Further, the focus on specific categories of each determinant (e.g., difficulty making ends meet) and consequence (e.g., poor quality diets) may have masked broader changes in the determinants and consequences. With these considerations, the overall consistency in alignment between changes in food insecurity and the determinants and consequences in each country lend confidence that nature of food insecurity did not change during the pandemic.

The finding that the observed prevalence of food insecurity among adults was similar or lower than predicted values across countries suggests that economic and social policy responses mitigated the potential exacerbation of food insecurity due to shocks associated with lockdowns and other measures. In Australia and Canada, where the observed proportions of adults in food-insecure households were lower than the predicted proportions, a high proportion of policy responses were classified as labor- (e.g., wage subsidies) and welfare-based (e.g., targeted financial assistance to older adults and individuals with pensions) (**Chapter 6**). These policy

responses provided financial-based support that likely partially addressed the financial precarity that underlies food insecurity. At the time point at which the observed proportion of adults in food-insecure households was lower than predicted in the US, labor-based policy responses such as the Paycheck Protection Program and several forms of unemployment compensation were in place. The US policy response also included food assistance and health-related (e.g., coverage of COVID-19 related testing and treatment) measures (**Chapter 6**). A low number of pandemic-related policy responses were implemented by Mexico at a national level. Nonetheless, the proportions of adults living in food-insecure households was not higher than predicted had the pandemic not occurred (**Chapter 6**). Similarly, despite the low overall number of national level policy responses in the UK relative to other countries, the observed prevalence of food insecurity among adults was not higher than that predicted had the pandemic not occurred (**Chapter 6**). In both Mexico and the UK, many of the policy responses in place provided support for long periods (six months or more) (**Chapter 6**) and the UK had an emphasis on financial-based support, including the Coronavirus Job Retention Scheme, the suspension of mortgage payments, and a £20/week increase in the working tax credit for one year (**Chapter 6**). Policy responses implemented or revised at the sub-national level may have also contributed to the lack of difference between the observed and predicted proportions of adults living in food-insecure households. Policy packages differed across countries, and it is not possible from this analysis to disentangle the implications of specific policy responses for food insecurity. The extent to which policies were implemented as intended and taken up by eligible individuals was also not considered. However, the evidence suggests that these packages, including policies that provided long periods of financial-based support, conferred protection against food insecurity during the pandemic. More broadly, findings suggest that packages of policy responses in each country

mitigated anticipated increases in food insecurity during the pandemic with indication that some countries had policy packages that were more protective against potential increases in food insecurity than others.

Subgroups of the population are known to disproportionately experience food insecurity (12,77,78,101,103,110,112,353,354) and continued to be impacted by food insecurity during the pandemic (33,36,94,238,239,283,302,355,356). There was, however, evidence of a lack of change in the strength of the association between selected characteristics and food insecurity during (2020 to 2022) compared to before (2019) the COVID-19 pandemic in all countries. This finding suggests that although food insecurity was more prevalent among subgroups with selected characteristics compared to reference subgroups in the present and prior investigations (33,36,94,238,239,283,302,355,356), the level of risk did not change over time. Moreover, some subgroups of adults and adolescents fared better during (2020 to 2022) than before (2019) the COVID-19 pandemic. For example, across all countries except Mexico, adults with a low level of education had a lower relative risk of varying degrees of food insecurity during compared to before the COVID-19 pandemic. Within this study, low educational attainment—high school completion or less—may be a proxy for student status, a subgroup known to be at risk of experiencing food insecurity (359–361). National level policy responses included responses targeted to students in some countries. For example, the Canada Emergency Student Benefit and freezing of student loan repayments in Canada and the US may have provided protection against food insecurity during the pandemic (**Chapter 6**). Overall, it appears that policy responses protected those who were anticipated to be more likely to experience food insecurity during relative to before the pandemic in all countries.

In sum, the findings suggest that trends in food insecurity were responsive to policies implemented by national governments to mitigate the impacts of the pandemic and measures to slow the spread of COVID-19. Countries that provided financial-based support for six months or more and/or implemented combinations of policy responses that can directly (e.g., labor-based support) and indirectly (e.g., expanded healthcare coverage) influence financial resources fared better with respect to food insecurity during the COVID-19 pandemic compared to countries without these responses. These findings add to the evidence that governments can ameliorate food insecurity through concerted policy efforts, including financial-based support (362,363). Some population subgroups were better protected against food insecurity during (2020 to 2022) relative to before (2019) the COVID-19 pandemic. Nonetheless, food insecurity continued to be a considerable challenge during the pandemic (1,12,13) and toward the end of the data collection period when inflation had become a global concern (334) and most financial policies related to the pandemic were winding down, the proportions of adults living in food-insecure households and adolescents experiencing food insecurity were trending upwards in most countries. This evidence underscores the urgent need to address food insecurity, including because of its adverse and widespread consequences for health and well-being (15,16,351,352,118–125). Addressing food insecurity beyond periods of crisis is also important for improving population health and reducing inequities so that all individuals can fare better in future emergencies. The COVID-19 pandemic disproportionately impacted subgroups of the population (229–232) and included negative consequences on morbidity and mortality from COVID-19 (229,233). Adequate nutrition, in addition to addressing the structural barriers that underlie differential disease burden (233), is important for preventing and recovering from illness (364).

Use of the same measures for food insecurity, sociodemographic characteristics, and other variables at the same time of year across all years among adults and adolescents is a strength of this work. Consistent measurement is advantageous because it instills confidence that observed changes, or lack thereof, over time reflect actual changes in food insecurity and the characteristics examined rather than differences in measurement tools or periods. The inclusion of a adolescent-reported measure is also a strength as prior food insecurity research related to the COVID-19 pandemic primarily focused on the adult perspective (33–35,238,239,254), potentially underestimating the prevalence of food insecurity among adolescents (85,89).

The use of repeat cross-sectional data limits the ability to establish causality. Integration of confounders in regression models strengthens inference by mitigating bias due to known uncontrolled confounding. Sample weighting increases the capacity to examine food insecurity over time using repeat cross-sectional data as differences in sample composition between years are mitigated. Estimates of food insecurity prevalence among adults living in households were higher than estimates from national level surveys, including in Canada and the US (12,13). Differences in estimates likely relate at least in part to the level at which food insecurity was examined and the method used to code the HFSSM. The present investigation estimated the proportions of adults living in food-insecure households. In contrast, national level estimates are typically weighted using household-level weights to reflect the proportions of households that experienced food insecurity (12,13). Additionally, this research used Health Canada’s coding approach for the HFSSM, which is expected to result in higher prevalence estimates compared to the US Department of Agriculture’s coding method (12,13,62).

To assess alignment between year-to-year changes in the proportions of food insecurity and its determinants and consequences, directionality and magnitude were considered. Changes

in food insecurity and the respective determinant or consequence were considered to be consistent if the directionality of the change was not in opposing directions and the difference in one from year-to-year was not more than two times the difference in the other. This threshold is arbitrary but was employed to avoid false conclusions about incongruent trends based on small changes between cycles. Moreover, only one level of each determinant and consequence was examined to limit the number of comparisons, whereas there may have been changes in the other levels of the determinants and consequences that indicated alignment or not. Finally, it was not possible to assess intra-year variability of food insecurity due to the use of a single measurement period each year. Food insecurity often fluctuates over the course of a year (13,365). For example, in the US in 2022, one-quarter of households had very low food security one or two months in the year (13). Access to intra-year data, in combination with detailed information on policy implementation and uptake, could facilitate nuanced examination of the policy response or responses that had the greatest benefit for mitigating food insecurity.

7.6 Conclusion

The findings of this study suggest that economic and social policy responses appeared to mitigate anticipated increases in food insecurity in Australia, Canada, Chile, Mexico, the UK, and the US. The present investigation also indicates it is possible for governments to implement financial-based policy responses that ameliorate food insecurity. Implementation of robust and stable policy responses, including beyond crisis periods, is needed to mitigate food insecurity's adverse consequences and support emergency preparedness, particularly among equity-deserving groups who have a high risk of food insecurity and tend to experience a disproportionate burden of emergencies, including those related to infectious diseases.

8.0 Discussion

This section provides a summary of the three inter-related studies (**Chapters 5, 6, and 7**). Hypotheses from **Chapter 6** are also examined using findings from **Chapter 7**. It was of interest to examine these hypotheses because year-to-year estimates of food insecurity among adults living in households were not available in prior research for all countries of interest. Given the order of study completion, estimates of the proportion of adults living in food-insecure households (**Chapter 7**) were not available at the time **Chapter 6** was drafted to examine the accuracy of the hypotheses developed. Thus, these hypotheses are examined in the general discussion of this thesis. Interpretation of findings and key themes from across the studies are shared before summarizing the overall strengths and limitations, policy implications, and implications for research and monitoring.

8.1 Summary

The objectives of this thesis were to 1) characterize changes, or lack thereof, in the prevalence and severity of food insecurity among adults and adolescents in Australia, Canada, Chile, Mexico, the UK, and the US from before (2019) to during (2020) the pandemic (**Chapter 5**); 2) examine national level government economic and social policy responses implemented or revised in these countries to, in part, mitigate the impacts of the COVID-19 pandemic and related safety measures (**Chapter 6**); and 3) determine whether economic and social policy responses appeared to mitigate anticipated increases in food insecurity (**Chapter 7**).

Chapter 5 indicates adults were no more likely to live in food-insecure households during (2020) compared to before (2019) the COVID-19 pandemic in the UK (adjusted odds ratio (AOR): 0.90; 95% CI: 0.79-1.02) and the US (AOR: 1.05; 95% CI: 0.93-1.19). In Australia

(AOR: 0.81; 95% CI: 0.72-0.92) and Canada (AOR: 0.87; 95% CI: 0.77-0.99), findings suggest adults were less likely to live in food-insecure households during (2020) compared to before the COVID-19 pandemic. Only in Mexico were adults more likely (AOR: 1.15; 95% CI: 1.02-1.31) to live in food-insecure households in 2020 compared to 2019. Findings for severity were similar. Adolescents in Mexico were also more likely (AOR: 1.43; 95% CI: 1.19-1.71) to report having one or more experiences of food insecurity during the pandemic compared to before. There was little indication of changes in food insecurity prevalence among adolescents in other countries. When examining the number of food insecurity experiences, adolescents in Australia (adjusted relative risk ratio (ARRR): 2.24; 95% CI: 1.65-3.02) and the United States (ARRR: 1.39; 95% CI: 1.04-1.86) had a higher relative risk ratio of many (11 to 20) compared to no experiences of food insecurity in 2020 than 2019. These findings collectively indicate the COVID-19 pandemic had a differential influence on food insecurity among adults and adolescents across countries.

To assist in contextualizing findings from **Chapter 5**, a policy analysis examining economic and social policy responses implemented or revised by national governments between January 2020 and December 2022 was undertaken (**Chapter 6**). Policy packages in Australia and Canada, where decreases in the prevalence of adults in food-insecure households were observed, emphasized policy responses with long periods of coverage (six months or more) and drew upon financial-based support in 2020. The UK, where no change in food insecurity was observed, also had a policy package that provided long periods of financial-based support. In the US, the scaling up of existing financial- (e.g., unemployment protection) and resource- (e.g., food assistance and healthcare coverage) based support appeared to safeguard against changes in household food insecurity after the onset of the pandemic. In Chile and Mexico, where increases

in the prevalence of food insecurity among adults living in households or household-level prevalence were observed in **Chapter 5** and prior research (238,239), policy packages equally emphasized financial- and resource-based support in 2020. Broader country-specific events also likely undermined the capacity of the policy package to mitigate increases in household food insecurity after the onset of the pandemic (309,338,339).

Packages of policy responses in all countries in 2021 largely followed the same pattern of response as 2020 and appeared to mitigate changes in the proportions of adults living in food-insecure households or household-level food insecurity between 2020 and 2021 in Canada, the UK, and the US (70,94,255). Lack of available data in Australia and the availability of individual-level food insecurity prevalence estimates as three-year averages in Chile and Mexico (67) limited the ability to map policy packages onto changes in food insecurity in 2021 relative to 2020. Household food insecurity was anticipated to increase from 2021 to 2022 in all countries except Mexico due to the waning number of policy responses and concerns about inflation (334). No change in household food insecurity from 2021 to 2022 was expected in Mexico because inflation was less of a concern relative to the other countries examined and the unemployment rate declined in 2022 (340,341). Available evidence in Australia, Canada, the UK, and the US provided indication that the proportions of adults in food-insecure households or household-level food insecurity did increase in 2022 relative to 2021 (12,13,94,256,337). Aggregated averages of food insecurity in Chile and Mexico precluded the assessment of changes in household food insecurity between 2021 and 2022 (67). Evidence from **Chapter 6** underscores the value of implementing packages of policy responses that provide long periods of financial-based support and/or scale up existing policy responses. Findings also point to the need for enduring policy responses to mitigate future increases in household food insecurity.

A final study was undertaken to determine whether economic and social policy responses mitigated anticipated increases in food insecurity among adults living in households and adolescents during the COVID-19 pandemic, extending the consideration of years from **Chapter 5** to include 2021 and 2022 (**Chapter 7**). Three lines of inquiry were examined. The first assessed alignment between year-to-year changes in the proportions of food insecurity among adults and adolescents and known determinants and consequences of food insecurity. Among adults living in households and adolescents, year-to-year changes in the proportion of food insecurity aligned more closely with changes in the proportion of known determinants than known consequences in most countries. Though there were some discrepancies, overall, the findings suggest that the nature of food insecurity did not change during the pandemic and the proceeding lines of inquiry could be undertaken.

The second line of inquiry compared the observed proportions of adults in food-insecure households in 2020, 2021, and 2022 to predicted proportions had the COVID-19 pandemic not occurred. *A priori* hypotheses guided interpretation of findings, which suggested the observed proportions of adults in food-insecure households in Australia, Canada, and the US were lower than predicted at various points throughout the pandemic. These findings were anticipated based on *a priori* hypotheses, increasing confidence in the conclusion that economic and social policy responses mitigated anticipated increases in food insecurity. In Mexico and the UK, there was little indication of differences between observed and predicted proportions of adults living in food-insecure households at most time points during the pandemic, once again suggesting policy responses mitigated anticipated increases in food insecurity.

The final line of inquiry examined whether the magnitude of associations between select sociodemographic characteristics that indicate high risk of experiencing food insecurity (e.g.,

difficulty making ends meet) and food insecurity differed in 2020, 2021, and 2022 compared to 2019. Recognizing that subgroups with selected characteristics were at greater risk of food insecurity before and during the COVID-19 pandemic (12,33,238,239,283,302,353–356,36,77,78,94,101,103,110,112) and the COVID-19 pandemic disproportionately impacted the same subgroups (229–232), these subgroups were anticipated to be at greater risk of experiencing food insecurity during compared to before the COVID-19 pandemic. Most subgroups anticipated to be disproportionately impacted by food insecurity during the COVID-19 pandemic were not, which suggests packages of policy responses protected those most at risk of experiencing food insecurity during the COVID-19 pandemic. Overall, the findings bolster the interpretation of the policy analysis and suggest that economic and social policy responses mitigated anticipated increases in food insecurity among adults and adolescents during the COVID-19 pandemic. These findings also suggest that although packages of economic and social policy responses differed across some contexts, they were able to protect adults and adolescents most at risk from experiencing large changes in food insecurity. More broadly, this finding points to the value of implementing packages of policy responses that align with specific context of the country.

8.2 Policy analysis hypothesis testing

As noted, it was of interest to examine hypotheses developed in **Chapter 6** using estimates of the proportions of adults living in food-insecure households from **Chapter 7**. Hypotheses about how household food insecurity changed year-to-year from 2020 to 2022 were developed based on the knowledge of changes, or lack thereof, in food insecurity from 2019 to 2020, packages of economic and social policy responses to the COVID-19 pandemic, and

broader global and country-specific events (**Chapter 6**). In most countries, food insecurity estimates were available to assess the accuracy of these hypotheses. Lack of comparable year-to-year data in Australia and three-year averages of individual-level food insecurity in Chile and Mexico, however, precluded the assessment of hypothesis accuracy (67). Leveraging results from the attribution analysis (**Chapter 7**) enables further examination of the accuracy of the hypotheses developed within the policy analysis. **Table 8.1** provides a summary of alignment between hypothesis developed and observed trends in food insecurity.

Table 8.1: Policy analysis hypotheses for year-to-year changes in food insecurity compared to observed year-to-year trends in food insecurity among adults in six countries.

Country	Policy analysis hypotheses	Trend observed ¹
Australia	2019 to 2020: decrease or no change 2020 to 2021: no change 2021 to 2022: increase	2019 to 2020: decrease 2020 to 2021: increase 2021 to 2022: increase
Canada	2019 to 2020: decrease or no change 2020 to 2021: increase or no change 2021 to 2022: increase	2019 to 2020: decrease 2020 to 2021: no change 2021 to 2022: increase
Chile	2019 to 2020: increase or no change 2020 to 2021: increase or no change 2021 to 2022: increase	Adolescent data only, unable to draw meaningful conclusions.
Mexico	2019 to 2020: increase 2020 to 2021: increase 2021 to 2022: no change	2019 to 2020: increase 2020 to 2021: decrease 2021 to 2022: increase
United Kingdom	2019 to 2020: increase or no change 2020 to 2021: increase or no change 2021 to 2022: increase	2019 to 2020: decrease 2020 to 2021: increase 2021 to 2022: no change
United States	2019 to 2020: no change 2020 to 2021: no change 2021 to 2022: increase	2019 to 2020: no change 2020 to 2021: decrease 2021 to 2022: increase

¹Year-to-year differences in food insecurity were assessed by examining the proportion of adults in food-insecure households and lack of overlap in 95% confidence intervals. No adjustments for confounders were made.

Based on unadjusted year-to-year changes in the proportions of adults in food-insecure households, there appears to be alignment (67%) between the hypotheses developed and

observed trends in food insecurity. When drawing on findings from **Chapter 5**, which assessed changes in food insecurity from 2019 to 2020 while adjusting for relevant confounders, the level of agreement increases to 73%. For example, there was little indication of a decrease in food insecurity among adults living in households observed in the UK between 2019 and 2020 after adjusting for relevant confounders. Overall, leveraging the results from **Chapter 7** provides additional evidence that the policy analysis hypotheses were reasonable and instills confidence in the theory of change that underlaid these hypotheses.

8.3 Interpretation of findings

Trends in food insecurity and economic and social policy responses to the COVID-19 pandemic discussed in this thesis provide critical insight into the policy responses that are amenable to addressing household food insecurity during periods of crisis. More broadly, actions taken by national level governments during the COVID-19 pandemic indicate it is possible to implement policy responses to ameliorate household food insecurity. Adolescents also appeared to be protected against experiences of food insecurity during the pandemic (**Chapters 5 and 7**). It is, however, important to recognize that economic and social policy responses were largely directed to households as a whole or to adults. Some exceptions were policy responses that targeted households with children (e.g., cash transfers for households with children) or food-based responses targeting children and adolescents (e.g., school meal programs) (**Chapter 6**). Thus, the protection from food insecurity was likely largely through the trickle down of benefits from household and adult-targeted policy responses. Recognizing the indirect nature of this assistance, benefits of policy responses likely vary based on the age of the child or adolescent. Prior research has demonstrated that adolescents can be less protected from experiences of food

insecurity and food insufficiency compared to children, with implications for the coping behaviors they undertake (90,92,366). For example, adolescents have been found to help reduce the burden of food insecurity on their caregivers and younger siblings by engaging in compensatory behaviors (90,92,366). Further examination of intrahousehold food dynamics and the potential for differential policy impacts could inform targeted policy responses to protect households with children from food insecurity and its deleterious consequences.

Although some population subgroups were not at greater odds or risk for food insecurity during (2020 to 2022) relative to before (2019) the COVID-19 pandemic, prior research emphasizes the disproportionate impact of food insecurity across subgroups (33,36,94,238,239,283,302,355,356). Comparison of the prevalence of food insecurity across population subgroups indicates the differential impact of food insecurity among subgroups of the population during and beyond the pandemic (**Chapter 7**). Continued emphasis and action towards addressing food insecurity among population subgroups most impacted by food insecurity is needed. This focus will help reduce the differential burden of food insecurity as well as financial precarity and poor health, given the interconnection between poverty, food insecurity, and health. More broadly, addressing these inter-related issues will help improve population health and reduce inequities so all individuals can fare better during future emergencies.

The COVID-19 pandemic highlighted, instigated, and exacerbated numerous challenges (e.g., racial-ethnic inequities, under-resourced healthcare systems) including food insecurity. In all countries examined, household food insecurity was not a new problem but rather one that has largely been left to non-governmental food assistance organizations to try to address (19,173,367). While these organizations work tirelessly to support as many people as possible,

the provision of food will only go so far in masking a financially rooted problem (19,171,173). During the COVID-19 pandemic, national level governments attempted to address household food insecurity by providing funding to food assistance organizations or altering other forms of food assistance, such as the SNAP (**Chapter 6**). These policy responses may have had a role in the differential patterns of food insecurity among adults and adolescents observed over time across countries during the pandemic (**Chapters 5 and 7**). However, what stood out were alterations to broader economic and social policy responses. Countries that emphasized financial-based support and/or scaled up existing policy responses appeared to mitigate expected increases in food insecurity among adults and adolescents and, in some cases, lower than anticipated prevalences of food insecurity were observed among adults during the pandemic. Population subgroups anticipated to be more likely to experience food insecurity during (2020 to 2022) compared to before (2019) the COVID-19 largely did not and, in some instances, fared better during the pandemic. These findings link more broadly to the need for sufficient agency, power, and resources to attain food security. The abundance of food available but the lack of access among portions of the population point to the intentional structure of societies that privilege some individuals at the expense and disadvantage faced by others (1–3). Rectifying this power imbalance is critical for stopping and reversing the climbing rates of food insecurity by 2030 (29). This goal, however, requires a concerted holistic effort that prioritizes people over short-term financial gain and benefit at the expense of others.

8.4 Key themes across studies

What follows is a discussion of key themes across the three studies. These themes include: 1) food insecurity and the COVID-19 pandemic, 2) past, present, and future disparities, and 3) balancing breadth and depth within comparative research.

8.4.1 Food insecurity and the COVID-19 pandemic

The COVID-19 pandemic was a natural experiment that created opportunities to examine food insecurity in relation to a range of policy environments. Findings from this thesis underscore the differential influence that the COVID-19 pandemic and related policy responses had on food insecurity across countries and over time. In alignment with prior research set within high-income countries (28,98,189,214), packages of policy responses that emphasized long periods of financial-based support appeared to mitigate increases in food insecurity in Australia, Canada, and the UK. There was little indication of change in food insecurity over time in the US even though financial-based support was not the primary emphasis of the US policy package. This lack of change likely relates to the scaling up of existing policy responses such as those related to healthcare. Healthcare-related policy responses were considered to have a low impact as per the theory of change (**Chapter 6**), but the US currently does not have a universal healthcare system, and the provision of these policy responses may have helped move the US closer to a universal system. Given the potential for healthcare costs to undermine the ability to access food (139,332,333), the expansion of healthcare coverage in the US may have had an important role in mitigating changes in food insecurity. The US also had multiple complementary unemployment policy responses and a range of housing-related supports that may have helped mitigate increases in food insecurity.

Policy responses in Chile and Mexico equally emphasized financial- and resource-based support. Both countries also faced circumstances beyond the COVID-19 pandemic that may have undermined food security. In Chile, protests began in late 2019 and centered around income inequality, while Mexico was the only upper-middle income country examined and as such, had lower capacity to invest in economic and social policy responses during the COVID-19 pandemic compared to the other countries examined (41,338). Taken together, the differential trends in food insecurity throughout the pandemic and across countries provides indication of the role that different economic and social policy responses have in altering trends in food insecurity. The lack of change or decreases in food insecurity prevalence across countries with different contexts and policy packages during the pandemic suggest that more than one combination of policy responses is amenable for ameliorating food insecurity. This finding underscores the need to consider contextual features within countries that enable policy responses to work synergistically rather than negate one another. Regardless of combination, the policy package needs to be persistent to mitigate increases in food insecurity after policy packages are removed. Despite the upward trend in food insecurity by 2022, findings from this work impress it is possible to make a rapid and measurable difference in the prevalence of food insecurity.

8.4.2 Past, present, and future disparities?

At the time of writing, the COVID-19 pandemic is no longer a Public Health Emergency of International Concern (207), but it has left lasting impacts, from individuals living with long COVID to those who are struggling to regain financial stability after multiple years of financial uncertainty and shocks (237,368). The ongoing challenges induced by the COVID-19 pandemic

underscore the need for ongoing interventions to address differential outcomes that portions of the population continue to experience. Findings within this thesis highlight both the value and the risk of changes to economic and social policy responses. The lower-than-expected prevalence and risk of food insecurity overall and among some population subgroups anticipated to be disproportionately impacted by food insecurity during the COVID-19 pandemic document that it is possible to make a measurable difference in food insecurity. These wins were, however, short-term as food insecurity estimates for 2022 and 2023, within and beyond this thesis, have highlighted the escalating nature of food insecurity prevalence once again (1,369). The lack of sustained change demonstrates the presence of underlying and unchallenged power imbalances that enable food insecurity to thrive. Rectifying these imbalances is possible through deliberate actions that promote financial stability and the capacity to purchase food, as well as decentralization of power in the food and other systems (3,7). In doing so, individuals will gain control, or agency, over their circumstances as they relate to food (3). It is necessary to consider and address agency as a dimension of food security, in addition to the established four dimensions and the recently recommended sustainability dimension (3,47) because these broader dimensions enable the complexities of food security to be considered and addressed (3).

8.4.3 Balancing breadth and depth within comparative research

While completing the three inter-related studies, there were trade-offs with respect to the level of breadth and depth of information analyzed and conclusions drawn. In particular, the scope of the policy analysis was subject to numerous decisions about what information was of interest and included for consideration and what could be of interest but was ultimately excluded to maintain the feasibility of the project. First, the selection of six countries as the contexts of

interest was motivated by the use of IFPS data for the prevalence and attribution analyses. The built-in constraint on the number of countries limited the breadth of geographic contexts examined and enabled a greater level of depth with respect to the number of economic and social policy response types considered. The focus on policy responses that were implemented or revised by national level governments was selected to align with the level of analysis in the prevalence and attribution analyses and to facilitate cross-country rather than within-country comparisons. Omitting sub-national policy responses was a decision that limited the depth of policy responses considered but enabled a wider breadth of policy response types to be examined. Seven categories of policy responses were initially identified as relevant to consider within the policy analysis. Despite the seemingly reasonable scope, the initial search resulted in the inclusion of many policy responses that would ultimately make synthesizing findings challenging. Some of these policy responses were not expected to have a large influence on food insecurity. A theory of change was developed to narrow the scope of policy responses considered by ultimately reducing the number of policy response types examined. Thus, decisions made throughout the course of the policy analysis ultimately shaped the breadth and depth of policy responses considered.

Trade-offs between the breadth and depth of analysis for the prevalence and attributions analyses were also evident. However, the availability of data from six countries also constrained the breadth of contexts examined, though enabled consideration of food insecurity among adults and adolescents. Moreover, the focus on six countries for the purpose of cross-country comparison necessitated variables that were comparable across countries. The surveys and resulting data within the IFPS were designed to facilitate across and within-country analyses. To enable cross-country comparison, data were aggregated, which resulted a loss in the level of

detail available. For example, racial-ethnic identity was aggregated into three heterogeneous categories. Using data for the purpose of cross-country comparison also meant analyses were not completed at the sub-national, constraining the depth of the analysis completed and opening an opportunity for future research. Overall, decisions that altered the breadth and depth of the three inter-related studies allowed concrete meaningful conclusions to be drawn within and across studies with recognition that further research would augment the analyses conducted.

8.5 Strengths and limitations

Strengths and limitations of the thesis include those discussed in each study, which should be considered in addition to the overarching strengths and limitations. In brief, strengths of the studies in **Chapters 5 and 7** included the use of multiple years of repeat cross-sectional data from both adults and adolescents. All data were weighted and collected using the same measurement tools at all time points. Limitations of these studies included the inability to conduct longitudinal analyses at the individual level given the use of repeat cross-sectional data. Data were collected annually using the HFSSM, which precluded the ability to assess intra-year variability in food insecurity and may not have captured all experiences of food insecurity during the COVID-19 pandemic. Strengths of the study contained within **Chapter 6** included engagement with a collaborative working group and use of a theory of change. Limitations of this study included the exclusion of sub-national policy responses that were implemented or revised during the COVID-19 pandemic, use of existing policy response trackers that varied in level of completeness, and the assumption that all policy responses were implemented as intended.

What follows is a discussion of the overarching strengths and limitations of this thesis. The consideration of food insecurity among adults and adolescents before and during multiple years of the COVID-19 pandemic in multiple countries is a unique strength of this work as many studies focus on singular contexts primarily from the adult perspective (33,35,94,238,239,254). Research that examines multiple contexts is available (1), but this work relies on aggregation of food insecurity and related determinants and consequences, limiting the ability to delve into country-specific findings. Thus, this thesis complements the existing body of work. The prevalence analysis (**Chapter 5**) used data (2018 to 2020) that was available at the time of study completion with plans to conduct analyses with subsequent years of data. While completing the prevalence analysis, it became apparent that a policy analysis would be helpful to contextualize the changes, or lack thereof, in food insecurity that were observed. To facilitate the accuracy and relevance of policy analysis findings, the collaborative working group was formed (**Chapter 6**). Recognizing the value of mapping policy analysis findings onto the attribution analysis (**Chapter 7**), working group members were also engaged during the attribution analysis. Thus, working group engagement during the policy and attribution analyses adds depth to this thesis by enabling consideration of factors beyond the COVID-19 pandemic that had the potential to influence food insecurity. The working group's critical feedback also led to the development of the theory of change, which was pivotal in identifying the policy responses considered, and the hypotheses developed within the policy analysis.

The focus on six different countries is both a strength and limitation of this thesis, as alluded to above in terms of trade-offs. Examination of multiple countries at the national level facilitated contextualization food insecurity trends during the COVID-19 pandemic by drawing comparisons across countries. Focus on the national level, however, necessitated the aggregation

of complex social identity factors into large heterogeneous categories, e.g., racial-ethnic identity and cultural diversity variable. Future research using disaggregated versions of these variables at the within country level will provide deeper insight into food insecurity during the COVID-19 pandemic. Similarly, examination of policy responses at the sub-national level in each country would add to this research area as provincial, state, territorial and municipal governments implemented or revised policy responses during the COVID-19 pandemic. Information about sub-national policy responses may reveal policy responses that are highly adept at addressing food insecurity that could be translated to other contexts.

The COVID-19 pandemic was a period of constant change with respect to the nature and strictness of safety measures, economic and social policy responses provided, among other events (209). As such, there was the potential for considerable dynamism between month-to-month, week-to-week, and even day-to-day experiences of food insecurity. Food insecurity is primarily an episodic event with the potential to shift based on contextual changes (13,365). However, food insecurity was measured over a 12-month period, and it was not possible to assess whether policy responses that were implemented or revised impacted shifts in food insecurity within the 12-month periods. Many of the sociodemographic characteristics considered within the prevalence and attribution analyses were anticipated to be time invariant or relatively stable within the year, e.g., sex at birth and level of educational attainment. To facilitate congruence between studies, economic and social policy responses were considered as policy packages on a yearly basis.

The COVID-19 pandemic was not the only event that could have influenced food insecurity over the period of interest. Additional events were considered to avoid overstating the influence that the COVID-19 pandemic and related policy responses had on food insecurity.

8.6 Policy implications and implications for research and monitoring

The following sections provide insight into policy implications and implications for future research and monitoring. Two subsections, policy responses and methods of delivery as well as policy response communication, pertain to policy implications. Implications for research and monitoring also contains two sections, food insecurity measurement and policy response tracker recommendations.

8.6.1 Policy implications – Policy responses and methods of delivery

Findings from this thesis underscore the need to implement and maintain ongoing financial-based support. Prior research within high-income countries has similarly identified that financial-based responses are best positioned to ameliorate the financial precarity that underlies food insecurity (18,22–27). Where the policy environment is not amenable or does not warrant solely implementing financial-based solutions, it may be relevant to implement complementary policy responses, e.g., healthcare-related policy responses, with the potential to avail financial resources to be directed to food (139,332,333). More specifically, the combination and nature of packages of policy responses need to be context specific and ensure coverage of all population subgroups disproportionately impacted by food insecurity. In the US, the implementation of healthcare-related policy responses appears to have had a positive influence on mitigating increases in food insecurity during the COVID-19 pandemic. The utility of this response may not transfer to other contexts with universal healthcare. More broadly, this finding underscores the need to tailor policy responses to the context within which they are implemented. Although the uptake of policy responses was not assessed within this thesis, there were indications of

eligibility criteria that facilitated ease of administration but did not encompass the needs of all potential recipients (344,345). For example, gig workers in Canada were unable to receive the Canada Emergency Response Benefit, despite being at risk of losing employment during the COVID-19 pandemic (344). Consequently, mechanisms for identifying population subgroups erroneously excluded from policy response receipt should be implemented. Relatedly, times of crisis are not amenable to evaluating the efficacy and fidelity of newly implemented or revised policy responses. Instead, ongoing responses that meet the needs of diverse populations, which can be scaled up during emergency periods, would mitigate concerns about unintentionally excluding potential recipients, challenges evaluating policy responses during crises, and reduce the amount of time needed to scale up these responses (342). Ongoing access to policy responses will also enable assessment of shame, stigma, or other social barriers to accessing various policy responses. It is unclear if policy responses during the COVID-19 pandemic induced feelings of shame or stigma that resulted in the lack of access to some responses. However, it is possible that some responses during the pandemic were not accessed due to fear of alienation, highlighting the need to evaluate if policy responses meet the needs and expectations of intended recipients.

8.6.2 Policy implications – Policy response communication

Review of government webpages for the purpose of verifying policy response details that were contained in the policy tracker enabled consideration of potential areas for improving communication of policy responses. Throughout the COVID-19 pandemic, policy responses were planned and announced but never implemented, implemented, revised, and/or withdrawn. The ever-evolving nature of these responses made it challenging to retroactively, and presumably prospectively, decipher which policy responses were active and could be applied for. In the

future, it would be valuable to have a central webpage, such as Canada's COVID-19 policy response webpage, that individuals could use to identify which benefits they are eligible for and, where applicable, navigate to application portals. Once the policy response is no longer active, information about the response can be retired to an archived version of the webpage, like the UK Government's Web Archive (<https://www.nationalarchives.gov.uk/webarchive/>). This practice would enable continued access to historical policy response information for research purposes while mitigating confusion about which responses are active and can be accessed.

8.6.3 Implications for research and monitoring – Food insecurity measurement

Consistent measurement of food insecurity among adults and adolescents within each country at the national level is needed and will result in multifold benefits. After the onset of the COVID-19 pandemic, researchers rushed to administer surveys to portions of the population to capture a glimpse into the consequences that the COVID-19 pandemic was having on experiences of food insecurity (242). Although this data collection has provided insights into experiences of food insecurity, several limitations have been noted, including lack of comparable measures of food insecurity before and during the pandemic, and changes to the measurement tool reference periods to periods for which they were not designed (242). Collectively, these practices create a fragmented picture of food insecurity during the COVID-19 pandemic and impress the need for consistent food insecurity measurement. In Canada, where food insecurity measurement was available at the national level but prior to 2019 was measured irregularly, initial estimates of food insecurity from May 2020 were compared to estimates from 2017/18 (12,36). Of the countries examined, the US stands out with its annual measurement of food insecurity in December each year, which enabled direct comparison of year-to-year estimates of

food insecurity from before and during the COVID-19 pandemic (13). Nonetheless, concerns about not having access to data on food insecurity until December 2020 was raised as a shortcoming, considering the pandemic became a substantive concern during early 2020 (207,301). To partially mitigate this shortcoming, Household Pulse Surveys were administered starting in April 2020 and included measurement of food insufficiency (370). Food insufficiency is, however, different from food insecurity, which again complicates interpretation (242). Taken together, having consistent annual measurement that captures all populations within a country will enable assessment of food insecurity during periods of crisis without needing to deploy new surveys that may not be comparable to existing measurement practices. In cases in which more frequent measurement is needed, brief surveys that measure food insecurity using a format like the Household Pulse Surveys in the US can be deployed to increase coverage and comparability of food insecurity measurement. Depending on resource constraints, more frequent intervals of measurement may be reserved for periods of crisis when greater access to intra-year data is of interest.

Relatedly, the type of measure used to assess food insecurity needs to be considered because what is measured will determine what inferences can be drawn. For example, the HFSSM captures information about the inability to access food due to limited financial resources, which aligns with the access dimension of food security. The HFSSM, however, does not provide insight into other dimensions of food security, including availability, access, utilization, stability, agency and sustainability (1,46,47). Consequently, work has been undertaken to develop measures that assess the availability, utilization, and stability dimensions of food security (371). Development of measures to assess the agency and sustainability dimensions is an area for future research. Moreover, the HFSSM does not capture all domains of

food insecurity (372). Recognizing this gap, work has been recently undertaken to develop items related to accessing food in socially unacceptable ways (372). Thus, work to establish consistent measurement of food insecurity also needs to consider what type of information is being collected and if it will meet research needs within the context that consistent measurement is established.

Beyond assessing the scale of the problem, consistent measurement of food insecurity allows for the impact of changes in the policy environment to be assessed. Access to consistent food insecurity measurement within the IFPS facilitated examination of the influence that policy packages on food insecurity during the COVID-19 pandemic and beyond, including when policy responses end. Food insecurity was trending upwards in all countries examined by 2022, a period when few policy responses were active, and inflation became a major concern (334). Continued assessment of food insecurity with consistent measurement tools is needed to enable a robust examination of the consequences of the expiration of COVID-19-related policy responses for food insecurity. The lack of ongoing measurement in Newfoundland and Labrador provides a cautionary example of the shortcomings of not having routine measurement (25,349). In 2006, Newfoundland and Labrador introduced a poverty reduction strategy and became a noteworthy example of how food insecurity can be ameliorated in Canada (25). However, several years into the strategy, food insecurity data were not collected, making it impossible to assess the efficacy of the policy package after changes were made. When data were available once again in 2017/18, adults were more likely to live in food-insecure households in 2017/18 than in 2011/12 (349). Although the shift in food insecurity appeared to be a consequence of changing policy responses, the lack of consistent data undermined the ability to identify when the increase in food insecurity

occurred and further delve into the specific policy changes that may have contributed to this disheartening pattern of food insecurity.

Relatedly, surveys that routinely collect food insecurity data should include measures of known determinants (e.g., level and source of income) and consequences (e.g., indicators of mental and physical health) of food insecurity, enabling examination of which portions of the population are disproportionately impacted by food insecurity and the adverse consequences that need to be addressed in the short- and long-terms. Access to information about determinants and consequences of food insecurity will also assist in assessing the positive and negative impact that policy responses have on population subgroups and potentially, on consequences of food insecurity (e.g., mental health). This information will allow for greater understanding of if and how policy responses need to be changed to better support portions of the populations that are at heightened risk of food insecurity and its adverse consequences. Collection of information on known consequences of food insecurity can also be used frame the economic value, or cost-savings, of implementing policy responses that can ameliorate food insecurity, a point that is likely particularly salient after extensive spending during the COVID-19 pandemic.

The recommendations noted above also apply to the direct assessment of food insecurity among adolescents. Although assessment of food insecurity among adolescents is indirectly enabled through some survey modules, like the HFSSM (58,59), adults are not always fully aware of all of adolescents experiences of food insecurity (85–88). Adolescents have experiences that are unique to their circumstances, such as worrying about their parents' ability to get enough food (86,89). Having deep insight into adolescents' experiences is critical as they experience consequences that are unique to their life stage, including compromised academic achievement and psychosocial development (162–167). Moreover, the coping strategies that adolescents

employ may be developmentally inappropriate for their life stage, such as prioritizing work over school to help increase the household level of income, or overarchingly risky regardless of life stage, e.g., selling drugs (89,373), impressing the need to understand all experiences of food insecurity that adolescents can have so they can be mitigated. Although data were not available to consider younger children, data for this population group are also needed to better understand their experiences of food insecurity.

8.6.4 Implications for research and monitoring – Policy response tracker recommendations

Several considerations for how policy response trackers could be optimized were drawn by reflecting on the use of eight policy response trackers, complementing the recommendations provided by the Oxford University COVID-19 Government Response Tracker team (374). The level of information about policy scope as well as who identified and verified policy responses varied by policy response tracker, which created challenges in understanding the type and extent of information captured in the trackers. It would be helpful to have in-depth documentation of the scope, policy response screening criteria, and verification method used to compile the list of policy responses in the tracker. Access to freely available archived versions of webpages that were used to acquire policy response information would enhance policy response trackers because links to non-archived webpages provided were, at times, no longer available when trackers were reviewed in March-June 2023. Clear indication of when policy responses were documented and, if applicable, revised to reflect policy response changes would further support transparency and enable users to make more informed decisions about how the available information can be used. Future instances in which it is helpful to collect policy response information related to an overarching issue would benefit from the consolidation and/or

harmonization of policy response information to reduce the duplication of work. Any effort to consolidate policy response trackers will, however, need to consider the practicality of consolidation given different end user needs.

8.7 Conclusions

Findings from this thesis indicate that food insecurity prevalence did not increase in all countries in 2020 compared to 2019. In most countries examined, adults and adolescents were no more and even less likely to live in food-insecure households or report having experiences of food insecurity in 2020 compared to 2019. Examination of food insecurity using data from 2018 to 2022 suggested that economic and social policy responses mitigated anticipated increases in food insecurity among adults living in households and adolescents during the COVID-19 pandemic. Packages of economic and social policy responses that emphasized long periods of financial-based support and/or scaled up existing policy responses underlaid the patterns of food insecurity observed throughout the pandemic. When coverage from policy packages began to wane in 2022 and inflation was a concern in most countries (334), the prevalence of food insecurity was trending upwards among adults and adolescents. The findings highlight the need for persistent policy responses to address food insecurity and indicate that it is possible for governments to ameliorate food insecurity.

We are within the final decade to achieve the 17 Sustainable Development Goals and although the height of the COVID-19 pandemic appears to be behind us, it stalled and eroded years of progress towards the Sustainable Development Goals (1,29). Urgent action, like what was observed during the COVID-19 pandemic, is needed to remedy the lasting scars created by the pandemic. These actions need to be enduring as the perpetual imbalance that neoliberal and

capitalistic societies operate within will undermine any progress made once policy responses to mitigate the impacts of the pandemic have been fully removed. Better yet, the COVID-19 pandemic can serve as a wake-up call to those who are still unconvinced by the need to radically alter the current neoliberal and capitalistic structures that prevent the world from reaching its full potential.

References

1. FAO, IFAD, UNICEF, WFP, WHO. The State of Food Security and Nutrition in the World 2023. Urbanization, agrifood systems transformation and healthy diets across the rural–urban continuum [Internet]. Rome: FAO; IFAD; UNICEF; WFP; WHO; 2023 [cited 2024 May 24]. Available from: <http://www.fao.org/documents/card/en/c/cc3017en>
2. Roser M, Ritchie H, Rosado P. Food Supply [Internet]. 2023 [cited 2024 May 24]. Available from: <https://ourworldindata.org/food-supply>
3. Clapp J, Moseley WG, Burlingame B, Termine P. Viewpoint: The case for a six-dimensional food security framework. *Food Policy*. 2021 Jan 1;102164.
4. Webb P, Coates J, Frongillo EA, Rogers BL, Swindale A, Bilinsky P. Measuring Household Food Insecurity: Why It’s So Important and Yet So Difficult to Do. *J Nutr*. 2006 May 1;136(5):1404S-1408S.
5. Barrett CB. Measuring food insecurity. *Science*. 2010 Feb 12;327(5967):825–8.
6. FAO. Hunger and food insecurity [Internet]. Rome: FAO; c2024 [cited 2024 May 24]. Available from: <https://www.fao.org/hunger/en/>
7. Alaimo K, Chilton M, Jones SJ. Food insecurity, hunger, and malnutrition. In: Marriott BP, Birt DF, Stallings VA, Yates AA, editors. *Present Knowledge in Nutrition*. 11th ed. Academic Press; Cambridge (MA): 2020. p. 311–26.
8. Long MA, Gonçalves L, Stretesky PB, Defeyter MA. Food Insecurity in Advanced Capitalist Nations: A Review. *Sustainability*. 2020 May 1;12(9):3654.
9. Smith N. Neoliberalism [Internet]. Chicago: Encyclopaedia Britannica; 2024 [cited 2024 May 24]. Available from: <https://www.britannica.com/money/neoliberalism>
10. Merriam-Webster Dictionary. Colonialism [Internet]. Springfield (MA): Merriam-Webster Dictionary; c2024 [cited 2024 May 24]. Available from: <https://www.merriam-webster.com/dictionary/colonialism>
11. The Editors of Encyclopaedia Britannica. What is capitalism? [Internet]. Chicago: Encyclopaedia Britannica; 2023 [cited 2024 May 24]. Available from: What is capitalism? <https://www.britannica.com/question/What-is-capitalism>
12. Li T, Fafard St-Germain A-A, Tarasuk V. Household Food Insecurity in Canada, 2022 [Internet]. Toronto: Research to identify policy options to reduce food insecurity (PROOF); 2023 Nov 19 [cited 2024 May 24]. Available from: <https://proof.utoronto.ca/resource/household-food-insecurity-in-canada-2022/>
13. Rabbitt MP, Hales LJ, Burke MP, Coleman-Jensen A. Household Food Security in the United States in 2022 [Internet]. Washington (DC): United States Department of Agriculture Economic Research Service; 2023 Oct [cited 2024 May 24]. Available from: <https://www.ers.usda.gov/publications/pub-details/?pubid=107702>
14. Kirkpatrick SI, Tarasuk V. Food insecurity is associated with nutrient inadequacies among Canadian adults and adolescents. *J Nutr*. 2008 Mar 1;138(3):604–12.

15. Jessiman-Perreault G, McIntyre L. The household food insecurity gradient and potential reductions in adverse population mental health outcomes in Canadian adults. *SSM - Popul Heal.* 2017 Dec 1;3:464–72.
16. Gregory CA, Coleman-Jensen A. Food Insecurity, Chronic Disease, and Health Among Working-Age Adults [Internet]. Washington (DC): United States Department of Agriculture Economic Research Service; 2017 Jul [cited 2024 May 24]. Available from: <https://www.ers.usda.gov/publications/pub-details/?pubid=84466>
17. Frongillo EA, Adebisi VO, Boncyk M. Meta-review of child and adolescent experiences and consequences of food insecurity. *Glob Food Sec.* 2024 Jun;41:100767.
18. Loopstra R. Interventions to address household food insecurity in high-income countries. *Proc Nutr Soc.* 2018 Mar 27;77(3):270–81.
19. Tarasuk V, Fafard St-Germain A-A, Loopstra R. The Relationship Between Food Banks and Food Insecurity: Insights from Canada. *Volunt Int J Volunt Nonprofit Organ.* 2020 Oct;31(5):841–52.
20. Booth S, Whelan J. Hungry for change: the food banking industry in Australia. *Br Food J.* 2014 Aug 26;116(9):1392–404.
21. Loopstra R, Reeves A, Taylor-Robinson D, Barr B, McKee M, Stuckler D. Austerity, sanctions, and the rise of food banks in the UK. *BMJ.* 2015 Apr 8;350:h1775.
22. Tarasuk V. Implications of a basic income guarantee for household food insecurity [Internet]. Thunder Bay: Northern Policy Institute; 2017 [cited 2024 May 24]. Available from: <https://proof.utoronto.ca/resources/proof-annual-reports/implications-of-a-basic-income-guarantee-for-household-food-insecurity/>
23. Ionescu-Ittu R, Glymour MM, Kaufman JS. A difference-in-differences approach to estimate the effect of income-supplementation on food insecurity. *Prev Med (Baltim).* 2015 Jan 1;70:108–16.
24. Brown EM, Tarasuk V. Money speaks: Reductions in severe food insecurity follow the Canada Child Benefit. *Prev Med (Baltim).* 2019 Dec 1;129:105876.
25. Loopstra R, Dachner N, Tarasuk V. An Exploration of the Unprecedented Decline in the Prevalence of Household Food Insecurity in Newfoundland and Labrador, 2007–2012. *Can Public Policy.* 2015 Sep;41(3):191–206.
26. Li N, Dachner N, Tarasuk V. The impact of changes in social policies on household food insecurity in British Columbia, 2005-2012. *Prev Med (Baltim).* 2016 Dec 1;93:151–8.
27. Saldivar-Frausto M, Unar-Munguía M, Méndez-Gómez-Humarán I, Rodríguez-Ramírez S, Shamah-Levy T. Effect of a conditional cash transference program on food insecurity in Mexican households: 2012–2016. *Public Health Nutr.* 2022 Apr;25(4):1084–93.
28. Pollard CM, Booth S. Food insecurity and hunger in rich countries—it is time for action against inequality. *Int J Environ Res Public Health.* 2019 May 21;16(10):1804–17.

29. United Nations. Transforming our world: the 2030 Agenda for Sustainable Development [Internet]. New York: United Nations; 2016 [cited 2024 May 24]. Available from: <https://sdgs.un.org/2030agenda>
30. FAO, IFAD, UNICEF, WFP, WHO. The State of Food Security and Nutrition in the World 2021. Transforming food systems for food security, improved nutrition and affordable healthy diets for all [Internet]. Rome: FAO, IFAD, UNICEF, WFP and WHO; 2021 [cited 2024 May 24]. Available from: <https://www.fao.org/documents/card/en/c/cb4474en/>
31. FAO, IFAD, UNICEF, WFP, WHO. The State of Food Security and Nutrition in the World 2022. Repurposing food and agricultural policies to make healthy diets more affordable [Internet]. Rome: FAO, IFAD, UNICEF, WFP, WHO; 2022 [cited 2024 May 24]. Available from: <https://www.fao.org/documents/card/en/c/cc0639en>
32. Lekagul A, Chattong A, Rueangsom P, Waleewong O, Tangcharoensathien V. Multi-dimensional impacts of Coronavirus disease 2019 pandemic on Sustainable Development Goal achievement. *Global Health*. 2022 Jun 27;18(1):65.
33. Kleve S, Bennett CJ, Davidson ZE, Kellow NJ, McCaffrey TA, O'Reilly S, et al. Food insecurity prevalence, severity and determinants in Australian households during the covid-19 pandemic from the perspective of women. *Nutrients*. 2021 Dec 1;13(12):4262.
34. Goudie S, McIntyre Z. A Crisis within a Crisis: The Impact of Covid-19 on Household Food Security [Internet]. London, England: The Food Foundation; 2021 Jan 3 [cited 2024 May 24]. Available from: <https://foodfoundation.org.uk/publication/crisis-within-crisis-impact-covid-19-household-food-security>
35. Wolfson JA, Leung CW. Food insecurity and COVID-19: Disparities in early effects for US adults. *Nutrients*. 2020 Jun 2;12(6):1648.
36. Statistics Canada. Food insecurity during the COVID-19 pandemic, May 2020 [Internet]. Ottawa: Statistics Canada; 2020 Jun 24 [cited 2024 May 24]. Available from: <https://www150.statcan.gc.ca/n1/pub/45-28-0001/2020001/article/00039-eng.htm>
37. Hammond D, Vanderlee L, White CM, Acton RB, White M, Roberto CA, et al. The conceptual framework for the international food policy study: evaluating the population-level impact of food policy. *J Nutr*. 2022 Jun 1;152(Supplement_1):1S-12S.
38. Hofstede G. Dimensionalizing Cultures: The Hofstede Model in Context. *Online Readings Psychol Cult*. 2011 Dec 1;2(1).
39. The Culture Factor Group. Country Comparison Tool [Internet]. Helsinki, Finland: The Culture Factor Group; c2024 [cited 2024 May 24]. Available from: <https://www.hofstede-insights.com/country-comparison-tool>
40. The Culture Factor Group. Frequently Asked Questions [Internet]. Helsinki, Finland: The Culture Factor Group; c2024 [cited 2024 May 24]. Available from: <https://www.hofstede-insights.com/frequently-asked-questions#whydidyouchangethenameofthemasdimensionfrommasculinitytomotivationtowardsachievementandsuccess>

41. World Bank. World Bank Country and Lending Groups [Internet]. Washington (DC): World Bank Group; [cited 2024 May 24]. Available from: <https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups>
42. Bognetti, G, Fellman D. Unitary and federal systems [Internet]. Chicago: Encyclopaedia Britannica; 2024 [cited 2024 May 24]. Available from: <https://www.britannica.com/topic/constitutional-law/Unitary-and-federal-systems>
43. Gender Equality Observatory for Latin America and the Caribbean. Chile - Political and electoral system [Internet]. Gender Equality Observatory for Latin America and the Caribbean; c2016 [cited 2024 May 24]. Available from: <https://oig.cepal.org/en/countries/8/system>
44. Herre B, Rodés-Guirao L, Ortiz-Ospina E, Roser M. Political Regime [Internet]. Our World in Data. Oxford, England: Our World in Data; 2013 [cited 2024 May 24]. Available from: <https://ourworldindata.org/grapher/political-regime>
45. FAO. Rome Declaration on World Food Security and World Food Summit Plan of Action [Internet]. Rome: FAO 1996 [cited 2024 May 24]. Available from: <http://www.fao.org/3/w3613e/w3613e00.htm>
46. FAO. Food Security [Internet]. Rome: FAO; 2006 Jun [cited 2024 May 24]. Available from: https://www.fao.org/fileadmin/templates/faoitally/documents/pdf/pdf_Food_Security_Concept_Note.pdf
47. High Level Panel of Experts on Food Security and Nutrition (HLPE). Food Security and Nutrition: Building a Global Narrative Towards 2030. 15th ed. [Internet]. Rome: High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security; 2020. Available from: <https://www.fao.org/cfs/cfs-hlpe/publications/hlpe-15/en>
48. Ballard TJ, Kepple AW, Cafiero C. The Food Insecurity Experience Scale Development of a Global Standard for Monitoring Hunger Worldwide [Internet]. Rome: FAO; 2013 Oct [cited 2024 May 24]. Available from: https://www.fao.org/fileadmin/templates/ess/voh/FIES_Technical_Paper_v1.1.pdf
49. Frongillo EA. Validity and cross-context equivalence of experience-based measures of food insecurity. *Glob Food Sec.* 2022 Mar 1;32:100599.
50. Radimer KL, Olson CM, Greene JC, Campbell CC, Habicht J-P. Understanding hunger and developing indicators to assess it in women and children. *J Nutr Educ Behav.* 1992 Jan 1;24(1):36S-44S.
51. Hamelin A, Beaudry M, Habicht J. Characterization of household food insecurity in Quebec: food and feelings. *Soc Sci Med.* 2002 Jan 1;54(1):119–32.
52. Radimer KL, Olson CM, Campbell CC. Development of indicators to assess hunger. *J Nutr.* 1990 Nov 1;120(suppl_11):1544–8.
53. Government of Canada. Household food insecurity in Canada: Overview [Internet]. Ottawa: Government of Canada; 2020 Feb 18 [cited 2024 May 24]. Available from:

- <https://www.canada.ca/en/health-canada/services/food-nutrition/food-nutrition-surveillance/health-nutrition-surveys/canadian-community-health-survey-cchs/household-food-insecurity-canada-overview.html>
54. United States Department of Agriculture Economic Research Service. Food Security in the U.S. Measurement [Internet]. Washington (DC): United States Department of Agriculture Economic Research Service; 2022 [cited 2024 May 24]. Available from: <https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-u-s/measurement/>
 55. Beacom E, Furey S, Hollywood L, Humphreys P. Investigating food insecurity measurement globally to inform practice locally: a rapid evidence review. *Crit Rev Food Sci Nutr*. 2021 Nov 13;61(20):3319–39.
 56. Carrillo-Álvarez E, Salinas-Roca B, Costa-Tutusaus L, Milà-Villaruel R, Shankar Krishnan N. The Measurement of Food Insecurity in High-Income Countries: A Scoping Review. *Int J Environ Res Public Health*. 2021 Sep 17;18(18):9829.
 57. Hamilton WL, Cook JT, Thompson WW, Frongillo EA, Olson CM, Wehler CA. Household Food Security in the United States in 1995: Summary Report of the Food Security Measurement Project [Internet]. Washington (DC): United States Department of Agriculture Economic Research Service; 1997 Sep [cited 2024 May 24]. Available from: <https://www.fns.usda.gov/household-food-security-united-states-1995-summary-report-food-security-measurement-project>
 58. Hamilton WL, Cook JT, Thompson WW, Buron LF, Frongillo EA, Olson CM, et al. Household Food Security in the United States in 1995: Technical Report of the Food Security Measurement Project [Internet]. Washington (DC): United States Department of Agriculture Economic Research Service; 1997 Sep [cited 2024 May 24]. Available from: <https://www.fns.usda.gov/household-food-security-united-states-1995-summary-report-food-security-measurement-project>
 59. Government of Canada. The Household Food Security Survey Module (HFSSM) [Internet]. Ottawa: Government of Canada; 2012 Jul 25 [cited 2024 May 24]. Available from: <https://www.canada.ca/en/health-canada/services/food-nutrition/food-nutrition-surveillance/health-nutrition-surveys/canadian-community-health-survey-cchs/household-food-insecurity-canada-overview/household-food-security-survey-module-hfssm-health-nutrition-surveys-health-canada.html>
 60. United States Department of Agriculture Economic Research Service. Survey Tools [Internet]. Washington (DC): United States Department of Agriculture Economic Research Service; 2023 Oct 25 [cited 2024 May 24]. Available from: <https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-u-s/survey-tools/#household>
 61. Government of Canada. Determining food security status [Internet]. Ottawa: Government of Canada; 2020 Feb 18 [cited 2024 May 24]. Available from: <https://www.canada.ca/en/health-canada/services/food-nutrition/food-nutrition-surveillance/health-nutrition-surveys/canadian-community-health-survey-cchs/household-food-insecurity-canada-overview/determining-food-security-status-food-nutrition->

surveillance-health-canada.html

62. Men F, Tarasuk V. Classification Differences in Food Insecurity Measures between the United States and Canada: Practical Implications for Trend Monitoring and Health Research. *J Nutr.* 2022 Apr 1;152(4):1082–90.
63. Department for Environment, Food and Rural Affairs. United Kingdom Food Security Report 2021: Theme 4: Food Security at Household Level [Internet]. London: Department for Environment, Food and Rural Affairs; 2021 [cited 2024 May 24]. Available from: <https://www.gov.uk/government/statistics/united-kingdom-food-security-report-2021/united-kingdom-food-security-report-2021-theme-4-food-security-at-household-level#united-kingdom-food-security-report-2021-theme4>
64. Bowden M. Understanding food insecurity in Australia [Internet]. Southbank, Australia: Australian Institute of Family Studies; 2020 Sep [cited 2024 May 24]. Available from: <https://aifs.gov.au/cfca/publications/understanding-food-insecurity-australia>
65. Australian Bureau of Statistics. Australian Health Survey: Nutrition - State and Territory results [Internet]. Canberra, Australia: Australian Bureau of Statistics; 2015 Oct 6 [cited 2024 May 24]. Available from: <https://www.abs.gov.au/statistics/health/health-conditions-and-risks/australian-health-survey-nutrition-state-and-territory-results/latest-release>
66. Butcher LM, O’Sullivan TA, Ryan MM, Lo J, Devine A. Utilising a multi-item questionnaire to assess household food security in Australia. *Heal Promot J Aust.* 2019 Jan;30(1):9–17.
67. FAO, IFAD, PAHO, UNICEF, WFP. Latin America and the Caribbean - Regional Overview of Food Security and Nutrition 2023: Statistics and Trends [Internet]. Santiago, Chile: Rome: FAO, IFAD, PAHO, UNICEF, WFP; 2023 [cited 2024 May 24]. Available from: <https://www.fao.org/documents/card/en?details=CC8514EN>
68. Segall Corrêa AM, Álvarez Uribe MC, Melgar Quiñonez H, Pérez Escamilla R. Escala latinoamericana y caribeña de seguridad alimentaria (ELCSA) Manual de uso y aplicación [Internet]. Rome: FAO; 2012 May [cited 2024 May 24]. Available from: https://bibliotecadigital.udea.edu.co/bitstream/10495/25324/1/SegallAna_2012_ELCSA.pdf
69. International Dietary Data Expansion Project. Latin American and Caribbean Food Security Scale (ELCSA) [Internet]. Boston: Tufts University; c2024 [cited 2024 May 24]. Available from: <https://index.nutrition.tufts.edu/data4diets/indicator/latin-american-and-caribbean-food-security-scale-elcsa>
70. Tarasuk V, Li T, Fafard St-Germain A-A. Household food insecurity in Canada, 2021 [Internet]. Toronto: Research to identify policy options to reduce food insecurity (PROOF); 2022 Aug 16 [cited 2024 May 24]. Available from: <https://proof.utoronto.ca/>
71. Armstrong B, King L, Clifford R, Jitlal M, Mears K, Parnell C, et al. Food and You 2: Wave 6 Key Findings [Internet]. London, England: Food Standards Agency; 2023 Jul 1 [cited 2024 May 24]. Available from: <https://www.food.gov.uk/research/fy2-wave-6-executive-summary>

72. Department for Work and Pensions. Family Resources Survey: background information and methodology [Internet]. London: Department for Work and Pensions; 2024 Mar 26 [cited 2024 May 24]. Available from: <https://www.gov.uk/government/statistics/family-resources-survey-financial-year-2022-to-2023/family-resources-survey-background-information-and-methodology>
73. Department for Work and Pensions. Family Resources Survey: financial year 2022 to 2023 [Internet]. London, England: Department for Work and Pensions; 2024 Mar 26 [cited 2024 May 24]. Available from: <https://www.gov.uk/government/statistics/family-resources-survey-financial-year-2022-to-2023/family-resources-survey-financial-year-2022-to-2023>
74. Armstrong B, King L, Clifford R, Jitlal M, Ibrahimi Jarchlo A, Mears K, et al. Food and You 2: Wave 5 Key Findings [Internet]. London, England: Food Standards Agency; 2023 Mar 13 [cited 2024 May 24]. Available from: <https://www.food.gov.uk/research/wave-5-key-findings-executive-summary>
75. Foodbank, Ipsos. Foodbank Hunger Report 2023: National Key Findings Report [Internet]. North Ryde, New South Wales: Foodbank; 2023 [cited 2024 May 24]. Available from: https://reports.foodbank.org.au/wp-content/uploads/2023/10/2023_Foodbank_Hunger_Report_IPSOS-Report.pdf
76. Foodbank. Foodbank Hunger Report 2023 [Internet]. North Ryde, New South Wales: Foodbank; 2023 [cited 2024 May 24]. Available from: <https://reports.foodbank.org.au/foodbank-hunger-report-2023/>
77. Tarasuk V, Fafard St-Germain A-A, Mitchell A. Geographic and socio-demographic predictors of household food insecurity in Canada, 2011-12. *BMC Public Health*. 2019 Jan 3;19(1):12.
78. Coleman-Jensen AJ. Working for peanuts: nonstandard work and food insecurity across household structure. *J Fam Econ Issues*. 2011 Mar 16;32(1):84–97.
79. Gundersen C, Kreider B, Pepper J. The economics of food insecurity in the United States. *Appl Econ Perspect Policy*. 2011 Aug 11;33(3):281–303.
80. Che J, Chen J. Food insecurity in Canadian households. *Heal Reports*. 2001 Aug 1;12(4):11–22.
81. McIntyre L, Glanville NT, Raine KD, Dayle JB, Anderson B, Battaglia N. Do low-income lone mothers compromise their nutrition to feed their children? *CMAJ*. 2003 Mar 18;168(6):686–91.
82. Hadley C, Lindstrom D, Tessema F, Belachew T. Gender bias in the food insecurity experience of Ethiopian adolescents. *Soc Sci Med*. 2008 Jan 1;66(2):427–38.
83. Kuku O, Gundersen C, Garasky S. Differences in food insecurity between adults and children in Zimbabwe. *Food Policy*. 2011 Apr 1;36(2):311–7.
84. Nord M. Youth Are Less Likely to be Food Insecure than Adults in the Same Household. *J Hunger Environ Nutr*. 2013 Apr 3;8(2):146–63.

85. Frongillo EA, Fram MS, Escobar-Alegría JL, Pérez-Garay M, Macaуда MM, Billings DL. Concordance and Discordance of the Knowledge, Understanding, and Description of Children’s Experience of Food Insecurity among Hispanic Adults and Children. *Fam Community Heal*. 2019 Oct 1;42(4):237–44.
86. Fram MS, Frongillo EA, Draper CL, Fishbein EM. Development and Validation of a Child Report Assessment of Child Food Insecurity and Comparison to Parent Report Assessment. *J Hunger Environ Nutr*. 2013 Apr 3;8(2):128–45.
87. Nalty CC, Sharkey JR, Dean WR. Children’s reporting of food insecurity in predominately food insecure households in Texas border colonias. *Nutr J*. 2013 Jan 28;12(15):9.
88. Carlos Chavez FL, Hernandez DC, Harris GJ, Grzywacz JG. Household food security discordance among Latino adolescents and parents. *Am J Health Behav*. 2017 Nov 1;41(6):775–83.
89. Fram MS, Frongillo EA, Jones SJ, Williams RC, Burke MP, DeLoach KP, et al. Children are aware of food insecurity and take responsibility for managing food resources. *J Nutr*. 2011 Jun 1;141(6):1114–9.
90. Bernal J, Frongillo EA, Herrera H, Rivera J. Children live, feel, and respond to experiences of food insecurity that compromise their development and weight status in peri-urban Venezuela. *J Nutr*. 2012 Jul 1;142(7):1343–9.
91. Ghattas H, Sassine AJ, Aqeel M, Hwalla N, Obeid OA, Sahyoun NR. Children’s Experiences of Food Insecurity in Lebanon: A Qualitative Study. *J Hunger Environ Nutr*. 2018 Jan 2;13(1):28–39.
92. Frongillo EA, Fram MS, Ghattas H, Bernal J, Jamaluddine Z, Kirkpatrick SI, et al. Development, Validity, and Cross-Context Equivalence of the Child Food Insecurity Experiences Scale for Assessing Food Insecurity of School-Age Children and Adolescents. *J Nutr*. 2022 Sep 1;152(9):2135–44.
93. The Food Foundation. The Food Foundation: Who we are [Internet]. London, England; c2016-2021 [cited 2024 May 24]. Available from: <https://foodfoundation.org.uk/who-we-are>
94. The Food Foundation. Food Insecurity Tracking [Internet]. London, England: The Food Foundation; 2022 [cited 2024 May 24]. Available from: <https://foodfoundation.org.uk/initiatives/food-insecurity-tracking>
95. Huisken A, Orr SK, Tarasuk V. Adults’ food skills and use of gardens are not associated with household food insecurity in Canada. *Can J Public Heal*. 2016 Nov;107(6):e526–32.
96. Peppetone A, Vanderlee L, White CM, Hammond D, Kirkpatrick SI. Food insecurity, food skills, health literacy and food preparation activities among young Canadian adults: a cross-sectional analysis. *Public Health Nutr*. 2021 Jun 2;24(9):2377–87.
97. Laidley J, Tabbara M. Welfare in Canada, 2022 [Internet]. Toronto: Maytree; 2023 Jul [cited 2024 May 24]. Available from: <https://maytree.com/changing-systems/data-measuring/welfare-in-canada/>

98. Emery JCH, Fleisch VC, McIntyre L. How a guaranteed annual income could put food banks out of business. *SPP Res Pap.* 2013 Dec 20;6–37:1–20.
99. McIntyre L, Dutton DJ, Kwok C, Emery JCH. Reduction of Food Insecurity among Low-Income Canadian Seniors as a Likely Impact of a Guaranteed Annual Income. *Can Public Policy.* 2016 Sep;42(3):274–86.
100. Government of Canada. Indexing rate – Retired members – Pension [Internet]. Ottawa: Government of Canada; 2023 Nov 11[cited 2024 May 24]. Available from: <https://www.canada.ca/en/treasury-board-secretariat/services/pension-plan/retired-members/rate-pension.html>
101. Nord M, Coleman-Jensen A, Gregory C. Prevalence of US food insecurity is related to changes in unemployment, inflation, and the price of food, ERR-167 [Internet]. Washington (DC): United States Department of Agriculture Economic Research Service; 2014 Jun [cited 2024 May 24]. Available from: <https://www.ers.usda.gov/publications/pub-details/?pubid=45216>
102. Department for Work and Pensions. Family Resources Survey: financial year 2021 to 2022 [Internet]. London, England: Department for Work and Pensions; 2023 Mar 23 [cited 2024 May 24]. Available from: <https://www.gov.uk/government/statistics/family-resources-survey-financial-year-2021-to-2022>
103. Yau A, White M, Hammond D, White C, Adams J. Socio-demographic characteristics, diet and health among food insecure UK adults: cross-sectional analysis of the International Food Policy Study. *Public Health Nutr.* 2020 Oct;23(14):2602–14.
104. Guo B. Household Assets and Food Security: Evidence from the Survey of Program Dynamics. *J Fam Econ Issues.* 2011 Mar 1;32(1):98–110.
105. Chang Y, Chatterjee S, Kim J. Household finance and food insecurity. *J Fam Econ Issues.* 2014 Dec;35(4):499–515.
106. Leete L, Bania N. The effect of income shocks on food insufficiency. *Rev Econ Househ.* 2010 Dec;8(4):505–26.
107. Brewer M. Household debt and children’s risk of food insecurity. *Soc Probl.* 2020 Aug 1;67(3):565–84.
108. McIntyre L, Wu X, Fleisch VC, Emery JH. Homeowner versus non-homeowner differences in household food insecurity in Canada. *J Hous Built Environ.* 2016;31(2):349–66.
109. Fafard St-Germain A-A, Tarasuk V. Homeownership status and risk of food insecurity: examining the role of housing debt, housing expenditure and housing asset using a cross-sectional population-based survey of Canadian households. *Int J Equity Health.* 2020 Jan 6;19(1):1–12.
110. Broussard NH. What explains gender differences in food insecurity? *Food Policy.* 2019 Feb 1;83:180–94.
111. Jung NM, de Bairros FS, Pattussi MP, Pauli S, Neutzling MB. Gender differences in the

- prevalence of household food insecurity: a systematic review and meta-analysis. *Public Health Nutr.* 2017 Apr;20(5):902–16.
112. Grimaccia E, Naccarato A. Food Insecurity in Europe: A Gender Perspective. *Soc Indic Res.* 2020 May 21;161(2–3):649–67.
 113. United Nations Women. Progress on the Sustainable Development Goals: The gender snapshot 2022 [Internet]. New York: United Nations Women; 2022 [cited 2024 May 24]. Available from: <https://www.unwomen.org/en/digital-library/publications/2022/09/progress-on-the-sustainable-development-goals-the-gender-snapshot-2022>
 114. United Nations Women. Progress on the Sustainable Development Goals: The gender snapshot 2023 [Internet]. New York: United Nations Women; 2023 [cited 2024 May 24]. Available from: <https://www.unwomen.org/en/digital-library/publications/2023/09/progress-on-the-sustainable-development-goals-the-gender-snapshot-2023>
 115. Myers AMC, Painter MA. Food insecurity in the United States of America: An examination of race/ethnicity and nativity. *Food Secur.* 2017 Nov 22;9(6):1419–32.
 116. De Araujo ML, de Deus Mendonça R, Lopes Filho JD, Lopes ACS. Association between food insecurity and food intake. *Nutrition.* 2018 Oct;54:54–9.
 117. Hanson KL, Connor LM. Food insecurity and dietary quality in US adults and children: a systematic review. *Am J Clin Nutr.* 2014 Aug 1;100(2):684–92.
 118. Turnbull O, Homer M, Ensaff H. Food insecurity: Its prevalence and relationship to fruit and vegetable consumption. *J Hum Nutr Diet.* 2021 Oct 1;34(5):849–57.
 119. Leung CW, Epel ES, Ritchie LD, Crawford PB, Laraia BA. Food insecurity is inversely associated with diet quality of lower-income adults. *J Acad Nutr Diet.* 2014 Dec 1;114(12):1943–53.
 120. Leung CW, Tester JM. The association between food insecurity and diet quality varies by race/ethnicity: an analysis of national health and nutrition examination survey 2011–2014 results. *J Acad Nutr Diet.* 2019 Oct 1;119(10):1676–86.
 121. Hutchinson J, Tarasuk V. The relationship between diet quality and the severity of household food insecurity in Canada. *Public Health Nutr.* 2022 Apr;25(4):1013–26.
 122. Tait CA, L'Abbé MR, Smith PM, Rosella LC. The association between food insecurity and incident type 2 diabetes in Canada: A population-based cohort study. *PLoS One.* 2018 May 23;13(5):e0195962.
 123. Seligman HK, Laraia BA, Kushel MB. Food Insecurity Is Associated with Chronic Disease among Low-Income NHANES Participants. *J Nutr* [Internet]. 2010 Feb 1;140(2):304–10. Available from: <https://doi.org/10.3945/jn.109.112573>
 124. Men F, Elgar FJ, Tarasuk V. Food insecurity is associated with mental health problems among Canadian youth. *J Epidemiol Community Health.* 2021 Feb 1;75(8):741–8.

125. Martin MS, Maddocks E, Chen Y, Gilman SE, Colman I. Food insecurity and mental illness: disproportionate impacts in the context of perceived stress and social isolation. *Public Health*. 2016 Mar 1;132:86–91.
126. Tarasuk V, Mitchell A, McLaren L, McIntyre L. Chronic physical and mental health conditions among adults may increase vulnerability to household food insecurity. *J Nutr*. 2013 Nov 1;143(11):1785–93.
127. Chan J, DeMelo M, Gingras J, Gucciardi E. Challenges of diabetes self-management in adults affected by food insecurity in a large urban centre of Ontario, Canada. *Int J Endocrinol*. 2015 Oct 20;2015:9.
128. Ippolito MM, Lyles CR, Prendergast K, Marshall MB, Waxman E, Seligman HK. Food insecurity and diabetes self-management among food pantry clients. *Public Health Nutr*. 2017 Jan;20(1):183–9.
129. Ma C, Singh S, Jairath V, Radulescu G, Ho SKM, Choi MY. Food Insecurity Negatively Impacts Gluten Avoidance and Nutritional Intake in Patients With Celiac Disease. *J Clin Gastroenterol*. 2022 Nov-Dec;56(10):863–8.
130. Anema A, Vogenthaler N, Frongillo EA, Kadiyala S, Weiser SD. Food insecurity and HIV/AIDS: current knowledge, gaps, and research priorities. *Curr HIV/AIDS Rep*. 2009 Nov;6(4):224–31.
131. Singer AW, Weiser SD, McCoy SI. Does Food Insecurity Undermine Adherence to Antiretroviral Therapy? A Systematic Review. *AIDS Behav*. 2015 Aug;19(8):1510–26.
132. Wilder ME, Kulie P, Jensen C, Levett P, Blanchard J, Dominguez LW, et al. The Impact of Social Determinants of Health on Medication Adherence: a Systematic Review and Meta-analysis. *J Gen Intern Med*. 2021 May;36(5):1359–70.
133. Men F, Gundersen C, Urquia ML, Tarasuk V. Food Insecurity Is Associated With Higher Health Care Use And Costs Among Canadian Adults. *Health Aff*. 2020 Aug 1;39(8):1377–85.
134. Berkowitz SA, Basu S, Gundersen C, Seligman HK. State-Level and County-Level Estimates of Health Care Costs Associated with Food Insecurity. *Prev Chronic Dis*. 2019 Jul;16:E90.
135. Tarasuk V, Cheng J, Gundersen C, de Oliveira C, Kurdyak P. The Relation between Food Insecurity and Mental Health Care Service Utilization in Ontario. *Can J Psychiatry*. 2018 Aug;63(8):557–69.
136. Tarasuk V, Cheng J, de Oliveira C, Dachner N, Gundersen C, Kurdyak P. Association between household food insecurity and annual health care costs. *CMAJ*. 2015 Oct;187(14):E429–36.
137. Berkowitz SA, Basu S, Meigs JB, Seligman HK. Food Insecurity and Health Care Expenditures in the United States, 2011-2013. *Health Serv Res*. 2018 Jun;53(3):1600–20.
138. Berkowitz SA, Seligman HK, Meigs JB, Basu S. Food insecurity, healthcare utilization, and high cost: a longitudinal cohort study. *Am J Manag Care*. 2018 Sep;24(9):399–404.

139. Johnson KT, Palakshappa D, Basu S, Seligman H, Berkowitz SA. Examining the bidirectional relationship between food insecurity and healthcare spending. *Health Serv Res.* 2021 Oct 17;56(5):864–73.
140. Gundersen C, Tarasuk V, Cheng J, De Oliveira C, Kurdyak P. Food insecurity status and mortality among adults in Ontario, Canada. *PLoS One.* 2018 Aug 23;13(8):1–10.
141. Men F, Gundersen C, Urquia ML, Tarasuk V. Association between household food insecurity and mortality in Canada: a population-based retrospective cohort study. *CMAJ.* 2020 Jan 20;192(3):E53–60.
142. Jun S, Cowan AE, Dodd KW, Tooze JA, Gahche JJ, Eicher-Miller HA, et al. Association of food insecurity with dietary intakes and nutritional biomarkers among US children, National Health and Nutrition Examination Survey (NHANES) 2011–2016. *Am J Clin Nutr.* 2021 Sep 1;114(3):1059–69.
143. Fram MS, Ritchie LD, Rosen N, Frongillo EA. Child experience of food insecurity is associated with child diet and physical activity. *J Nutr.* 2015 Mar 1;145(3):499–504.
144. Men F, Urquia ML, Tarasuk V. Examining the relationship between food insecurity and causes of injury in Canadian adults and adolescents. *BMC Public Health.* 2021 Dec;21(1):1557.
145. Ryu J-H, Bartfeld JS. Household food insecurity during childhood and subsequent health status: the early childhood longitudinal study—kindergarten cohort. *Am J Public Health.* 2012 Nov;102(11):e50–55.
146. Gundersen C, Kreider B. Bounding the effects of food insecurity on children’s health outcomes. *J Health Econ.* 2009 Sep 1;28(5):971–83.
147. Thomas MM, Miller DP, Morrissey TW. Food insecurity and child health. *Pediatrics.* 2019 Oct 1;144(4):e20190397.
148. Cook JT, Frank DA, Berkowitz C, Black MM, Casey PH, Cutts DB, et al. Food Insecurity Is Associated with Adverse Health Outcomes among Human Infants and Toddlers. *J Nutr.* 2004 Jun 1;134(6):1432–8.
149. Park K, Kersey M, Geppert J, Story M, Cutts D, Himes JH. Household food insecurity is a risk factor for iron-deficiency anaemia in a multi-ethnic, low-income sample of infants and toddlers. *Public Health Nutr.* 2009 Nov;12(11):2120–8.
150. Skalicky A, Meyers AF, Adams WG, Yang Z, Cook JT, Frank DA. Child Food Insecurity and Iron Deficiency Anemia in Low-Income Infants and Toddlers in the United States. *Matern Child Health J.* 2006 Mar;10(2):177–85.
151. Mangini LD, Hayward MD, Dong YQ, Forman MR. Household Food Insecurity Is Associated with Childhood Asthma. *J Nutr.* 2015 Dec 1;145(12):2756–64.
152. Mangini LD, Hayward MD, Zhu Y, Dong Y, Forman MR. Timing of household food insecurity exposures and asthma in a cohort of US school-aged children. *BMJ Open.* 2018 Nov 1;8(11):e021683.

153. Anderson KK, Clemens KK, Le B, Zhang L, Comeau J, Tarasuk V, et al. Household food insecurity and health service use for mental and substance use disorders among children and adolescents in Ontario, Canada. *Can Med Assoc J*. 2023 Jul 24;195(28):E948–55.
154. Clemens KK, Le B, Anderson KK, Comeau J, Tarasuk V, Shariff SZ. The association between household food insecurity and healthcare costs among Canadian children. *Can J Public Heal*. 2024 Feb;115(1):89-98.
155. Alaimo K, Olson CM, Frongillo EA. Family Food Insufficiency, but Not Low Family Income, Is Positively Associated with Dysthymia and Suicide Symptoms in Adolescents. *J Nutr*. 2002 Apr 1;132(4):719–25.
156. Weinreb L, Wehler C, Perloff J, Scott R, Hosmer D, Sagor L, et al. Hunger: Its Impact on Children’s Health and Mental Health. *Pediatrics*. 2002 Oct 1;110(4):e41.
157. Brown AD, Seligman H, Sliwa S, Barnidge E, Krupsky KL, Demissie Z, et al. Food Insecurity and Suicidal Behaviors Among US High School Students. *J Sch Health*. 2022 Sep;92:898–906.
158. Maynard MS, Perlman CM, Kirkpatrick SI. Food insecurity and perceived anxiety among adolescents: an analysis of data from the 2009–2010 National Health and Nutrition Examination Survey (NHANES). *J Hunger Environ Nutr*. 2019 May;14(3):339–51.
159. Ovenell M, Azevedo Da Silva M, Elgar FJ. Shielding children from food insecurity and its association with mental health and well-being in Canadian households. *Can J Public Heal*. 2022 Apr;113(2):250–9.
160. McIntyre L, Wu X, Kwok C, Patten SB. The pervasive effect of youth self-report of hunger on depression over 6 years of follow up. *Soc Psychiatry Psychiatr Epidemiol*. 2017 May;52(5):537–47.
161. McIntyre L, Williams JVA, Lavorato DH, Patten S. Depression and suicide ideation in late adolescence and early adulthood are an outcome of child hunger. *J Affect Disord*. 2013 Aug;150(1):123–9.
162. Melchior M, Chastang JF, Falissard B, Galéra C, Tremblay RE, Côté SM, et al. Food Insecurity and Children’s Mental Health: A Prospective Birth Cohort Study. *PLoS One*. 2012 Dec 26;7(12):e52615.
163. Gallegos D, Eivers A, Sondergeld P, Pattinson C. Food insecurity and child development: A state-of-the-art review. *Int J Environ Res Public Health*. 2021 Aug 21;18(17):8990.
164. Alaimo K, Olson CM, Frongillo EA. Food Insufficiency and American School-Aged Children’s Cognitive, Academic, and Psychosocial Development. *Pediatrics*. 2001 Jul 1;108(1):44–53.
165. Jyoti DF, Frongillo EA, Jones SJ. Food insecurity affects school children’s academic performance, weight gain, and social skills. *J Nutr*. 2005 Dec 1;135(12):2831–9.
166. Grineski SE, Morales DX, Collins TW, Rubio R. Transitional dynamics of household food insecurity impact children’s developmental outcomes. *J Dev Behav Pediatr*. 2018 Dec 1;39(9):715–25.

167. Howard LL. Does food insecurity at home affect non-cognitive performance at school? A longitudinal analysis of elementary student classroom behavior. *Econ Educ Rev.* 2011 Feb 1;30(1):157–76.
168. Lindberg R, Wingrove K, Bastian A, West R, Caraher M, Mchiza ZJ, et al. Social and economic policy interventions to address household food insecurity in high-income countries (HIC) and the developing nations of Brazil, Russia, India, China and South Africa (BRICS). *Cochrane Database Syst Rev.* 2023 Jun 27;2023(6):CD015419.
169. Loopstra R, Tarasuk V. The relationship between food banks and household food insecurity among low-income Toronto Families. *Can Public Policy.* 2012 Dec;38(4):497–514.
170. Holmes E, Fowokan A, Seto D, Lear SA, Black JL. Examining food insecurity among food bank members in Greater Vancouver. *J Hunger Environ Nutr.* 2019 Mar;14(1–2):141–54.
171. Tarasuk VS, Beaton GH. Household Food Insecurity and Hunger Among Families Using Food Banks. *Can J Public Heal.* 1999 Mar;90(2):109–13.
172. Simmet A, Depa J, Tinnemann P, Stroebele-Benschop N. The Nutritional Quality of Food Provided from Food Pantries: A Systematic Review of Existing Literature. *J Acad Nutr Diet.* 2017 Apr 1;117(4):577–88.
173. PROOF Food Insecurity Policy Research. Food Insecurity: A problem of inadequate income, not solved by food [Internet]. Toronto: Research to identify policy options to reduce food insecurity (PROOF); 2022 [cited 2024 May 24]. Available from: <https://proof.utoronto.ca/resource/food-insecurity-a-problem-of-inadequate-income-not-solved-by-food/>
174. Garthwaite K. Stigma, shame and 'people like us': an ethnographic study of foodbank use in the UK. *J poverty Soc justice.* 2016 Oct;24(3):277–89.
175. Purdam K, Garratt EA, Esmail A. Hungry? Food Insecurity, Social Stigma and Embarrassment in the UK. *Sociology.* 2016 Dec;50(6):1072–88.
176. Tarasuk V. A critical examination of community-based responses to household food insecurity in Canada. *Heal Educ Behav.* 2001 Aug;28(4):487–99.
177. Loopstra R, Tarasuk V. Perspectives on Community Gardens, Community Kitchens and the Good Food Box Program. *Can J Public Heal.* 2013 Jan;104(1):e55–9.
178. Engler-Stringer R, Berenbaum S. Exploring Food Security With Collective Kitchens Participants in Three Canadian Cities. *Qual Health Res.* 2007 Jan;17(1):75–84.
179. United States Department of Agriculture. A Short History of SNAP [Internet]. Alexandria (VA): United States Department of Agriculture Food and Nutrition Service; 2023 Dec 28 [cited 2024 May 24]. Available from: <https://www.fns.usda.gov/snap/short-history-snap>
180. Caswell JA, Yaktine AL, National Research Council. Supplemental Nutrition Assistance Program: Examining the Evidence to Define Benefit Adequacy. Washington (DC): The National Academies Press; 2013.

181. Bartfeld J, Dunifon R. State-level predictors of food insecurity among households with children. *J policy Anal Manag.* 2006 Sep;25(4):921–42.
182. Mabli J, Ohls J. Supplemental Nutrition Assistance Program participation is associated with an increase in household food security in a national evaluation. *J Nutr.* 2015 Feb 1;145(2):344–51.
183. Edin K, Boyd M, Mabli J, Ohls J, Worthington J, Greene S, et al. SNAP Food Security In-Depth Interview Study [Internet]. Alexandria (VA): United States Department of Agriculture Food and Nutrition Service; 2013 Mar [cited 2024 May 24]. Available from: <https://www.fns.usda.gov/snap/food-security-depth-interview-study>
184. Miller DP, Thomas MMC. Policies to reduce food insecurity: An ethical imperative. *Physiol Behav.* 2020 Aug 1;222:112943.
185. Schmidt L, Shore-Sheppard LD, Watson T. The Effect of Safety Net Programs on Food Insecurity. *J Hum Resour.* 2016 Aug 1;51(3):589-614
186. Lambie-Mumford H, Sims L. ‘Feeding Hungry Children’: The Growth of Charitable Breakfast Clubs and Holiday Hunger Projects in the UK. *Child Soc.* 2018 May;32(3):244–54.
187. Ralston K, Treen K, Coleman-Jensen A, Guthrie J. Children’s Food Security and USDA Child Nutrition Programs [Internet]. Washington (DC): United States Department of Agriculture Economic Research Service; 2017 Jun [cited 2024 May 24]. Available from: <https://www.ers.usda.gov/webdocs/publications/84003/eib-174.pdf?v=0>
188. Hock K, Barquera S, Corvalán C, Goodman S, Sacks G, Vanderlee L, et al. Awareness of and Participation in School Food Programs in Youth from Six Countries. *J Nutr.* 2022 Jun 1;152(Supplement_1):85S-97S.
189. Loopstra R, Reeves A, McKee M, Stuckler D. Food insecurity and social protection in Europe: Quasi-natural experiment of Europe’s great recessions 2004–2012. *Prev Med (Baltim).* 2016 Aug 1;89:44–50.
190. Reeves A, Loopstra R. The Continuing Effects of Welfare Reform on Food Bank use in the UK: The Roll-out of Universal Credit. *J Soc Policy.* 2021 Oct;50(4):788–808.
191. Oliveira MC, Osorio Gonnet C. Change and continuity between Chile Solidario and Ingreso Ético Familiar. *Rev Adm Pública.* 2022 Mar 21;56(1):80-99.
192. International Social Security Association. Social Security Around the World [Internet]. Geneva: International Social Security Association; [cited 2024 May 24]. Available from: <https://www.issa.int/databases/country-profiles>
193. Government of Canada. Canada child benefit [Internet]. Ottawa: Government of Canada; 2023 Nov 11 [cited 2024 May 24]. Available from: <https://www.canada.ca/en/revenue-agency/services/child-family-benefits/canada-child-benefit-overview.html>
194. Shelley P. Reducing Poverty: An Action Plan for Newfoundland and Labrador [Internet]. St. John’s (NL): Department of Human Resources, Labour and Employment; 2006 Jun [cited 2024 May 24]. Available from: <https://www.gov.nl.ca/cssd/files/publications-pdf->

prs-poverty-reduction-strategy.pdf

195. Laidley J, Tabbara M. Welfare in Canada, 2020 [Internet]. Toronto: Maytree; 2021 Dec [cited 2024 May 24]. Available from: https://maytree.com/wp-content/uploads/Welfare_in_Canada_2020.pdf
196. Dávila Lárraga LG. How does Prospera work?: Best practices in the implementation of conditional cash transfer programs in Latin America and the Caribbean [Internet]. Washington (DC): Inter-American Development Bank; 2016 Apr [cited 2024 May 24]. Available from: <https://publications.iadb.org/en/how-does-prospera-work-best-practices-implementation-conditional-cash-transfer-programs-latin>
197. Government of the United Kingdom. Universal Credit [Internet]. London, England: Government of the United Kingdom; [cited 2024 May 24]. Available from: <https://www.gov.uk/universal-credit>
198. Pasma C, Regehr S. Basic Income: Some Policy Options for Canada [Internet]. Toronto: Basic Income Canada Network; c2019 [cited 2024 May 24]. Available from: https://basicincomecanada.org/wp-content/uploads/2021/04/Basic_Income-_Some_Policy_Options_for_Canada.pdf
199. Regehr S. BIG or UBI for Canada? [Internet]. Toronto: Basic Income Canada Network; [cited 2024 May 24]. Available from: <https://torontoartscouncil.org/TAC/media/tac/BICN-UBI-vs-BIG-chart-2.pdf>
200. Ferdosi M, McDowell T, Lewchuk W, Ross S. Southern Ontario's basic income experience [Internet]. Hamilton: McMaster University; 2020 Mar [cited 2024 May 24]. Available from: <https://labourstudies.mcmaster.ca/documents/southern-ontarios-basic-income-experience.pdf>
201. Forget EL. The Town with No Poverty: The Health Effects of a Canadian Guaranteed Annual Income Field Experiment. *Can Public Policy / Anal Polit.* 2011 Oct 12;37(3):283–305.
202. Napolitano N. An Unexpected Outcome Of The Covid-19 Pandemic: A Slew Of Universal Income Programs. *Forbes Advisor* [Internet]. 2022 May 12 [cited 2024 May 24]; Available from: <https://www.forbes.com/advisor/personal-finance/universal-basic-income-programs/>
203. Hobson F, Kulakiewicz A. Potential merits of a universal basic income [Internet]. London, England: UK Parliament, House of Commons Library; 2022 Jun 13 [cited 2024 May 24]. Available from: <https://commonslibrary.parliament.uk/research-briefings/cdp-2022-0104/>
204. Gentilini U, Grosh M, Rigolini J, Yemtsov R. Exploring Universal Basic Income : A Guide to Navigating Concepts, Evidence, and Practices [Internet]. Washington (DC): World Bank; 2020 [cited 2024 May 24]. Available from: <https://openknowledge.worldbank.org/handle/10986/32677>
205. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet.* 2020 Feb 15;395(10223):497–506.
206. Wu Y-C, Chen C-S, Chan Y-J. The outbreak of COVID-19: An overview. *J Chinese Med*

- Assoc. 2020 Mar;83(3):217–20.
207. World Health Organization. Coronavirus disease (COVID-19) pandemic: Overview [Internet]. Geneva: World Health Organization; c2024 [cited 2024 May 24]. Available from: <https://www.who.int/europe/emergencies/situations/covid-19>
 208. Blavatnik School of Government, University of Oxford. Oxford COVID-19 Government Response Tracker [Internet]. Oxford, England: Blavatnik School of Government, University of Oxford; [cited 2024 May 24]. Available from: <https://www.bsg.ox.ac.uk/research/covid-19-government-response-tracker>
 209. Hale T, Petherick A, Phillips T, Anania J, Andretti de Mello B, Angrist N, et al. Variation in Government Responses to COVID-19 [Internet]. Oxford, England: Blavatnik School of Government, University of Oxford; 2023 Jun 29 [cited 2024 May 24]. Available from: <https://www.bsg.ox.ac.uk/research/publications/variation-government-responses-covid-19>
 210. Polisena J, Ospina M, Sanni O, Matenchuk B, Livergant R, Amjad S, et al. Public health measures to reduce the risk of SARS-CoV-2 transmission in Canada during the early days of the COVID-19 pandemic: a scoping review. *BMJ Open*. 2021 Mar 11;11(3):e046177.
 211. Ayouni I, Maatoug J, Dhouib W, Zammit N, Fredj S Ben, Ghammam R, et al. Effective public health measures to mitigate the spread of COVID-19: a systematic review. *BMC Public Health*. 2021 May 29;21(1):1–1015.
 212. International Monetary Fund. Policy Responses to COVID-19: Policy Tracker [Internet]. Washington (DC): International Monetary Fund; [cited 2024 May 24]. Available from: <https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19>
 213. Béland D, Dinan S, Rocco P, Waddan A. Social policy responses to COVID-19 in Canada and the United States: Explaining policy variations between two liberal welfare state regimes. *Soc Policy Adm*. 2021 Mar 1;55(2):280–94.
 214. Men F, Urquia ML, Tarasuk V. The role of provincial social policies and economic environments in shaping food insecurity among Canadian families with children. *Prev Med (Baltim)*. 2021 Jul 1;148:106558.
 215. Hale T, Angrist N, Goldszmidt R, Kira B, Petherick A, Phillips T, et al. A global panel database of pandemic policies (Oxford COVID-19 Government Response Tracker). *Nat Hum Behav*. 2021 Apr;5(4):529–38.
 216. Roser M. What is the COVID-19 Stringency Index? [Internet]. Oxford, England: Our World in Data; 2021 Dec 24 [cited 2024 May 24]. Available from: <https://ourworldindata.org/metrics-explained-covid19-stringency-index>
 217. Mathieu E, Ritchie H, Rodés-Guirao L, Appel C, Giattino C, Hasell J, et al. COVID-19: Income Support and Debt Relief [Internet]. Oxford, England: Our World in Data; 2020 [cited 2024 May 24]. Available from: <https://ourworldindata.org/covid-income-support-debt-relief>
 218. Phillips T. OxCGRT COVID Policy Dataset: Documentation and codebook [Internet]. Oxford, England: Blavatnik School of Government, University of Oxford; 2023 Jun 1 [cited 2024 May 24]. Available from: <https://github.com/OxCGRT/covid-policy->

dataset/blob/main/documentation_and_codebook.md

219. Ministers Department of Health and Aged Care. First confirmed case of novel coronavirus in Australia [Internet]. Canberra, Australia: Australian Government Department of Health and Aged Care; 2020 Jan 20 [cited 2024 May 24]. Available from: <https://www.health.gov.au/ministers/the-hon-greg-hunt-mp/media/first-confirmed-case-of-novel-coronavirus-in-australia>
220. International COVID-19 Policies and Epidemiology WorkingGroup. DATABASE - COVID-19 policies and epidemiology [Internet]. Hamilton: McMaster University; c2024 [cited 2024 May 24]. Available from: <https://covid19-policies.healthsci.mcmaster.ca/>
221. World Health Organization. WHO Coronavirus (COVID-19) Dashboard [Internet]. Geneva: World Health Organization; c2024 [cited 2024 May 24]. Available from: <https://covid19.who.int/>
222. Mathieu E, Ritchie H, Rodés-Guirao L, Appel C, Giattino C, Hasell J, et al. COVID-19 Stringency Index [Internet]. Oxford, England: Our World in Data. 2020 [cited 2024 May 24]. Available from: <https://ourworldindata.org/covid-stringency-index>
223. Cameron-Blake E, Annan H, Marro L, Michaud D, Sawatsky J, Tatlow H. Variation in the stringency of COVID-19 public health measures on self-reported health, stress, and overall wellbeing in Canada. *Sci Rep*. 2023 Aug 11;13(1):13094.
224. Canadian Institutes of Health Research. Canadian COVID-19 Intervention Timeline [Internet]. Ottawa: Canadian Institutes of Health Research; 2022 Oct 13 [cited 2024 May 24]. Available from: <https://www.cihi.ca/en/canadian-covid-19-intervention-timeline>
225. Tariq A, Undurraga EA, Laborde CC, Vogt-Geisse K, Luo R, Rothenberg R, et al. Transmission dynamics and control of COVID-19 in Chile, March-October, 2020. *PLoS Negl Trop Dis*. 2021 Jan;15(1):e0009070.
226. Ma Y, Mishra SR, Han X-K, Zhu D-S. The relationship between time to a high COVID-19 response level and timing of peak daily incidence: an analysis of governments' Stringency Index from 148 countries. *Infect Dis Poverty*. 2021 Dec;10(1):96.
227. Bennett Institute for Public Policy Cambridge. The history of emergency legislation and the COVID-19 crisis [Internet]. Cambridge, England: Bennett Institute for Public Policy Cambridge; 2020 Apr 18 [cited 2024 May 24]. Available from: <https://www.bennettinstitute.cam.ac.uk/blog/history-emergency-legislation-and-covid-19-crisis/>
228. Centers for Disease Control and Prevention. CDC Museum COVID-19 Timeline [Internet]. Atlanta (GA): Centers for Disease Control and Prevention; 2023 Mar 15 [cited 2024 May 24]. Available from: <https://www.cdc.gov/museum/timeline/covid19.html>
229. Dorn A van, Cooney RE, Sabin ML. COVID-19 exacerbating inequalities in the US. *Lancet*. 2020 Apr 18;395(10232):1243–4.
230. Webb Hooper M, Nápoles AM, Pérez-Stable EJ. COVID-19 and Racial/Ethnic Disparities. *JAMA*. 2020 Jun 23;323(24):2466–7.

231. Patel JA, Nielsen FBH, Badiani AA, Assi S, Unadkat VA, Patel B, et al. Poverty, inequality and COVID-19: the forgotten vulnerable. *Public Health*. 2020 Jun;183:110–1.
232. Redefining vulnerability in the era of COVID-19. *Lancet*. 2020 Apr 4;395(10230):1089.
233. Sze S, Pan D, Nevill CR, Gray LJ, Martin CA, Nazareth J, et al. Ethnicity and clinical outcomes in COVID-19: A systematic review and meta-analysis. *EClinicalMedicine*. 2020 Dec 1;29–30:100630.
234. Mackey K, Ayers CK, Kondo KK, Saha S, Advani SM, Young S, et al. Racial and ethnic disparities in COVID-19–related infections, hospitalizations, and deaths: a systematic review. *Ann Intern Med*. 2021 Mar;174(3):362–73.
235. Devakumar D, Shannon G, Bhopal SS, Abubakar I. Racism and discrimination in COVID-19 responses. *Lancet*. 2020 Apr 11;395(10231):1194.
236. Mein SA. COVID-19 and health disparities: the reality of “the Great Equalizer.” *J Gen Intern Med*. 2020 Aug;35(8):2439–40.
237. Sidik SM. How COVID has deepened inequality-in six stark graphics. *Nature*. 2022;606(7915):638–9.
238. Giacoman C, Herrera MS, Ayala Arancibia P. Household food insecurity before and during the COVID-19 pandemic in Chile. *Public Health*. 2021 Sep 1;198:332–9.
239. Gaitán-Rossi P, Vilar-Compte M, Teruel G, Pérez-Escamilla R. Food insecurity measurement and prevalence estimates during the COVID-19 pandemic in a repeated cross-sectional survey in Mexico. *Public Health Nutr*. 2021 Feb;24(3):412–21.
240. Kent K, Murray S, Penrose B, Auckland S, Visentin D, Godrich S, et al. Prevalence and socio-demographic predictors of food insecurity in Australia during the COVID-19 pandemic. *Nutrients*. 2020 Sep 2;12(9):2682.
241. Fitzpatrick KM, Harris C, Drawve G, Willis DE. Assessing Food Insecurity among US Adults during the COVID-19 Pandemic. *J Hunger Environ Nutr*. 2021 Jan 2;16(1):1–18.
242. Poblacion A, Ettinger de Cuba S, Cook JT. Comparing Food Security Before and During the COVID-19 Pandemic: Considerations When Choosing Measures. *J Acad Nutr Diet*. 2021 Oct;121(10):1945–7.
243. Geldsetzer P, Fawzi W. Quasi-experimental study designs series—paper 2: complementary approaches to advancing global health knowledge. *J Clin Epidemiol*. 2017 Sep;89:12–6.
244. de Vocht F, Katikireddi SV, McQuire C, Tilling K, Hickman M, Craig P. Conceptualising natural and quasi experiments in public health. *BMC Med Res Methodol*. 2021 Dec;21(1):32.
245. Tugwell P, Knottnerus JA, McGowan J, Tricco A. Big-5 Quasi-Experimental designs. *J Clin Epidemiol*. 2017 Sep;89:1–3.
246. White H, Sabarwal S. Quasi-experimental design and methods. *Methodological Briefs, Impact Evaluation No. 8* [Internet]. Florence: UNICEF; 2014 Sep 30 [cited 2024 May 24].

Available from: <https://www.unicef.org/innocenti/reports/view-all>

247. Bärnighausen T, Tugwell P, Røttingen J-A, Shemilt I, Rockers P, Geldsetzer P, et al. Quasi-experimental study designs series—paper 4: uses and value. *J Clin Epidemiol*. 2017 Sep;89:21–9.
248. Craig P, Di Ruggiero E, Frolich KL, Mykhalovskiy E, White M, Campbell R, et al. Taking account of context in the population health intervention research process. In: Taking account of context in population health intervention research: guidance for producers, users and funders of research [Internet]. Southampton, England: National Institutes for Health Research; 2018 May 1 [cited 2024 May 24]. Available from: <https://dspace.stir.ac.uk/handle/1893/27205#.YrJgHHbMKUk>
249. Kirkpatrick SI, Dodd KW, Parsons R, Ng C, Garriguet D, Tarasuk V. Household Food Insecurity Is a Stronger Marker of Adequacy of Nutrient Intakes among Canadian Compared to American Youth and Adults. *J Nutr*. 2015 Jul 1;145(7):1596–603.
250. Baistow K. Cross-national research: What can we learn from inter-country comparisons. *Soc Work Eur*. 2000;7(3):8–13.
251. Cacace M, Ettelt S, Mays N, Nolte E. Assessing quality in cross-country comparisons of health systems and policies: Towards a set of generic quality criteria. *Health Policy (New York)*. 2013 Sep 1;112(1):156–62.
252. Klein R. Learning from others: Shall the last be the first? *J Health Polit Policy Law*. 1997 Oct;22(5):1267–78.
253. FAO, IFAD, UNICEF, WFP, WHO. The State of Food Security and Nutrition in the World 2020. Transforming food systems for affordable healthy diets [Internet]. Rome: FAO, IFAD, UNICEF, WFP, WHO; 2020 [cited 2024 May 24]. Available from: <http://www.fao.org/documents/card/en/c/ca9692en/>
254. Polsky JY, Garriguet D. Household food insecurity in Canada early in the COVID-19 pandemic. *Heal Reports*. 2022 Feb 1;33(2):15–26.
255. Coleman-Jensen A, Rabbitt MP, Gregory CA, Singh A. Household Food Security in the United States in 2021 [Internet]. Washington (DC): United States Department of Agriculture Economic Research Service; 2022 Sep [cited 2024 May 24]. Available from: <https://www.ers.usda.gov/publications/pub-details/?pubid=104655>
256. Miller K, Li E. Foodbank Hunger Report 2022 [Internet]. North Ryde, New South Wales: Foodbank; 2022 [cited 2024 May 24]. Available from: <https://reports.foodbank.org.au/foodbank-hunger-report-2022/?state=au>
257. Shamah-Levy T, Romero-Martínez M, Barrientos-Gutiérrez T, Cuevas-Nasu L, Bautista-Arredondo S, Colchero M, et al. Encuesta Nacional de Salud y Nutrición 2021 sobre Covid-19. Resultados nacionales [Internet]. Cuernavaca, México: ENSANUT; 2022 Aug 4 [cited 2024 May 24]. Available from: <https://ensanut.insp.mx/encuestas/ensanutcontinua2021/informes.php>
258. Hammond D. International Food Policy Study: Surveys [Internet]. Waterloo: International Food Policy Study; c2024 [cited 2024 May 24]. Available from:

- <http://foodpolicystudy.com/methods/>
259. Statistics Canada. Canadian Community Health Survey - Annual Component (CCHS) [Internet]. Ottawa: Statistics Canada; 2023 Dec 19 [cited 2024 May 24]. Available from: <https://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=3226>
 260. United States Department of Agriculture Economic Research Service. Food Security in the United States [Internet]. Washington (DC): United States Department of Agriculture, Economic Research Service; 2022 [cited 2024 May 24]. Available from: <https://www.ers.usda.gov/data-products/food-security-in-the-united-states/>
 261. Centers for Disease Control and Prevention. NHANES Questionnaires, Datasets, and Related Documentation [Internet]. Atlanta (GA): Centers for Disease Control and Prevention; [cited 2024 May 24]. Available from: <https://wwwn.cdc.gov/Nchs/Nhanes/>
 262. World Bank Group. Social Protection and Jobs Responses to COVID-19: A Real-Time Review of Country Measures (Vol. 2): Global Database on Social Protection Responses to COVID-19 (English) [Internet]. Washington (DC): World Bank Group; 2022 Feb 3 [cited 2024 May 24]. Available from: <http://documents.worldbank.org/curated/en/482751643897737073/Global-Database-on-Social-Protection-Responses-to-COVID-19>
 263. Gentilini U, Almenfi MBA, Okamura Y, Downes JA, Dale P, Weber M, et al. Social Protection and Jobs Responses to COVID-19: A Real-Time Review of Country Measures [Internet]. Social Protection and Jobs Responses to COVID-19 : A Real-Time Review of Country Measures. Washington (DC): World Bank Group; 2022 Feb 7 [cited 2024 May 24]. Available from: <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/110221643895832724/social-protection-and-jobs-responses-to-covid-19-a-real-time-review-of-country-measures>
 264. United Nations Economic Commission for Latin America. COVID-19 Observatory in Latin America and the Caribbean, Economic and social impact [Internet]. Santiago, Chile: United Nations Economic Commission for Latin America; [cited 2024 May 24]. Available from: <https://statistics.cepal.org/forms/covid-country-sheet/index.html?country>
 265. United Nations Economic Commission for Latin America. Social Development and COVID-19 in Latin America and the Caribbean [Internet]. Santiago, Chile: United Nations Economic Commission for Latin America; [cited 2024 May 24]. Available from: https://dds.cepal.org/observatorio/socialcovid19/en/listamedidas.php?id_pais
 266. International Labour Organization. Social Protection Monitor [Internet]. Geneva: International Labour Organization; c2024 [cited 2024 May 24]. Available from: <https://www.social-protection.org/gimi/ShowWiki.action?id=3426>
 267. Eurofound. EU PolicyWatch Database of national-level policy measures [Internet]. Dublin, Ireland: Eurofound; [cited 2024 May 24]. Available from: <https://static.eurofound.europa.eu/covid19db/>
 268. Yale Program on Financial Stability. COVID-19 Financial Response Tracker [Internet]. New Haven (CT): Yale Program on Financial Stability; c2024 [cited 2024 May 24]. Available from: <https://som.yale.edu/centers/program-on-financial-stability/covid-19->

crisis

269. World Trade Organization. COVID-19: Support measures [Internet]. Geneva: World Trade Organization; 2023 Oct 12 [cited 2024 May 24]. Available from: https://www.wto.org/english/tratop_e/covid19_e/trade_related_support_measures_e.htm
270. Godin K, Stapleton J, Kirkpatrick SI, Hanning RM, Leatherdale ST. Applying systematic review search methods to the grey literature: a case study examining guidelines for school-based breakfast programs in Canada. *Syst Rev*. 2015 Oct 22;4:138.
271. Tomlinson E, Parker R, NIHR Network Support Fellows. Six-Step Stakeholder Engagement Framework [Internet]. London, England: Cochrane; 2021 July 9 [cited 2024 May 24]. Available from: <https://community.cochrane.org/news/six-step-stakeholder-engagement-framework>
272. Bennett LM, Gadlin H, Marchand C. Collaboration and Team Science Field Guide [Internet]. Bethesda (MD): National Cancer Institute; 2018 [cited 2024 May 24]. Available from: <https://www.cancer.gov/about-nci/organization/crs/research-initiatives/team-science-field-guide/collaboration-team-science-guide.pdf>
273. International Association for Public Participation. Core Values, Ethics, Spectrum - The 3 Pillars of Public Participation [Internet]. Ottawa: International Association for Public Participation; [cited 2024 May 24]. Available from: <https://www.iap2.org/page/pillars>
274. Tarasuk V, Mitchell A. Household Food Insecurity in Canada, 2017-18 [Internet]. Toronto: Research to identify policy options to reduce food insecurity (PROOF); 2020 Mar 12 [cited 2024 May 24]. Available from: <https://proof.utoronto.ca>
275. Grimaccia E, Naccarato A. Food Insecurity Individual Experience: A Comparison of Economic and Social Characteristics of the Most Vulnerable Groups in the World. *Soc Indic Res*. 2019 May 15;143(1):391–410.
276. Smith MD, Meade B. Who Are the World's Food Insecure? Identifying the Risk Factors of Food Insecurity Around the World. *Amber Waves: The Econ Food, Farming, Nat Resour Rural Am*. 2019 Jun 3;2019(5):1–10.
277. Kirkpatrick SI, McIntyre L, Potestio ML. Child hunger and long-term adverse consequences for health. *Arch Pediatr Adolesc Med*. 2010 Aug 1;164(8):754–62.
278. Eicher-Miller HA, Zhao Y. Evidence for the age-specific relationship of food insecurity and key dietary outcomes among US children and adolescents. *Nutr Res Rev*. 2018 Jun;31(1):98–113.
279. Alaimo K. Food Insecurity in the United States: An Overview. *Top Clin Nutr*. 2005 Oct 1;20(4):281–98.
280. Loopstra R, Reeves A, Tarasuk V. The rise of hunger among low-income households: an analysis of the risks of food insecurity between 2004 and 2016 in a population-based study of UK adults. *J Epidemiol community Heal*. 2019 Jul 1;73(7):668–73.
281. Men F, Tarasuk V. Food insecurity amid the COVID-19 pandemic: Food charity, government assistance and employment. *Can Public Policy*. 2021 Mar 2;47(2):202–30.

282. Coleman-Jensen A, Rabbitt MP, Gregory C, Singh A. Household food security in the United States in 2019 [Internet]. Washington (DC): United States Department of Agriculture, Economic Research Service; 2020 Sep [cited 2024 May 24]. Available from: <https://www.ers.usda.gov/webdocs/publications/99282/err-275.pdf?v=9255.2>
283. Niles MT, Bertmann F, Belarmino EH, Wentworth T, Biehl E, Neff R. The Early Food Insecurity Impacts of COVID-19. *Nutrients*. 2020 Jul 15;12(7):2096.
284. Hammond D. International Food Policy Study: About [Internet]. Waterloo: International Food Policy Study c2024 [cited 2024 May 24]. Available from: <http://foodpolicystudy.com/about/>
285. Groves RM, Fowler Jr FJ, Couper MP, Lepkowski JM, Singer E, Tourangeau R. *Survey Methodology*, 2nd ed. New Jersey: John Wiley & Sons; 2009.
286. Groves RM. Nonresponse rates and nonresponse bias in household surveys. *Public Opin Q*. 2006 Jan 1;70(5):646–75.
287. Barón JD, Breunig R V, Cobb-Clark DA, Gørgens T, Sartbayeva A. Does the effect of incentive payments on survey response rates differ by income support history? Bonn, Germany: Institute for the Study of Labor; 2008 Apr [cited 2024 May 24]. Available from: <http://ftp.iza.org/dp3473.pdf>
288. Bailar BA. The effects of rotation group bias on estimates from panel surveys. *J Am Stat Assoc*. 1975 Mar 1;70(349):23–30.
289. Hammond D, White CM, Rynard VL, Vanderlee L. International Food Policy Study: Technical Report - 2018 Survey (Wave 2) [Internet]. Waterloo: International Food Policy Study; 2024 Feb 14 [cited 2024 May 24]. Available from: <https://foodpolicystudy.com/methods/>
290. Hammond D, White CM, Rynard VL, Vanderlee L. International Food Policy Study: Technical Report - 2019 Survey (Wave 3) [Internet]. Waterloo: International Food Policy Study; 2021 Dec 20 [cited 2024 May 24]. Available from: <http://foodpolicystudy.com/methods/>
291. Hammond D, White CM, Rynard VL, Vanderlee L. International Food Policy Study: Technical Report - 2020 Survey (Wave 4) [Internet]. Waterloo: International Food Policy Study; 2022 Jan 24 [cited 2024 May 24]. Available from: <https://foodpolicystudy.com/methods/>
292. Hammond D, White CM, Rynard VL, Vanderlee L. International Food Policy Study: Technical Report - 2019 Youth Survey [Internet]. Waterloo: International Food Policy Study; 2021 Dec 20 [cited 2024 May 24]. Available from: <https://foodpolicystudy.com/methods/>
293. Hammond D, White CM, Rynard VL, Vanderlee L. International Food Policy Study: Technical Report - 2020 Youth Survey [Internet]. Waterloo: International Food Policy Study; 2021 Dec 20 [cited 2024 May 24]. Available from: <https://foodpolicystudy.com/methods/>
294. Tarasuk V, Li T, Mitchell A, Dachner N. The case for more comprehensive data on

- household food insecurity. *Heal Promot Chronic Dis Prev Canada*. 2018 May;38(5):210–3.
295. Martin MA, Lippert AM. Feeding her children, but risking her health: The intersection of gender, household food insecurity and obesity. *Soc Sci Med*. 2012 Jun 1;74(11):1754–64.
296. Olson CM. Food Insecurity in Women: A Recipe for Unhealthy Trade-offs. *Top Clin Nutr*. 2005 Oct 1;20(4):321–8.
297. Canadian Institutes of Health Research. How to integrate sex and gender into research [Internet]. Ottawa: Canadian Institutes of Health Research; 2019 Aug 21 [cited 2024 May 24]. Available from: <https://cihr-irsc.gc.ca/e/50836.html>
298. Australian Bureau of Statistics. Language used at home (LANP) [Internet]. Canberra, Australia: Australian Bureau of Statistics; 2021 Oct 15 [cited 2024 May 24]. Available from: <https://www.abs.gov.au/census/guide-census-data/census-dictionary/2021/variables-topic/cultural-diversity/language-used-home-lanp>
299. Muff S, Nilsen EB, O’Hara RB, Nater CR. Rewriting results sections in the language of evidence. *Trends Ecol Evol*. 2022 Mar 1;37(3):203–10.
300. Althouse AD. Adjust for multiple comparisons? It’s not that simple. *Ann Thorac Surg*. 2016 May;101(5):1644–5.
301. Ahn S, Norwood FB. Measuring Food Insecurity during the COVID-19 Pandemic of Spring 2020. *Appl Econ Perspect Policy*. 2021 Mar;43(1):162–8.
302. Coleman-Jensen A, Rabbitt MP, Gregory C, Singh A. Household food security in the United States in 2020 [Internet]. Washington (DC): United States Department of Agriculture Economic Research Service; 2021 Sep [cited 2024 May 24]. Available from: <https://www.ers.usda.gov/webdocs/publications/102076/err-298.pdf?v=4144.9>
303. St. Pierre C, Guan W, Merrill J, Sacheck JM. Urban Youth Perspectives on Food Insecurity during the COVID-19 Pandemic: Evidence from the COACHES Study. *Nutrients*. 2022 Jan 20;14(3):455.
304. Danielli S, Patria R, Donnelly P, Ashrafian H, Darzi A. Economic interventions to ameliorate the impact of COVID-19 on the economy and health: an international comparison. *J Public Health (Bangkok)*. 2021 Apr 12;43(1):42–6.
305. Klapdor M, Lotric A. Australian Government COVID-19 Disaster Payments: a Quick Guide [Internet]. Canberra, Australia: Parliament of Australia; 2022 Jan 21 [cited 2024 May 24]. Available from: https://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/pubs/rp/rp2122/Quick_Guides/COVID-19DisasterPayments
306. Palma J, Araos C. Household Coping Strategies During the COVID-19 Pandemic in Chile. *Front Sociol*. 2021 Aug 31; 6:728095.
307. HM Treasury. How to access government financial support if you or your business has been affected by COVID-19 [Internet]. London, England: Government of the United Kingdom; 2020 Mar 9 [cited 2024 May 24]. Available from:

- <https://www.gov.uk/government/publications/support-for-those-affected-by-covid-19>
308. Lustig N, Trasberg M. How Brazil and Mexico Diverged on Social Protection in the Pandemic. *Curr Hist*. 2021 Feb 1;120(823):57–63.
 309. Ahmed Hannan S, Honjo K, Raissi M, Goyal R. Mexico Needs a Fiscal Twist: Response to Covid-19 and Beyond. *IMF Work Pap*. 2020;2020(215):A001.
 310. International Monetary Fund. Fiscal Monitor Database of Country Fiscal Measures in Response to the COVID-19 Pandemic [Internet]. Washington (DC): International Monetary Fund; 2021 Oct [cited 2024 May 24]. Available from: <https://www.imf.org/en/Topics/imf-and-covid19/Fiscal-Policies-Database-in-Response-to-COVID-19>
 311. Magaña-Lemus D, Ishdorj A, Rosson III CP, Lara-Álvarez J. Determinants of household food insecurity in Mexico. *Agric Food Econ*. 2016;4(10):1–20.
 312. Sederberg PB, Howard MW, Kahana MJ. A context-based theory of recency and contiguity in free recall. *Psychol Rev*. 2008 Oct;115(4):893–912.
 313. Nord M. A 30-Day Food Security Scale for Current Population Survey Food Security Supplement Data [Internet]. Washington (DC): United States Department of Agriculture Economic Research Service; 2002 Aug [cited 2024 May 24]. Available from: <https://www.ers.usda.gov/publications/pub-details/?pubid=43199>
 314. Agarwal R, Kimball M. Will Inflation Remain High? Finance & Development [Internet]. Washington (DC): International Monetary Fund; 2022 Jun [cited 2024 May 24]. Available from: <https://www.imf.org/en/Publications/fandd/issues/2022/03/Future-of-inflation-partI-Agarwal-kimball>
 315. Coates J, Frongillo EA, Rogers BL, Webb P, Wilde PE, Houser R. Commonalities in the experience of household food insecurity across cultures: what are measures missing? *J Nutr*. 2006 May;136(5):1438S-1448S.
 316. Toossi S, Jones JW, Hodges L. The Food and Nutrition Assistance Landscape: Fiscal Year 2020 Annual Report [Internet]. Washington (DC): United States Department of Agriculture Economic Research Service; 2021 Aug [cited 2024 May 24]. Available from: <https://www.ers.usda.gov/publications/pub-details/?pubid=101908>
 317. Francis-Devine B, Danechi S, Tyler G. House of Commons Library: Briefing Paper 9209, 30 April 2021: Food poverty: Households, food banks and free school meals [Internet]. London, England: House of Commons Library; 2021 Apr 30 [cited 2024 May 24]. Available from: <https://dera.ioe.ac.uk/37861/1/CBP-9209%20%28redacted%29.pdf>
 318. Food Banks Canada. A Snapshot of Food Banks in Canada and the COVID-19 Crisis [Internet]. Mississauga: Food Banks Canada; c2024 [cited 2024 May 24]. Available from: <https://foodbankscanada.ca/covid-snapshot/>
 319. Korngiebel DM, Taulii M, Forquera R, Harris R, Buchwald D. Addressing the Challenges of Research With Small Populations. *Am J Public Health*. 2015 Sep;105(9):1744–7.

320. BMC Medicine. Food insecurity: a neglected public health issue requiring multisectoral action. *BMC Med.* 2023 Apr;21(130).
321. Gundersen C. Lessons Learned from the Lack of Increase in Food Insecurity during COVID-19. *J Nutr.* 2023 Apr;153(4):920–1.
322. Peppetone A, Frongillo EA, Dodd KW, Wallace MP, Hammond D, Kirkpatrick SI. Prevalence and severity of food insecurity before and during the Coronavirus Disease 2019 pandemic among adults and youth in Australia, Canada, Chile, Mexico, the United Kingdom, and the United States. *J Nutr.* 2023 Apr 1;153(4):1231–43.
323. Jacobs M, McDade TR, Chaparro MV, Corea M. Sick, Hungry, and Vulnerable: Federal Stimulus and Food Security on Marginalized Populations During the COVID-19 Pandemic. *J racial Ethn Heal disparities.* 2023 Dec;10(6):2685–703.
324. Li Y, Zhang S, Wang L, Lu G, Pfeiffer R, Zou Z. The Association of Supplemental Nutrition Assistance Program Participation and Food Insufficiency among Households with Children in the United States during COVID-19. *J Nutr.* 2023 Oct 1;153(10):3110–21.
325. Bryant A, Follett L. Hunger relief: A natural experiment from additional SNAP benefits during the COVID-19 pandemic. *Lancet Reg Heal Am.* 2022 Jun 1;(10):100224.
326. Cejudo GM, Michel CL. Instruments for Policy Integration: How Policy Mixes Work Together. *SAGE Open.* 2021 Jul 13;11(3):215824402110321.
327. Howlett M. The criteria for effective policy design: character and context in policy instrument choice. *J Asian Public Policy.* 2018 Sep 2;11(3):245–66.
328. Eurofound. EU PolicyWatch About [Internet]. Dublin, Ireland: Eurofound; [cited 2024 May 24]. Available from: <https://www.eurofound.europa.eu/data/eu-policywatch>
329. International Labour Organization. World Social Protection Report 2017-19: Universal social protection to achieve the Sustainable Development Goals [Internet]. Geneva: International Labour Organization; 2017 [cited 2024 May 24]. Available from: https://www.ilo.org/global/publications/books/WCMS_604882/lang--en/index.htm
330. Devereux S, Béné C, Hoddinott J. Conceptualising COVID-19’s impacts on household food security. *Food Secur.* 2020 Aug;12(4):769–72.
331. United States Department of Agriculture Food and Nutrition Service. SNAP EBT [Internet]. Alexandria (VA): United States Department of Agriculture Food and Nutrition Service; 2024 Apr 26 [cited 2024 May 24]. Available from: <https://www.fns.usda.gov/snap/ebt>
332. Seligman HK, Schillinger D. Hunger and Socioeconomic Disparities in Chronic Disease. *N Engl J Med.* 2010 Jul;363(1):6–9.
333. Weiser S, Palar K, Hatcher A, Young S, Frongillo E, Laraia B. Food Insecurity and Health: A Conceptual Framework. In: Ivers L, editor. *Food Insecurity and Public Health.* Boca Raton (FL): CRC Press; 2015 May 6. p. 23–50.

334. Organisation for Economic Cooperation and Development. Inflation (CPI) [Internet]. Paris, France: Organisation for Economic Cooperation and Development; 2024 [cited 2024 May 24]. Available from: <https://data.oecd.org/price/inflation-cpi.htm>
335. Walker N. Brexit timeline: events leading to the UK's exit from the European Union [Internet]. London, England: UK Parliament House of Commons Library; 2021 Jan 6 [cited 2024 May 24]. Available from: <https://commonslibrary.parliament.uk/research-briefings/cbp-7960/>
336. Ranta R, Mulrooney H. Pandemics, food (in)security, and leaving the EU: What does the Covid-19 pandemic tell us about food insecurity and Brexit. *Soc Sci Humanit Open*. 2021 Jan 1;3(1):100125.
337. Foodbank. Foodbank Hunger Report 2021 [Internet]. North Ryde, New South Wales: Foodbank; 2021 [cited 2024 May 24]. Available from: <https://www.foodbank.org.au/research-reports/?state=au>
338. Sasse L. Chile Despertó – The Reasons for the Mass Protests in Chile 2019/2020 [Internet]. Berlin, Germany: Berlin School of Economics and Law; 2021 [cited 2024 May 24]. Available from: https://www.ipe-berlin.org/fileadmin/institut-ipe/Dokumente/Working_Papers/ipe_working_paper_166.pdf
339. Somma NM, Bargsted M, Disi Pavlic R, Medel RM. No water in the oasis: the Chilean Spring of 2019–2020. *Soc Mov Stud*. 2021 Jul 4;20(4):495–502.
340. Proyectos México. Tasas de inflación históricas [Internet]. Mexico City: Proyectos México; c2024 [cited 2024 May 24]. Available from: https://www.proyectosmexico.gob.mx/por-que-invertir-en-mexico/economia-solida/politica-monetaria/sd_tasas-de-inflacion-historicas/
341. Gobierno de México. Data Mexico: Economically Active Population [Internet]. Mexico City: Gobierno de México; [cited 2024 May 24]. Available from: <https://www.economia.gob.mx/datamexico/en/profile/geo/mexico>
342. De Wispelaere J, Morales L. Emergency Basic Income during the Pandemic. *Cambridge Q Healthc Ethics*. 2021 Apr;30(2):248–54.
343. Jones AM. “Not fair”: CERB recipients who now have to pay the money back share their stories [Internet]. Toronto: CTV News; 2022 Jun 2 [cited 2024 May 24]; Available from: <https://www.ctvnews.ca/canada/not-fair-cerb-recipients-who-now-have-to-pay-the-money-back-share-their-stories-1.5929985>
344. Burke A. Who won and lost with the Canada Emergency Response Benefit [Internet]. Montreal: Policy Options Politiques. 2023 Mar 15 [cited 2024 May 24]. Available from: <https://policyoptions.irpp.org/magazines/march-2023/cerb-winners-losers/>
345. Larkham Z. ‘I only had £5’: what happened to the 3.8 million people denied furlough at the start of Covid? [Internet]. London, England: The Guardian; 2024 Apr 24 [cited 2024 May 24]; Available from: <https://www.theguardian.com/uk-news/2024/apr/02/i-only-had-five-pounds-38-million-people-denied-furlough-start-of-covid->
346. Patel SB, Kariel J. Universal basic income and covid-19 pandemic. *BMJ*. 2021 Jan

26;372:n193.

347. Broad G, Nadjiwon-Smith J. B.I.G. and First Nations: Cautions for Implementation [Internet]. Thunder Bay: Northern Policy Institute; 2017 May [cited 2024 May 24]. Available from: <https://www.northernpolicy.ca/bigandfirstnations>
348. Forget EL. Do we still need a basic income guarantee in Canada ? [Internet]. Thunder Bay: Northern Policy Institute; 2017 May [cited 2024 May 24]. Available from: <https://www.northernpolicy.ca/dowestillneedabig>
349. Hussain Z, Tarasuk V. A comparison of household food insecurity rates in Newfoundland and Labrador in 2011–2012 and 2017–2018. *Can J Public Heal.* 2022 Apr;113(2):239–49.
350. Pool U, Dooris M. Prevalence of food security in the UK measured by the Food Insecurity Experience Scale. *J Public Health (Bangkok).* 2022 Sep;44(3):634–41.
351. Polsky J, Gilmour H. Food insecurity and mental health during the COVID-19 pandemic. *Heal Reports.* 2020 Dec 16;31(12):3–11.
352. Wolfson JA, Garcia T, Leung CW. Food Insecurity Is Associated with Depression, Anxiety, and Stress: Evidence from the Early Days of the COVID-19 Pandemic in the United States. *Heal Equity.* 2021 Feb 25;5(1):64–71.
353. Dhunna S, Tarasuk V. Black–white racial disparities in household food insecurity from 2005 to 2014, Canada. *Can J Public Heal.* 2021 Oct;112(5):888–902.
354. Hales LJ, Coleman-Jensen A. Household Food Insecurity Across Race and Ethnicity in the United States, 2016–21 [Internet]. Washington (DC): United States Department of Agriculture Economic Research Service; 2024 Apr [cited 2024 May 24]. Available from: <https://www.ers.usda.gov/publications/pub-details/?pubid=108904>
355. Loopstra R. Vulnerability to food insecurity since the COVID-19 lockdown - Preliminary Report [Internet]. London, England: The Food Foundation; 2020 Apr 14 [cited 2024 May 24]. Available from: https://foodfoundation.org.uk/wp-content/uploads/2020/04/Report_COVID19FoodInsecurity-final.pdf
356. Novoa-Sanzana S, Moya-Osorio J, Morejón Terán Y, Ríos-Castillo I, Becerra Granados LM, Prada Gómez G, et al. Food insecurity and sociodemographic factors in Latin America during the COVID-19 pandemic. *Rev Panam Salud Publica.* 2024 Apr 22;48:e21.
357. Statistics Canada. Canadian Health Measures Survey - Cycle 3 [Internet]. 2020 Dec 4 [cited 2024 May 24]. Available from: https://www.statcan.gc.ca/en/statistical-programs/instrument/5071_Q1_V3
358. Kirkpatrick SI, Tarasuk V. Housing circumstances are associated with household food access among low-income urban families. *J Urban Health.* 2011 Apr;88(2):284–96.
359. Maynard MS, Meyer SB, Perlman CM, Kirkpatrick SI. Experiences of Food Insecurity Among Undergraduate Students: “You Can’t Starve Yourself Through School.” *Can J High Educ.* 2018;48(2):130–48.
360. Hamilton C, Taylor D, Huisken A, Bottorff JL. Correlates of Food Insecurity Among

- Undergraduate Students. *Can J High Educ.* 2020;50(2):15–23.
361. Payne-Sturges DC, Tjaden A, Caldeira KM, Vincent KB, Arria AM. Student Hunger on Campus: Food Insecurity Among College Students and Implications for Academic Institutions. *Am J Heal Promot.* 2018 Feb;32(2):349–54.
 362. Reeves A, Loopstra R, Tarasuk V. Wage-Setting Policies, Employment, and Food Insecurity: A Multilevel Analysis of 492 078 People in 139 Countries. *Am J Public Health.* 2021 Apr;111(4):718–25.
 363. Reeves A, Loopstra R, Tarasuk V. Family policy and food insecurity: an observational analysis in 142 countries. *Lancet Planet Heal.* 2021 Aug;5(8):e506–13.
 364. Akhtar S, Das JK, Ismail T, Wahid M, Saeed W, Bhutta ZA. Nutritional perspectives for the prevention and mitigation of COVID-19. *Nutr Rev.* 2021 Feb 11;79(3):289–300.
 365. Sassi M. Food Security Basics. In: *Understanding Food Insecurity: Key Features, Indicators, and Response Design.* 1st ed. New York: Cham: Springer International Publishing; 2018. p. 1–30.
 366. Connell CL, Lofton KL, Yadrick K, Rehner TA. Children’s experiences of food insecurity can assist in understanding its effect on their well-being. *J Nutr.* 2005 Jul;135(7):1683–90.
 367. Lambie-Mumford H. The rise of food charity: issues and challenges. *Geography.* 2016 Mar 1;101(1):11–6.
 368. Centers for Disease Control and Prevention. Long COVID or Post-COVID Conditions [Internet]. Atlanta (GA): Centers for Disease Control and Prevention; 2024 Mar 14 [cited 2024 May 24]. Available from: <https://www.cdc.gov/coronavirus/2019-ncov/long-term-effects/index.html>
 369. PROOF Food Insecurity Policy Research. New data on household food insecurity in 2023 [Internet]. Toronto: Research to identify policy options to reduce food insecurity (PROOF); 2024 Apr 26 [cited 2024 May 24]; Available from: <https://proof.utoronto.ca/2024/new-data-on-household-food-insecurity-in-2023/>
 370. United States Census Bureau. Household Pulse Survey: Measuring Emergent Social and Economic Matters Facing U.S. Households [Internet]. 2024 [cited 2024 May 22]. Available from: <https://www.census.gov/data/experimental-data-products/household-pulse-survey.html>
 371. Calloway EE, Carpenter LR, Gargano T, Sharp JL, Yaroch AL. New measures to assess the “Other” three pillars of food security—availability, utilization, and stability. *Int J Behav Nutr Phys Act.* 2023 Apr;20(1):51.
 372. Frongillo EA, Bethancourt HJ, Norcini Pala A, Maya S, Wu KC, Kizer JR, et al. Complementing the United States Household Food Security Survey Module with Items Reflecting Social Unacceptability. *J Nutr.* 2024 Apr;154(4):1428–39.
 373. Mmari K, Offiong A, Gross S, Mendelson T. How adolescents cope with food insecurity in Baltimore City: an exploratory study. *Public Health Nutr.* 2019 Aug;22(12):2260–7.

374. Wenham C, Hale T, Green K, Andretti de Mello B, Furst R, Kamenkovich N, et al. What Would a Data Framework for Policy Responses to Pandemic Diseases Look Like? [Internet]. Oxford, England; 2023 Feb 16 [cited 2024 May 24]. Available from: <https://www.bsg.ox.ac.uk/research/publications/what-would-data-framework-policy-responses-pandemic-diseases-look>

Appendices

Supplemental materials for Chapter 5

Supplemental table 5.1: Sociodemographic characteristics of adults aged 18 to 100 years participating in the International Food Policy Study in 2018, by country (n = 22,747)¹⁻³.

Country	Australia (n = 4,083)	Canada (n = 4,386)	Mexico (n = 4,132)	United Kingdom (n = 5,516)	United States (n = 4,630)
	n (%)	n (%)	n (%)	n (%)	n (%)
Age⁴, years	46.5 (45.9-47.1)	48.2 (47.5-48.8)	39.4 (38.8-39.9)	48.1 (47.5-48.6)	46.8 (46.2-47.4)
Gender identity					
Man (including trans male/trans man)	1,972 (49.0%)	2,093 (49.2%)	2,178 (47.7%)	2,685 (48.8%)	2,209 (48.1%)
Woman (including trans female/trans woman)	2,105 (50.8%)	2,273 (50.3%)	1,938 (51.9%)	2,817 (51.0%)	2,397 (51.3%)
Other/not stated	6 (0.2%)	20 (0.5%)	16 (0.4%)	14 (0.2%)	24 (0.6%)
Racial/ethnic identity and cultural diversity					
BIPOC and/or speaks language other than English at home	561 (24.3%)	881 (20.0%)	636 (20.9%)	503 (11.1%)	1,130 (35.5%)
White and/or English speaking	3,508 (75.4%)	3,387 (76.6%)	3,417 (77.5%)	4,964 (88.1%)	3,474 (63.8%)
Not stated	14 (0.3%)	118 (3.4%)	79 (1.7%)	49 (0.9%)	26 (0.7%)
Educational attainment⁵					
Low	1,261 (42.1%)	1,078 (42.2%)	802 (19.9%)	1,520 (48.3%)	1,502 (58.6%)
Medium	1,449 (32.2%)	1,696 (33.1%)	477 (13.2%)	1,544 (23.0%)	1,021 (9.8%)
High	1,367 (25.6%)	1,593 (24.2%)	2,846 (66.8%)	2,430 (28.2%)	2,100 (31.4%)
Not stated	6 (0.2%)	19 (0.4%)	7 (0.1%)	22 (0.5%)	7 (0.2%)
Employment status					
Working	2,001 (49.2%)	2,156 (46.2%)	2,982 (69.2%)	2,652 (46.5%)	2,221 (42.3%)
Not working	1,722 (40.8%)	1,828 (41.4%)	926 (25.2%)	2,358 (41.4%)	1,920 (43.4%)

Unemployed	325 (9.0%)	341 (10.7%)	182 (4.6%)	459 (11.0%)	372 (10.7%)
Not stated	35 (1.0%)	61 (1.7%)	42 (1.0%)	47 (1.1%)	117 (3.6%)
Perceived income adequacy					
Difficult	1,110 (27.9%)	1,094 (28.1%)	1,685 (43.7%)	1,232 (25.0%)	1,233 (29.6%)
Neither	1,483 (37.0%)	1,569 (36.6%)	1,630 (38.6%)	1,914 (36.2%)	1,533 (34.8%)
Easy	1,457 (34.0%)	1,687 (34.2%)	792 (17.2%)	2,330 (37.9%)	1,836 (34.7%)
Not stated	33 (1.2%)	36 (1.1%)	25 (0.5%)	40 (0.9%)	28 (0.9%)
Living arrangement					
No other adults or children	832 (19.1%)	1,087 (25.4%)	223 (5.8%)	1,216 (22.5%)	1,016 (21.3%)
Other adults but no children	1,929 (46.8%)	2,044 (46.5%)	1,461 (35.5%)	2,555 (44.7%)	2,042 (45.0%)
No other adults but children	241 (6.1%)	234 (5.5%)	202 (6.1%)	322 (7.0%)	261 (6.3%)
Other adults with children	1,064 (27.6%)	1,013 (22.4%)	2,230 (52.1%)	1,409 (25.5%)	1,296 (26.9%)
Not stated	17 (0.4%)	8 (0.2%)	16 (0.5%)	14 (0.3%)	15 (0.5%)

¹Abbreviation: BIPOC, Black, Indigenous, People of Color.

²Cell sizes are unweighted and may not align with the percentages, which are weighted using sample weights.

³Percentages may not sum to 100% due to rounding.

⁴Mean and 95% confidence interval for age. Sample size is equivalent to the sample size noted by country.

⁵Low educational attainment includes secondary education or less, medium includes some post-secondary education, high educational attainment includes university degree or above.

Supplemental table 5.2: Sociodemographic characteristics of adults aged 18 to 100 years participating in the International Food Policy Study in 2019, by country (n = 19,225)¹⁻³.

Country	Australia (n = 3,479)	Canada (n = 3,908)	Mexico (n = 4,210)	United Kingdom (n = 3,703)	United States (n = 3,925)
	n (%)	n (%)	n (%)	n (%)	n (%)
Age⁴, years	45.2 (44.5-45.8)	47.0 (46.3-47.6)	39.0 (38.5-39.6)	47.7 (47.1-48.3)	46.6 (45.9-47.2)
Gender identity					
Man (including trans male/trans man)	1,717 (49.7%)	1,941 (49.8%)	2,114 (46.9%)	1,805 (48.2%)	1,776 (46.0%)
Woman (including trans female/trans woman)	1,751 (49.9%)	1,948 (49.7%)	2,079 (52.7%)	1,890 (51.6%)	2,136 (53.5%)
Other/not stated	11 (0.4%)	19 (0.5%)	17 (0.4%)	8 (0.2%)	13 (0.5%)
Racial/ethnic identity and cultural diversity					
BIPOC and/or speaks language other than English at home	545 (26.4%)	778 (19.6%)	702 (21.0%)	358 (11.8%)	1,074 (36.1%)
White and/or English speaking	2,927 (73.5%)	3,069 (78.7%)	3,429 (77.2%)	3,314 (87.4%)	2,831 (63.1%)
Not stated	7 (0.2%)	61 (1.8%)	79 (1.8%)	31 (0.7%)	20 (0.8%)
Educational attainment⁵					
Low	1,105 (42.5%)	1,153 (42.7%)	922 (22.9%)	1,076 (50.4%)	1,411 (58.9%)
Medium	1,268 (32.1%)	1,503 (33.3%)	523 (13.0%)	964 (20.6%)	880 (9.7%)
High	1,091 (24.9%)	1,241 (23.7%)	2,755 (63.9%)	1,638 (28.2%)	1,626 (31.1%)
Not stated	15 (0.6%)	11 (0.3%)	10 (0.2%)	25 (0.8%)	8 (0.2%)
Employment status					
Working	1,720 (47.9%)	1,954 (46.1%)	2,966 (68.3%)	1,813 (48.2%)	1,741 (40.9%)
Not working	1,293 (37.5%)	1,566 (42.4%)	967 (24.6%)	1,564 (40.6%)	1,744 (45.6%)
Unemployed	417 (13.0%)	337 (9.8%)	233 (5.7%)	297 (10.4%)	348 (10.4%)
Not stated	49 (1.6%)	51 (1.6%)	44 (1.4%)	29 (0.9%)	92 (3.1%)
Perceived income adequacy					
Difficult	1,045 (30.4%)	1,089 (30.1%)	1,728 (42.4%)	800 (24.4%)	1,109 (30.6%)
Neither	1,294 (38.1%)	1,478 (38.2%)	1,664 (39.6%)	1,300 (37.0%)	1,281 (34.5%)

Easy	1,106 (30.4%)	1,311 (31.0%)	798 (17.5%)	1,567 (37.6%)	1,491 (33.4%)
Not stated	34 (1.1%)	30 (0.7%)	20 (0.5%)	36 (1.1%)	44 (1.5%)
Living arrangement					
No other adults or children	688 (18.7%)	870 (22.3%)	221 (6.2%)	777 (20.6%)	867 (20.8%)
Other adults but no children	1,618 (47.7%)	1,849 (47.8%)	1,359 (32.8%)	1,693 (43.1%)	1,713 (44.8%)
No other adults but children	263 (7.7%)	251 (6.2%)	278 (7.5%)	226 (7.1%)	274 (7.5%)
Other adults with children	893 (25.3%)	926 (23.1%)	2,336 (53.1%)	994 (28.9%)	1,054 (26.3%)
Not stated	17 (0.6%)	12 (0.6%)	16 (0.4%)	13 (0.3%)	17 (0.6%)

¹Abbreviation: BIPOC, Black, Indigenous, People of Color.

²Cell sizes are unweighted and may not align with the percentages, which are weighted using sample weights.

³Percentages may not sum to 100% due to rounding.

⁴Mean and 95% confidence interval for age. Sample size is equivalent to the sample size noted by country.

⁵Low educational attainment includes secondary education or less, medium includes some post-secondary education, high educational attainment includes university degree or above.

Supplemental table 5.3: Sociodemographic characteristics of adults aged 18 to 100 years participating in the International Food Policy Study in 2020, by country (n = 21,306)¹⁻³.

Country	Australia (n = 4,083)	Canada (n = 4,276)	Mexico (n = 4,279)	United Kingdom (n = 4,075)	United States (n = 4,593)
	n (%)	n (%)	n (%)	n (%)	n (%)
Age⁴, years	46.4 (45.8-46.9)	48.0 (47.3-48.6)	40.5 (39.9-41.1)	47.9 (47.3-48.5)	46.8 (46.2-47.4)
Gender identity					
Man (including trans male/trans man)	1,985 (48.1%)	2,095 (49.1%)	2,157 (47.8%)	2,012 (48.5%)	2,188 (48.5%)
Woman (including trans female/trans woman)	2,086 (51.6%)	2,159 (50.3%)	2,101 (51.8%)	2,048 (51.1%)	2,387 (51.1%)
Other/not stated	12 (0.3%)	22 (0.6%)	21 (0.4%)	15 (0.4%)	18 (0.4%)
Racial/ethnic identity and cultural diversity					
BIPOC and/or speaks language other than English at home	693 (26.9%)	882 (21.4%)	700 (18.8%)	417 (11.4%)	1,681 (36.4%)
White and/or English speaking	3,375 (72.7%)	3,341 (77.4%)	3,475 (78.9%)	3,634 (88.1%)	2,893 (63.2%)
Not stated	15 (0.4%)	53 (1.2%)	104 (2.4%)	24 (0.5%)	19 (0.4%)
Educational attainment⁵					
Low	1,767 (41.7%)	1,198 (42.2%)	969 (23.1%)	1,604 (50.7%)	1,699 (54.8%)
Medium	1,255 (31.8%)	1,754 (33.2%)	582 (13.9%)	1,186 (19.4%)	945 (10.1%)
High	1,042 (26.1%)	1,304 (24.1%)	2,721 (62.8%)	1,256 (29.1%)	1,923 (34.7%)
Not stated	19 (0.5%)	20 (0.5%)	7 (0.2%)	29 (0.7%)	26 (0.5%)
Employment status					
Working	1,957 (49.4%)	2,015 (43.5%)	2,696 (60.2%)	1,958 (48.2%)	2,043 (39.8%)
Not working	1,640 (38.3%)	1,735 (42.2%)	1,119 (29.0%)	1,700 (40.5%)	1,957 (44.6%)
Unemployed	440 (11.2%)	450 (12.0%)	409 (9.6%)	388 (10.6%)	462 (12.0%)
Not stated	46 (1.1%)	76 (2.3%)	55 (1.2%)	29 (0.8%)	131 (3.6%)
Perceived income adequacy					
Difficult	837 (20.7%)	931 (24.8%)	2,059 (50.4%)	785 (20.3%)	1,329 (30.6%)
Neither	1,660 (41.1%)	1,700 (40.0%)	1,554 (35.0%)	1,548 (38.9%)	1,578 (34.4%)

Easy	1,545 (37.0%)	1,593 (33.7%)	616 (13.5%)	1,695 (39.6%)	1,622 (33.4%)
Not stated	41 (1.2%)	52 (1.5%)	50 (1.1%)	47 (1.2%)	64 (1.5%)
Living arrangement					
No other adults or children	824 (19.1%)	986 (24.0%)	235 (6.0%)	827 (20.5%)	835 (20.3%)
Other adults but no children	1,897 (46.3%)	2,088 (48.4%)	1,509 (35.7%)	1,899 (45.5%)	1,737 (39.1%)
No other adults but children	298 (7.4%)	203 (4.8%)	340 (8.7%)	245 (6.8%)	362 (8.0%)
Other adults with children	1,046 (26.8%)	987 (22.5%)	2,184 (49.3%)	1,091 (26.9%)	1,649 (32.4%)
Not stated	18 (0.5%)	12 (0.3%)	11 (0.3%)	13 (0.4%)	10 (0.3%)

¹Abbreviation: BIPOC, Black, Indigenous, People of Color.

²Cell sizes are unweighted and may not align with the percentages, which are weighted using sample weights.

³Percentages may not sum to 100% due to rounding.

⁴Mean and 95% confidence interval for age. Sample size is equivalent to the sample size noted by country.

⁵Low educational attainment includes secondary education or less, medium includes some post-secondary education, high educational attainment includes university degree or above.

Supplemental table 5.4: Sociodemographic characteristics of adolescents aged 10 to 17 years participating in the International Food Policy Study in 2019, by country (n = 11,090)¹⁻³.

Country	Australia (n = 1,431)	Canada (n = 3,674)	Chile (n = 1,252)	Mexico (n = 1,616)	United Kingdom (n = 1,518)	United States (n = 1,599)
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Age⁴, years	13.4 (13.2-13.5)	13.5 (13.4-13.6)	13.5 (13.4-13.7)	13.5 (13.3-13.6)	13.4 (13.2-13.5)	13.5 (13.3-13.6)
Sex						
Male	787 (51.5%)	1,919 (51.0%)	665 (51.1%)	911 (50.4%)	750 (51.3%)	791 (51.2%)
Female	644 (48.5%)	1,755 (49.0%)	587 (48.9%)	705 (49.6%)	768 (48.7%)	808 (48.8%)
Racial/ethnic identity and cultural diversity						
BIPOC and/or speaks language other than English at home	235 (23.3%)	869 (25.3%)	141 (14.4%)	218 (21.2%)	155 (17.0%)	546 (48.0%)
White and/or English speaking	1,190 (76.3%)	2,735 (72.8%)	1,077 (83.2%)	1,349 (75.4%)	1,350 (82.2%)	1,047 (51.6%)
Not stated	6 (0.4%)	70 (1.9%)	34 (2.4%)	49 (3.4%)	13 (0.8%)	6 (0.5%)
Perceived income adequacy						
Not enough	362 (24.6%)	632 (17.3%)	374 (30.6%)	445 (28.4%)	417 (26.8%)	472 (29.6%)
Enough	1,057 (74.5%)	2,998 (81.4%)	866 (68.5%)	1160 (71.1%)	1,083 (72.0%)	1,116 (69.6%)
Not stated	12 (0.9%)	44 (1.3%)	12 (0.9%)	11 (0.5%)	18 (1.2%)	11 (0.7%)

¹Abbreviation: BIPOC, Black, Indigenous, People of Color.

²Cell sizes are unweighted and may not align with the percentages, which are weighted using sample weights.

³Percentages may not sum to 100% due to rounding.

⁴Mean and 95% confidence interval for age. Sample size is equivalent to the sample size noted by country.

Supplemental table 5.5: Sociodemographic characteristics of adolescents aged 10 to 17 years participating in the International Food Policy Study in 2020, by country (n = 12,017)¹⁻³.

Country	Australia (n = 1,590)	Canada (n = 3,890)	Chile (n = 1,615)	Mexico (n = 1,822)	United Kingdom (n = 1,518)	United States (n = 1,582)
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Age⁴, years	13.4 (13.3-13.5)	13.5 (13.4-13.5)	13.5 (13.4-13.6)	13.4 (13.3-13.6)	13.5 (13.4-13.6)	13.5 (13.3-13.6)
Sex						
Male	839 (51.3%)	1,950 (50.9%)	928 (51.1%)	1,013 (50.7%)	748 (51.2%)	838 (51.0%)
Female	751 (48.7%)	1,940 (49.1%)	687 (48.9%)	809 (49.3%)	770 (48.8%)	744 (49.0%)
Racial/ethnic identity and cultural diversity						
BIPOC and/or speaks language other than English at home	365 (25.7%)	1,088 (29.2%)	169 (14.5%)	221 (19.5%)	209 (17.1%)	340 (47.8%)
White and/or English speaking	1219 (73.9%)	2,745 (69.3%)	1,408 (83.5%)	1,557 (78.0%)	1,296 (82.1%)	1,240 (51.9%)
Not stated	6 (0.4%)	57 (1.5%)	38 (2.1%)	44 (2.6%)	13 (0.9%)	2 (0.3%)
Perceived income adequacy						
Not enough	316 (19.5%)	686 (17.9%)	513 (32.7%)	620 (37.7%)	342 (22.6%)	290 (22.7%)
Enough	1,257 (79.5%)	3,146 (80.5%)	1,080 (66.2%)	1,190 (61.7%)	1,159 (76.3%)	1,277 (76.4%)
Not stated	17 (1.1%)	58 (1.6%)	22 (1.2%)	12 (0.6%)	17 (1.1%)	15 (0.9%)

¹Abbreviation: BIPOC, Black, Indigenous, People of Color.

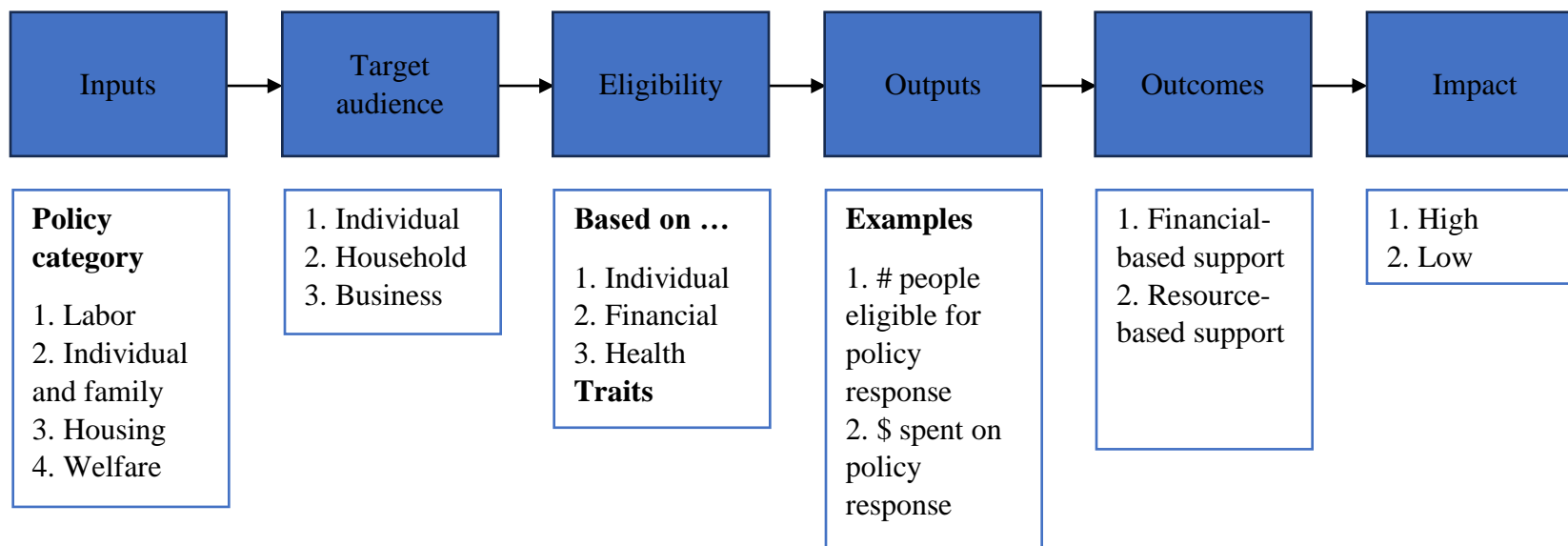
²Cell sizes are unweighted and may not align with the percentages, which are weighted using sample weights.

³Percentages may not sum to 100% due to rounding.

⁴Mean and 95% confidence interval for age. Sample size is equivalent to the sample size noted by country.

Supplemental materials for Chapter 6

Supplemental figure 6.1: Theory of change and supporting assumptions, risks, and external factors.



Assumptions	Risks	External factors
<ul style="list-style-type: none"> - Policy responses were implemented as intended. - Policy responses were sufficient to reach the outcomes specified. - Individuals were aware of the policy responses and chose to access them. - All relevant policy responses were captured in policy response trackers that were searched. - Policy responses unrelated to the COVID-19 pandemic did not have a substantive influence on food insecurity. 	<ul style="list-style-type: none"> - Policy responses were not implemented as intended and/or did not reach their intended audience. - Policy responses were sufficient to reach the outcomes specified. - Individuals were not aware of the policy responses, chose not to access them, or were incorrectly identified as ineligible. - Relevant policy responses were not captured in policy response trackers that were searched. - Policy responses unrelated to the COVID-19 pandemic had a substantive influence on food insecurity. 	<ul style="list-style-type: none"> - Lockdown measures and other safety measures. - Political desire and capacity to provide support during the COVID-19 pandemic. - Technological barriers and digital literacy that shaped ability to access the policy. - Sub-national policy-related decisions. E.g., implementation of a policy at the sub-national level. - Other crises, economic or geopolitical events during the COVID-19 pandemic.

Supplemental table 6.1: Theory of change sections and associated details.

Theory of change sections	Additional details
Context	The COVID-19 pandemic and associated safety measures.
Goal	Mitigate the negative consequences (e.g., interruptions to income) of the COVID-19 pandemic and related safety measures.
Inputs – policy category	One of the four policy categories adapted from Lindberg et al.: labor, individual and family, housing, welfare.
Inputs – policy type	More granular level policy response classification than the policy categories noted above, e.g., unemployment protection
Inputs – level of implementation	The level of government that implemented the policy response. Designated as national, national with sub-national implementation, sub-national.
Target audience – beneficiary	Who the policy was directed to or intended to benefit. Includes individuals, households, businesses. *It was assumed that policy responses directed to individuals benefited the individual’s household.
Eligibility restricted by ... characteristics	Determinants that influence eligibility for the policy response. Includes individual characteristics, financial characteristics, health characteristics, food-related characteristics.
Outputs	Metrics that were hypothetically within the control of the implementing agency, e.g., amount of funding for the policy response.
Outcomes – intended impact in the short-term	Description of what the policy response intended to accomplish, e.g., enable access to paid leave during the COVID-19 pandemic.
Outcomes – intermediate step between policy benefit delivery and influence on food insecurity	Policy responses may need to impact other factors, e.g., business profitability followed by the provision of employee wages, before influencing household food insecurity.
Outcomes – mechanism of influence category	Mechanism by which the policy response was hypothesized to influence food insecurity.

Outcomes – mechanism of influence detailed description	Description of how the policy response may have influenced food insecurity.
Outcomes – long-term	Anticipated influence of the policy response on food insecurity beyond the policy duration and/or COVID-19 pandemic.
Impact – scale	The portion of the population impacted or eligible for the policy response. I.e., entire population or subgroups of the population.
Impact – strength/ magnitude of impact	The metric is based on the level of implementation, beneficiary, intermediate step between policy response delivery and influence on food insecurity, mechanism of influence category, mechanism of influence detailed description, and scale of policy responses.

Supplemental table 6.2: Data extraction table outlining the information collected for policy responses.

Column heading	Additional details or elaboration
Country	Australia, Canada, Chile, Mexico, United Kingdom, United States
Policy response name	Name of the policy response.
Brief description	Two-three sentence summary stating the benefit provided and target population.
Second round screening - include/exclude	Include, exclude
Reason for exclusion	Reason for exclusion was specified. Where applicable, reference to the exclusion criteria noted in the theory of change was noted.
Policy category	One of the four policy categories adapted from Lindberg et al.: labor, individual and family, housing, welfare.
Policy type	More granular level policy classification than the policy categories noted above, e.g., unemployment protection.
Policy response duration	When was the policy response in place?
Month of policy start	Month or left blank where not applicable.
Year of policy start	Year or pre-dated COVID-19 pandemic noted. Not specified was an option.
Month of policy end	Month or left blank where not applicable.
Year of policy end	Year or ongoing noted. Not specified was an option.
Population targeted by the policy response	Who was the intended beneficiary of the policy response?
Eligibility criteria	Conditions that needed to be met to receive benefit of the policy response
Intent	What was the intended outcome of the policy response?
Coded intent	Individual, Individual and household, household, business then individual
Organization that implemented the policy response	Who implemented the policy response?
Mechanism of influence on food insecurity	Financial-based support, resource-based support, both
Long-term outcomes of policy	When policy is no longer active what is the hypothesized impact. Options drawn from the theory of change based on policy type.
Level of influence on food insecurity	High, low, both
Resource used to identify policy	World Bank database, policy tracker (specify), government webpage, academic literature
Row number in World Bank policy tracker	
Row number in Yale policy tracker	
Link to resource	
Also found in ...	Additional policy trackers that reported the policy response.

Supplemental materials for Chapter 7

Supplemental table 7.1: Proportion of adults aged 18 to 100 years living in food-insecure households by selected subgroup characteristics in 2018, by country, International Food Policy Study (n = 22,747)^{1,2}.

	Australia (n = 4,386)	Canada (n = 4,386)	Mexico (n = 4,132)	United Kingdom (n = 5,516)	United States (n = 4,630)
Sex	% (95% Confidence intervals)				
Female	40.9% (38.5-43.3%)	43.1% (40.5-45.6%)	71.7% (69.2-74.2%)	39.3% (37.1-41.5%)	47.7% (45.2-50.2%)
Male	42.1% (39.5-44.7%)	38.1% (35.5-40.7%)	73.0% (70.9-75.1%)	40.5% (38.2-42.8%)	47.1% (44.4-49.7%)
Racial-ethnic identity³	% (95% Confidence intervals)				
BIPOC and/or speaks language other than English at home	50.0% (45.5-54.6%)	49.4% (45.4-53.3%)	83.7% (80.3-87.1%)	58.3% (53.1-63.5%)	57.2% (53.8-60.7%)
White and/or English speaking	38.6% (36.8-40.4%)	37.8% (35.8-39.9%)	69.1% (67.2-70.9%)	37.7% (36.1-39.4%)	42.1% (40.0-44.1%)
Educational attainment⁴	% (95% Confidence intervals)				
Low	40.8% (37.8-43.9%)	48.9% (45.4-52.4%)	82.7% (79.6-85.8%)	41.3% (38.6-44.0%)	51.7% (49.0-54.5%)
Medium	42.1% (39.3-45.0%)	38.2% (35.7-40.6%)	80.4% (76.3-84.6%)	42.7% (39.8-45.5%)	48.7% (45.4-52.0%)
High	41.5% (38.5-44.5%)	29.3% (26.9-31.6%)	67.7% (65.6-69.8%)	35.4% (33.3-37.5%)	38.9% (36.6-41.2%)
Employment status	% (95% Confidence intervals)				
Working	42.7% (40.2-45.2%)	40.8% (38.4-43.2%)	71.1% (69.2-73.0%)	44.5% (42.2-46.7%)	46.8% (44.2-49.4%)
Not working	36.0% (33.3-38.7%)	34.5% (31.7-37.4%)	73.6% (70.0-77.3%)	28.7% (26.4-31.0%)	43.1% (40.3-45.9%)
Unemployed	59.5% (53.5-65.6%)	63.1% (56.6-69.7%)	80.4% (73.6-87.3%)	62.9% (57.7-68.1%)	65.4% (59.4-71.4%)
Perceived income adequacy	% (95% Confidence intervals)				
Difficult	71.9% (68.9-74.8%)	76.7% (73.7-79.6%)	84.0% (81.8-86.2%)	77.2% (74.6-79.9%)	76.9% (74.0-79.7%)
Neither	37.5% (34.6-40.4%)	36.6% (33.6-39.6%)	68.0% (65.3-70.7%)	36.6% (34.0-39.2%)	43.4% (40.3-46.6%)
Easy	20.5% (18.0-23.0%)	15.4% (13.2-17.5%)	52.4% (48.2-56.5%)	18.7% (16.7-20.7%)	26.4% (23.8-29.0%)
Living arrangement	% (95% Confidence intervals)				
No other adults or children	45.2% (41.4-49.1%)	44.3% (40.6-48.0%)	73.9% (67.1-80.7%)	40.0% (36.6-43.3%)	47.9% (44.1-51.8%)
Other adults but no children	33.4% (30.8-35.9%)	34.2% (31.5-36.8%)	68.5% (65.6-71.5%)	30.5% (28.3-32.8%)	40.9% (38.2-43.7%)
No other adults but children	65.9% (59.5-72.3%)	60.1% (52.5-67.7%)	70.5% (62.9-78.1%)	58.0% (51.7-64.2%)	60.7% (53.0-68.4%)
Other adults with children	46.9% (43.5-50.3%)	44.9% (41.2-48.6%)	74.9% (72.8-77.0%)	51.5% (48.3-54.6%)	55.1% (51.7-58.6%)

¹Food insecurity corresponds to 1 or more affirmations to questions in the Household Food Security Survey Module. ²Not stated category estimates were suppressed due to small cells counts among some subgroups. ³Abbreviation: BIPOC, Black, Indigenous, People of Color. ⁴Low: secondary education or less; medium: some post-secondary education; high: university degree or above.

Supplemental table 7.2: Proportion of adults aged 18 to 100 years living in food-insecure households by selected subgroup characteristics in 2019, by country, International Food Policy Study (n = 19,225)^{1,2}.

	Australia (n =3,479)	Canada (n =3,908)	Mexico (n =4,210)	United Kingdom (n = 3,703)	United States (n = 3,925)
Sex	% (95% Confidence intervals)				
Female	47.1% (44.5-49.7%)	46.1% (43.6-48.6%)	72.3% (69.9-74.8%)	39.8% (37.2-42.5%)	52.3% (49.8-54.8%)
Male	47.7% (45.0-50.4%)	43.8% (41.3-46.3%)	69.2% (67.0-71.4%)	41.3% (38.5-44.1%)	49.0% (46.2-51.8%)
Racial-ethnic identity³	% (95% Confidence intervals)				
BIPOC and/or speaks language other than English at home	56.2% (51.7-60.7%)	52.9% (49.0-56.8%)	79.2% (75.6-82.9%)	59.5% (53.5-65.5%)	65.2% (62.0-68.5%)
White and/or English speaking	44.2% (42.3-46.2%)	42.7% (40.7-44.7%)	68.4% (66.5-70.3%)	37.9% (35.9-39.9%)	42.5% (40.4-44.7%)
Educational attainment⁴	% (95% Confidence intervals)				
Low	50.3% (47.1-53.5%)	53.6% (50.4-56.8%)	77.4% (74.1-80.8%)	43.2% (40.0-46.4%)	57.8% (55.0-60.5%)
Medium	47.8% (44.8-50.8%)	42.9% (40.3-45.5%)	80.5% (76.4-84.5%)	43.7% (40.2-47.1%)	44.8% (41.3-48.3%)
High	41.7% (38.4-45.0%)	32.3% (29.6-34.9%)	66.5% (64.4-68.7%)	33.0% (30.5-35.5%)	39.4% (36.9-41.9%)
Employment status	% (95% Confidence intervals)				
Working	48.1% (45.4-50.7%)	44.3% (41.8-46.7%)	69.2% (67.2-71.2%)	44.3% (41.6-47.0%)	52.4% (49.6-55.2%)
Not working	40.4% (37.4-43.4%)	38.8% (36.0-41.6%)	72.6% (69.1-76.1%)	30.0% (27.2-32.9%)	46.5% (43.7-49.3%)
Unemployed	66.6% (61.6-71.6%)	70.9% (65.3-76.6%)	80.3% (73.5-87.1%)	61.7% (55.4-68.1%)	59.7% (53.7-65.8%)
Perceived income adequacy	% (95% Confidence intervals)				
Difficult	74.5% (71.5-77.4%)	78.9% (76.3-81.5%)	83.8% (81.7-86.0%)	78.9% (75.6-82.1%)	80.6% (78.0-83.3%)
Neither	44.9% (41.8-48.0%)	39.3% (36.5-42.2%)	66.7% (64.0-69.5%)	42.1% (38.8-45.3%)	49.3% (46.0-52.5%)
Easy	23.5% (20.6-26.5%)	19.0% (16.4-21.5%)	48.8% (44.7-52.9%)	14.1% (12.0-16.2%)	25.2% (22.6-27.9%)
Living arrangement	% (95% Confidence intervals)				
No other adults or children	45.5% (41.4-49.6%)	49.5% (45.7-53.2%)	68.1% (60.0-76.2%)	38.2% (34.0-42.4%)	45.1% (41.1-49.0%)
Other adults but no children	42.4% (39.6-45.2%)	39.3% (36.7-41.8%)	68.0% (65.0-71.0%)	29.2% (26.5-31.9%)	43.2% (40.4-46.0%)
No other adults but children	69.7% (63.7-75.7%)	59.2% (52.6-65.9%)	74.6% (68.2-80.9%)	61.7% (54.5-68.9%)	66.2% (59.8-72.5%)
Other adults with children	51.0% (47.3-54.6%)	48.5% (45.0-52.1%)	72.4% (70.2-74.5%)	54.0% (50.3-57.7%)	63.6% (60.2-67.0%)

¹Food insecurity corresponds to 1 or more affirmations to questions in the Household Food Security Survey Module. ²Not stated category estimates were suppressed due to small cells counts among some subgroups. ³Abbreviation: BIPOC, Black, Indigenous, People of Color. ⁴Low: secondary education or less; medium: some post-secondary education; high: university degree or above.

Supplemental table 7.3: Proportion of adults aged 18 to 100 years living in food-insecure households by selected subgroup characteristics in 2020, by country, International Food Policy Study (n = 21,306)^{1,2}.

	Australia (n = 4,083)	Canada (n = 4,276)	Mexico (n = 4,279)	United Kingdom (n = 4,075)	United States (n = 4,593)
Sex	% (95% Confidence intervals)				
Female	39.2% (37.0-41.4%)	39.7% (37.3-42.1%)	76.2% (73.9-78.5%)	36.6% (34.4-38.9%)	53.7% (51.4-56.0%)
Male	37.6% (35.2-39.9%)	39.7% (37.2-42.2%)	72.9% (70.8-75.0%)	36.5% (34.2-38.9%)	51.1% (48.7-53.6%)
Racial-ethnic identity³	% (95% Confidence intervals)				
BIPOC and/or speaks language other than English at home	49.7% (45.8-53.6%)	52.0% (48.2-55.7%)	85.6% (82.3-88.9%)	53.8% (48.6-59.0%)	60.3% (57.4-63.2%)
White and/or English speaking	34.3% (32.6-35.9%)	36.2% (34.2-38.2%)	71.9% (70.1-73.7%)	34.3% (32.6-36.0%)	47.8% (45.8-49.9%)
Educational attainment⁴	% (95% Confidence intervals)				
Low	35.3% (32.9-37.7%)	47.4% (44.1-50.6%)	84.5% (82.0-87.1%)	36.3% (33.8-38.9%)	58.6% (56.0-61.1%)
Medium	40.1% (37.2-43.0%)	34.3% (32.0-36.7%)	81.6% (77.8-85.3%)	37.5% (34.5-40.5%)	48.8% (45.3-52.2%)
High	41.1% (37.9-44.4%)	33.5% (30.8-36.1%)	69.4% (67.3-71.5%)	36.0% (33.3-38.8%)	43.6% (41.2-46.0%)
Employment status	% (95% Confidence intervals)				
Working	40.5% (38.2-42.9%)	40.3% (37.9-42.7%)	72.2% (70.2-74.2%)	40.2% (37.9-42.6%)	52.2% (49.7-54.7%)
Not working	30.4% (27.9-32.8%)	31.9% (29.2-34.7%)	77.2% (74.2-80.1%)	26.4% (24.0-28.7%)	46.5% (43.9-49.1%)
Unemployed	55.4% (50.5-60.3%)	61.8% (56.6-66.9%)	82.8% (78.3-87.4%)	57.6% (52.3-62.9%)	72.6% (67.8-77.4%)
Perceived income adequacy	% (95% Confidence intervals)				
Difficult	73.5% (70.4-76.6%)	75.5% (72.4-78.6%)	86.1% (84.2-87.9%)	76.4% (73.3-79.6%)	81.4% (79.0-83.8%)
Neither	36.0% (33.5-38.5%)	38.2% (35.5-40.9%)	68.3% (65.5-71.1%)	38.0% (35.4-40.7%)	47.2% (44.3-50.1%)
Easy	21.5% (19.2-23.8%)	14.4% (12.4-16.4%)	48.9% (44.2-53.5%)	14.6% (12.7-16.4%)	31.0% (28.4-33.7%)
Living arrangement	% (95% Confidence intervals)				
No other adults or children	38.0% (34.5-41.5%)	41.8% (38.1-45.5%)	66.8% (58.9-74.6%)	33.2% (29.6-36.7%)	48.7% (44.7-52.7%)
Other adults but no children	32.0% (29.6-34.3%)	33.8% (31.3-36.3%)	74.7% (72.1-77.3%)	28.1% (25.8-30.3%)	44.6% (41.8-47.3%)
No other adults but children	55.9% (49.9-61.8%)	60.4% (52.7-68.1%)	78.2% (72.1-84.3%)	56.4% (49.7-63.1%)	64.8% (59.2-70.4%)
Other adults with children	44.7% (41.5-47.9%)	45.6% (42.1-49.1%)	74.9% (72.8-77.0%)	48.6% (45.4-51.8%)	61.2% (58.5-63.9%)

¹Food insecurity corresponds to 1 or more affirmations to questions in the Household Food Security Survey Module. ²Not stated category estimates were suppressed due to small cells counts among some subgroups. ³Abbreviation: BIPOC, Black, Indigenous, People of Color. ⁴Low: secondary education or less; medium: some post-secondary education; high: university degree or above.

Supplemental table 7.4: Proportion of adults aged 18 to 100 years living in food-insecure households by selected subgroup characteristics in 2021, by country, International Food Policy Study (n = 20,589)^{1,2}.

	Australia (n = 3,784)	Canada (n = 4,537)	Mexico (n = 4,165)	United Kingdom (n = 4,032)	United States (n = 4,071)
Sex	% (95% Confidence intervals)				
Female	44.4% (42.0-46.8%)	43.6% (41.0-46.2%)	72.0% (69.5-74.5%)	44.6% (42.2-47.1%)	48.7% (46.1-51.2%)
Male	46.7% (44.1-49.3%)	41.7% (39.1-44.3%)	67.1% (64.8-69.3%)	44.0% (41.4-46.6%)	45.5% (43.0-48.1%)
Racial-ethnic identity³	% (95% Confidence intervals)				
BIPOC and/or speaks language other than English at home	53.4% (49.3-57.5%)	54.3% (50.4-58.1%)	85.2% (81.9-88.4%)	59.7% (54.3-65.0%)	61.5% (58.1-64.9%)
White and/or English speaking	42.4% (40.5-44.2%)	39.0% (36.9-41.1%)	65.8% (63.9-67.7%)	42.4% (40.5-44.3%)	39.4% (37.4-41.3%)
Educational attainment⁴	% (95% Confidence intervals)				
Low	47.7% (44.6-50.8%)	51.2% (47.7-54.8%)	81.7% (78.7-84.7%)	47.7% (44.7-50.7%)	57.2% (54.5-59.9%)
Medium	45.9% (43.0-48.9%)	39.1% (36.6-41.5%)	74.4% (69.8-79.0%)	43.9% (40.6-47.1%)	40.4% (36.7-44.0%)
High	41.3% (38.3-44.2%)	32.4% (30.0-34.8%)	64.8% (62.7-67.0%)	38.9% (36.4-41.3%)	33.1% (30.7-35.6%)
Employment status	% (95% Confidence intervals)				
Working	49.1% (46.5-51.6%)	43.3% (40.8-45.7%)	67.2% (65.2-69.2%)	50.5% (48.0-53.0%)	48.1% (45.5-50.7%)
Not working	36.2% (33.5-38.9%)	32.4% (29.5-35.3%)	72.9% (69.5-76.4%)	31.6% (28.9-34.3%)	40.0% (37.3-42.8%)
Unemployed	62.0% (56.6-67.3%)	72.1% (66.5-77.8%)	81.7% (75.2-88.3%)	65.0% (59.1-70.8%)	70.8% (65.2-76.4%)
Perceived income adequacy	% (95% Confidence intervals)				
Difficult	81.9% (79.1-84.7%)	80.8% (77.9-83.6%)	84.6% (82.3-86.8%)	80.9% (77.9-83.9%)	84.6% (82.1-87.2%)
Neither	48.2% (45.2-51.3%)	40.9% (37.8-44.0%)	66.1% (63.4-68.8%)	47.5% (44.4-50.6%)	50.9% (47.6-54.3%)
Easy	22.5% (20.1-24.9%)	15.7% (13.7-17.7%)	45.9% (42.0-49.7%)	22.9% (20.7-25.2%)	22.6% (20.5-24.8%)
Living arrangement	% (95% Confidence intervals)				
No other adults or children	43.9% (40.2-47.7%)	43.4% (39.6-47.1%)	58.5% (50.2-66.8%)	37.4% (33.6-41.2%)	41.2% (37.1-45.2%)
Other adults but no children	37.7% (34.9-40.4%)	37.8% (35.1-40.5%)	67.2% (64.2-70.2%)	32.4% (29.7-35.1%)	40.9% (38.2-43.6%)
No other adults but children	67.4% (61.5-73.4%)	65.4% (58.9-72.0%)	74.2% (67.6-80.8%)	70.6% (64.8-76.5%)	63.9% (57.4-70.4%)
Other adults with children	52.0% (48.7-55.3%)	46.2% (42.5-49.9%)	71.8% (69.6-73.9%)	59.1% (55.9-62.3%)	56.5% (53.2-59.8%)

¹Food insecurity corresponds to 1 or more affirmations to questions in the Household Food Security Survey Module. ²Not stated category estimates were suppressed due to small cells counts among some subgroups. ³Abbreviation: BIPOC, Black, Indigenous, People of Color. ⁴Low: secondary education or less; medium: some post-secondary education; high: university degree or above.

Supplemental table 7.5: Proportion of adults aged 18 to 100 years living in food-insecure households by selected subgroup characteristics in 2022, by country, International Food Policy Study (n = 20,551)^{1,2}.

	Australia (n = 4,043)	Canada (n = 4,310)	Mexico (n = 4,098)	United Kingdom (n = 4,158)	United States (n = 3,942)
Sex	% (95% Confidence intervals)				
Female	51.5% (49.2-53.9%)	50.8% (48.2-53.3%)	76.3% (74.0-78.7%)	47.5% (45.2-49.8%)	60.6% (58.2-63.0%)
Male	50.6% (48.1-53.1%)	51.9% (49.2-54.6%)	71.9% (69.8-74.1%)	46.9% (44.4-49.3%)	59.7% (57.3-62.2%)
Racial-ethnic identity³	% (95% Confidence intervals)				
BIPOC and/or speaks language other than English at home	58.0% (54.1-61.9%)	56.6% (53.0-60.2%)	86.3% (82.9-89.7%)	62.4% (57.7-67.1%)	69.5% (66.3-72.7%)
White and/or English speaking	48.1% (46.3-49.9%)	49.4% (47.2-51.6%)	71.2% (69.4-73.0%)	44.7% (42.9-46.5%)	54.8% (52.8-56.8%)
Educational attainment⁴	% (95% Confidence intervals)				
Low	52.4% (49.3-55.4%)	58.9% (55.3-62.5%)	84.5% (81.7-87.2%)	49.1% (46.0-52.1%)	65.8% (63.2-68.4%)
Medium	54.7% (51.9-57.6%)	50.3% (47.7-52.9%)	77.4% (72.9-81.9%)	49.3% (46.1-52.4%)	57.6% (53.9-61.3%)
High	45.4% (42.4-48.4%)	41.1% (38.5-43.7%)	70.1% (68.1-72.2%)	43.0% (40.6-45.3%)	51.8% (49.2-54.4%)
Employment status	% (95% Confidence intervals)				
Working	53.2% (50.8-55.5%)	54.9% (52.5-57.3%)	72.2% (70.3-74.2%)	53.2% (50.9-55.5%)	62.6% (60.1-65.1%)
Not working	43.7% (40.9-46.5%)	42.2% (39.2-45.3%)	77.3% (74.1-80.5%)	33.9% (31.3-36.5%)	52.4% (49.6-55.2%)
Unemployed	69.7% (64.1-75.3%)	73.1% (67.1-79.1%)	81.9% (76.0-87.9%)	69.5% (64.3-74.7%)	76.9% (72.0-81.8%)
Perceived income adequacy	% (95% Confidence intervals)				
Difficult	81.0% (78.5-83.4%)	83.9% (81.6-86.2%)	88.4% (86.6-90.3%)	78.2% (75.6-80.7%)	84.9% (82.7-87.1%)
Neither	48.6% (45.7-51.6%)	49.7% (46.6-52.8%)	67.9% (65.2-70.6%)	40.9% (38.2-43.5%)	55.2% (52.0-58.5%)
Easy	29.3% (26.6-32.0%)	22.2% (19.7-24.8%)	49.4% (45.1-53.7%)	24.3% (21.8-26.8%)	40.3% (37.4-43.2%)
Living arrangement	% (95% Confidence intervals)				
No other adults or children	48.4% (44.8-52.1%)	51.3% (47.5-55.2%)	68.9% (61.3-76.5%)	41.2% (37.6-44.7%)	54.0% (50.2-57.7%)
Other adults but no children	43.4% (40.7-46.1%)	46.5% (43.7-49.3%)	72.3% (69.5-75.1%)	37.7% (35.2-40.2%)	53.8% (51.0-56.6%)
No other adults but children	69.5% (64.1-74.8%)	69.2% (62.6-75.8%)	77.1% (70.9-83.3%)	70.7% (64.7-76.7%)	80.0% (75.0-85.1%)
Other adults with children	58.8% (55.7-61.9%)	57.4% (53.9-60.9%)	75.5% (73.4-77.6%)	59.6% (56.7-62.5%)	68.5% (65.5-71.5%)

¹Food insecurity corresponds to 1 or more affirmations to questions in the Household Food Security Survey Module. ²Not stated category estimates were suppressed due to small cells counts among some subgroups. ³Abbreviation: BIPOC, Black, Indigenous, People of Color. ⁴Low: secondary education or less; medium: some post-secondary education; high: university degree of above.

Supplemental table 7.6: Proportion of adolescents aged 10 to 17 years experiencing food insecurity by selected subgroup characteristics in 2019, by country, International Food Policy Study (n = 11,090)^{1,2}.

	Australia (n = 1,431)	Canada (n = 3,674)	Chile (n = 1,252)	Mexico (n = 1,616)	United Kingdom (n = 1,518)	United States (n = 1,599)
Sex	% (95% Confidence intervals)					
Female	44.9% (40.9-48.9%)	36.7% (34.4-39.0%)	74.4% (70.7-78.1%)	63.5% (59.4-67.7%)	46.6% (42.7-50.4%)	51.8% (48.1-55.6%)
Male	46.1% (42.4-49.7%)	36.1% (33.9- 38.3%)	67.3% (63.5-71.1%)	63.6% (59.9-67.3%)	44.1% (40.4-47.9%)	48.8% (45.0-52.6%)
Racial-ethnic identity³	% (95% Confidence intervals)					
BIPOC and/or speaks language other than English at home	46.4% (39.6-53.2%)	39.0% (35.6- 42.3%)	70.4% (62.3-78.5%)	68.2% (60.5-75.9%)	46.9% (38.4-55.3%)	51.7% (47.3-56.1%)
White and/or English speaking	45.3% (42.4-48.2%)	35.4% (33.6- 37.3%)	70.5% (67.7-73.3%)	62.1% (59.2-65.0%)	44.9% (42.1- 47.7%)	49.0% (45.8-52.2%)
Perceived income adequacy	% (95% Confidence intervals)					
Not enough	84.0% (80.0-88.0%)	81.6% (78.6-84.7%)	91.5% (88.4-94.6%)	92.4% (89.8-95.1%)	81.1% (77.1-85.1%)	82.4% (78.5-86.2%)
Enough	32.9% (29.9-35.9%)	26.5% (24.9-28.1%)	61.5% (58.1-64.9%)	52.0% (48.5-55.5%)	31.9% (28.9-34.9%)	36.6% (33.5-39.7%)

¹Food insecurity corresponds to 1 or more affirmations to questions on the Child Food Insecurity Experiences Scale.

²Not stated category estimates were suppressed due to small cells counts among some subgroups.

³Abbreviation: BIPOC, Black, Indigenous, People of Color.

Supplemental table 7.7: Proportion of adolescents aged 10 to 17 years experiencing food insecurity by selected subgroup characteristics in 2020, by country, International Food Policy Study (n = 12,017)^{1,2}.

	Australia (n = 1,590)	Canada (n = 3,890)	Chile (n = 1,615)	Mexico (n = 1,822)	United Kingdom (n = 1,518)	United States (n = 1,582)
Sex	% (95% Confidence intervals)					
Female	46.8% (43.1-50.4%)	35.7% (33.5-37.8%)	73.7% (70.3-77.1%)	73.3% (69.8-76.8%)	42.2% (38.6-45.9%)	47.0% (42.4-51.6%)
Male	45.3% (41.9-48.8%)	34.4% (32.2-36.6%)	67.0% (63.8-70.1%)	72.9% (69.7-76.0%)	38.7% (35.1-42.4%)	45.1% (41.0-49.3%)
Racial-ethnic identity³	% (95% Confidence intervals)					
BIPOC and/or speaks language other than English at home	54.9% (49.7-60.1%)	42.1% (39.1-45.1%)	77.7% (71.1-84.4%)	85.7% (80.4-90.9%)	51.6% (44.6-58.6%)	44.9% (39.4-50.5%)
White and/or English speaking	42.8% (40.0-45.7%)	32.1% (30.3-33.9%)	68.9% (66.4-71.4%)	69.9% (67.2-72.5%)	38.0% (35.3-40.8%)	47.1% (44.1-50.2%)
Perceived income adequacy	% (95% Confidence intervals)					
Not enough	87.5% (83.8-91.3%)	79.6% (76.5-82.7%)	93.3% (91.0-95.5%)	92.4% (90.0-94.7%)	83.0% (78.8-87.2%)	77.7% (71.5-83.8%)
Enough	35.9% (33.2-38.6%)	25.0% (23.5-26.6%)	58.9% (55.8-61.9%)	61.3% (58.0-64.6%)	28.0% (25.3-30.7%)	36.5% (33.3-39.8%)

¹Food insecurity corresponds to 1 or more affirmations to questions on the Child Food Insecurity Experiences Scale.

²Not stated category estimates were suppressed due to small cells counts among some subgroups.

³Abbreviation: BIPOC, Black, Indigenous, People of Color.

Supplemental table 7.8: Proportion of adolescents aged 10 to 17 years experiencing food insecurity by selected subgroup characteristics in 2021, by country, International Food Policy Study (n = 10,190)^{1,2}.

	Australia (n = 831)	Canada (n = 3,252)	Chile (n = 1,095)	Mexico (n = 1,615)	United Kingdom (n = 1,563)	United States (n = 1,734)
Sex	% (95% Confidence intervals)					
Female	47.0% (41.9-52.1%)	37.8% (35.3-40.4%)	60.7% (55.7-65.6%)	68.5% (64.3-72.7%)	42.6% (38.8-46.3%)	50.4% (46.8-54.1%)
Male	50.0% (45.1-55.0%)	37.4% (35.1-39.7%)	60.2% (55.9-64.5%)	64.6% (60.8-68.4%)	42.3% (38.6-46.0%)	50.9% (47.3-54.4%)
Racial-ethnic identity³	% (95% Confidence intervals)					
BIPOC and/or speaks language other than English at home	54.6% (46.7-62.5%)	39.1% (35.8-42.4%)	73.8% (65.0-82.7%)	68.9% (60.5-77.3%)	51.3% (43.8-58.8%)	54.2% (50.2-58.3%)
White and/or English speaking	46.6% (42.7-50.6%)	37.0% (35.0-39.0%)	58.4% (54.9-61.9%)	65.9% (63.0-68.8%)	40.7% (37.9-43.5%)	47.2% (44.1-50.3%)
Perceived income adequacy	% (95% Confidence intervals)					
Not enough	88.7% (84.2-93.2%)	82.2% (79.2-85.3%)	89.7% (85.6-93.7%)	89.3% (85.9-92.7%)	81.2% (76.8-85.6%)	81.9% (78.3-85.5%)
Enough	37.2% (33.2-41.1%)	27.4% (25.7-29.1%)	52.6% (48.8-56.4%)	56.0% (52.4-59.5%)	31.7% (28.9-34.5%)	36.8% (33.8-39.8%)

¹Food insecurity corresponds to 1 or more affirmations to questions on the Child Food Insecurity Experiences Scale.

²Not stated category estimates were suppressed due to small cells counts among some subgroups.

³Abbreviation: BIPOC, Black, Indigenous, People of Color.

Supplemental table 7.9: Proportion of adolescents aged 10 to 17 years experiencing food insecurity by selected subgroup characteristics in 2022, by country, International Food Policy Study (n = 11,462)^{1,2}.

	Australia (n = 1,380)	Canada (n = 3,563)	Chile (n = 1,583)	Mexico (n = 1,603)	United Kingdom (n = 1,597)	United States (n = 1,736)
Sex	% (95% Confidence intervals)					
Female	50.0% (46.0-54.0%)	42.7% (40.3-45.1%)	69.3% (65.6-73.1%)	64.4% (60.1-68.8%)	48.9% (45.1-52.7%)	51.6% (47.8-55.4%)
Male	50.4% (46.7-54.1%)	39.2% (36.9-41.5%)	65.8% (62.4-69.1%)	66.6% (63.1-70.0%)	49.4% (45.6-53.2%)	56.1% (52.1-60.1%)
Racial-ethnic identity³	% (95% Confidence intervals)					
BIPOC and/or speaks language other than English at home	53.9% (48.7-59.1%)	45.4% (42.5-48.3%)	79.3% (72.3-86.3%)	72.9% (65.3-80.5%)	56.4% (49.5-63.2%)	55.5% (50.8-60.2%)
White and/or English speaking	48.5% (45.3-51.7%)	38.7% (36.7-40.8%)	65.7% (63.0-68.3%)	63.8% (60.8-66.7%)	46.9% (44.1-49.7%)	52.2% (49.2-55.2%)
Perceived income adequacy	% (95% Confidence intervals)					
Not enough	85.4% (81.4-89.3%)	80.5% (77.8-83.3%)	93.6% (91.3-95.8%)	94.9% (92.9-97.0%)	81.3% (77.5-85.0%)	83.7% (80.0-87.5%)
Enough	38.8% (35.7-41.9%)	28.6% (26.8-30.3%)	51.4% (48.0-54.8%)	50.9% (47.3-54.4%)	35.5% (32.3-38.6%)	40.7% (37.5-43.9%)

¹Food insecurity corresponds to 1 or more affirmations to questions on the Child Food Insecurity Experiences Scale.

²Not stated category estimates were suppressed due to small cells counts among some subgroups.

³Abbreviation: BIPOC, Black, Indigenous, People of Color.

Supplemental table 7.10: Select determinants and consequences of food insecurity among adults aged 18 to 100 years participating in the International Food Policy Study in 2018, 2019, 2020, 2021, and 2022, in Australia (n = 19,472)¹.

Year	2018 (n = 4,083)	2019 (n = 3,479)	2020 (n = 4,083)	2021 (n = 3,784)	2022 (n = 4,043)
	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
Employment status					
Working	49.2% (47.4-51.0%)	47.9% (46.1-49.8%)	49.4% (47.7-51.0%)	48.0% (46.2-49.7%)	53.6% (51.9-55.3%)
Not working	40.8% (39.1-42.5%)	37.5% (35.7-39.3%)	38.3% (36.7-39.9%)	38.8% (37.1-40.5%)	36.5% (34.8-38.1%)
Unemployed	9.0% (7.9-10.1%)	13.0% (11.7-14.3%)	11.2% (10.1-12.2%)	11.8% (10.6-13.0%)	8.6% (7.7-9.6%)
Not stated	1.0% (0.6-1.4%)	1.6% (1.1-2.0%)	1.1% (0.8-1.5%)	1.4% (0.9-1.9%)	1.3% (0.8-1.7%)
Perceived income adequacy					
Difficult	27.9% (26.3-29.4%)	30.4% (28.6-32.1%)	20.7% (19.4-22.1%)	22.9% (21.5-24.4%)	28.3% (26.8-29.9%)
Neither	37.0% (35.3-38.7%)	38.1% (36.3-39.9%)	41.1% (39.5-42.7%)	35.3% (33.6-37.0%)	35.7% (34.1-37.4%)
Easy	34.0% (32.3-35.6%)	30.4% (28.7-32.1%)	37.0% (35.4-38.5%)	40.4% (38.7-42.2%)	34.9% (33.3-36.5%)
Not stated	1.2% (0.7-1.7%)	1.1% (0.7-1.5%)	1.2% (0.8-1.6%)	1.3% (0.9-1.8%)	1.1% (0.7-1.5%)
Self-reported general health					
Poor	30.6% (29.0-32.2%)	32.8% (31.0-34.5%)	30.6% (29.1-32.1%)	30.1% (28.4-31.7%)	29.2% (27.6-30.7%)
Good	68.1% (66.4-69.7%)	65.8% (64.1-67.6%)	68.1% (66.6-69.6%)	68.7% (67.1-70.3%)	69.5% (67.9-71.1%)
Not stated	1.3% (0.9-1.7%)	1.4% (1.0-1.8%)	1.3% (0.9-1.7%)	1.2% (0.8-1.7%)	1.4% (1.0-1.8%)
Self-reported mental health					
Poor	24.9% (23.4-26.5%)	29.3% (27.6-31.0%)	26.0% (24.6-27.4%)	29.4% (27.8-31.1%)	28.8% (27.2-30.3%)
Good	73.9% (72.3-75.4%)	69.5% (67.7-71.2%)	73.0% (71.5-74.4%)	69.2% (67.5-70.8%)	69.9% (68.4-71.5%)
Not stated	1.2% (0.8-1.6%)	1.3% (0.8-1.7%)	1.0% (0.7-1.3%)	1.4% (0.9-1.8%)	1.3% (0.9-1.7%)
Perceived stress					
Low stress	82.3% (80.9-83.7%)	79.8% (78.3-81.3%)	83.4% (82.2-84.6%)	80.0% (78.5-81.4%)	81.7% (80.4-83.1%)
High stress	16.7% (15.4-18.1%)	19.1% (17.6-20.6%)	15.3% (14.2-16.5%)	18.9% (17.5-20.3%)	16.8% (15.4-18.1%)
Not stated	1.0% (0.6-1.3%)	1.1% (0.7-1.5%)	1.3% (0.9-1.7%)	1.2% (0.8-1.5%)	1.5% (1.1-1.9%)
Perceived diet healthfulness					
Poor	31.2% (29.5-32.8%)	31.9% (30.2-33.7%)	29.6% (28.1-31.1%)	30.9% (29.3-32.5%)	30.3% (28.7-31.9%)
Good	67.6% (65.9-69.2%)	67.0% (65.3-68.8%)	69.2% (67.7-70.7%)	67.8% (66.2-69.5%)	68.4% (66.8-70.0%)
Not stated	1.2% (0.8-1.7%)	1.1% (0.7-1.4%)	1.2% (0.8-1.5%)	1.3% (0.9-1.7%)	1.3% (0.9-1.7%)

¹Percentages may not sum to 100% due to rounding.

Supplemental table 7.11: Select determinants and consequences of food insecurity among adults aged 18 to 100 years participating in the International Food Policy Study in 2018, 2019, 2020, 2021, and 2022, in Canada (n = 21,417)¹.

Year	2018 (n = 4,386)	2019 (n = 3,908)	2020 (n = 4,276)	2021 (n = 4,537)	2022 (n = 4,310)
	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
Employment status					
Working	46.2% (44.5-48.0%)	46.1% (44.3-47.8%)	43.5% (41.8-45.2%)	45.6% (43.8-47.4%)	48.0% (46.1-49.8%)
Not working	41.4% (39.6-43.2%)	42.4% (40.7-44.2%)	42.2% (40.4-43.9%)	40.5% (38.7-42.3%)	40.9% (39.0-42.7%)
Unemployed	10.7% (9.4-12.1%)	9.8% (8.7-11.0%)	12.0% (10.8-13.2%)	11.5% (10.1-12.8%)	9.3% (8.0-10.5%)
Not stated	1.7% (1.1-2.2%)	1.6% (1.1-2.2%)	2.3% (1.7-2.9%)	2.4% (1.8-3.1%)	1.8% (1.2-2.5%)
Perceived income adequacy					
Difficult	28.1% (26.4-29.8%)	30.1% (28.4-31.7%)	24.8% (23.2-26.4%)	27.4% (25.7-29.2%)	30.6% (28.8-32.4%)
Neither	36.6% (34.9-38.3%)	38.2% (36.4-39.9%)	40.0% (38.3-41.7%)	34.9% (33.2-36.6%)	36.6% (34.8-38.4%)
Easy	34.2% (32.5-35.8%)	31.0% (29.5-32.6%)	33.7% (32.1-35.3%)	36.8% (35.1-38.4%)	31.6% (29.9-33.2%)
Not stated	1.1% (0.7-1.5%)	0.7% (0.5-1.0%)	1.5% (1.0-1.9%)	0.9% (0.6-1.2%)	1.2% (0.7-1.7%)
Self-reported general health					
Poor	29.6% (27.9-31.3%)	30.5% (28.9-32.2%)	29.1% (27.5-30.8%)	31.3% (29.6-33.1%)	27.0% (25.3-28.8%)
Good	69.2% (67.4-70.9%)	68.3% (66.6-70.0%)	69.3% (67.6-71.0%)	67.6% (65.8-69.4%)	71.0% (69.3-72.8%)
Not stated	1.2% (0.8-1.7%)	1.2% (0.8-1.6%)	1.6% (1.1-2.1%)	1.0% (0.7-1.4%)	1.9% (1.3-2.5%)
Self-reported mental health					
Poor	22.2% (20.7-23.7%)	25.1% (23.5-26.7%)	26.4% (24.8-28.1%)	28.2% (26.5-30.0%)	26.8% (25.2-28.5%)
Good	76.9% (75.4-78.5%)	73.9% (72.3-75.5%)	72.0% (70.3-73.6%)	70.8% (69.0-72.5%)	71.6% (69.9-73.3%)
Not stated	0.9% (0.5-1.2%)	1.0% (0.7-1.3%)	1.6% (1.1-2.1%)	1.0% (0.7-1.4%)	1.6% (1.1-2.1%)
Perceived stress					
Low stress	79.0% (77.5-80.5%)	78.0% (76.5-79.4%)	80.1% (78.7-81.6%)	80.1% (78.6-81.6%)	78.5% (77.0-80.1%)
High stress	20.2% (18.7-21.7%)	20.9% (19.5-22.4%)	18.3% (16.9-19.7%)	18.8% (17.3-20.3%)	19.7% (18.2-21.3%)
Not stated	0.8% (0.5-1.1%)	1.1% (0.7-1.5%)	1.5% (1.1-2.0%)	1.1% (0.7-1.5%)	1.7% (1.3-2.2%)
Perceived diet healthfulness					
Poor	34.1% (32.3-35.9%)	36.2% (34.5-37.9%)	33.8% (32.1-35.5%)	35.3% (33.4-37.1%)	31.5% (29.7-33.3%)
Good	64.6% (62.8-66.4%)	62.4% (60.6-64.1%)	64.3% (62.6-66.0%)	63.6% (61.8-65.5%)	66.5% (64.7-68.3%)
Not stated	1.3% (0.8-1.8%)	1.4% (1.0-1.9%)	1.9% (1.4-2.4%)	1.1% (0.7-1.5%)	2.0% (1.4-2.6%)

¹Percentages may not sum to 100% due to rounding.

Supplemental table 7.12: Select determinants and consequences of food insecurity among adults aged 18 to 100 years participating in the International Food Policy Study in 2018, 2019, 2020, 2021, and 2022, in Mexico (n = 20,884)¹.

Year	2018 (n = 4,132)	2019 (n = 4,210)	2020 (n = 4,279)	2021 (n = 4,165)	2022 (n = 4,098)
	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
Employment status					
Working	69.2% (67.4-71.0%)	68.3% (66.5-70.0%)	60.2% (58.3-62.0%)	66.6% (64.9-68.4%)	66.5% (64.8-68.2%)
Not working	25.2% (23.5-26.9%)	24.6% (23.0-26.2%)	29.0% (27.3-30.7%)	26.5% (24.8-28.1%)	27.3% (25.6-28.9%)
Unemployed	4.6% (3.8-5.4%)	5.7% (4.9-6.6%)	9.6% (8.5-10.7%)	5.6% (4.8-6.5%)	5.2% (4.5-6.0%)
Not stated	1.0% (0.7-1.4%)	1.4% (0.9-1.9%)	1.2% (0.8-1.6%)	1.3% (0.9-1.7%)	1.0% (0.6-1.3%)
Perceived income adequacy					
Difficult	43.7% (41.9-45.6%)	42.4% (40.6-44.2%)	50.4% (48.6-52.2%)	39.5% (37.7-41.3%)	44.8% (43.0-46.6%)
Neither	38.6% (36.8-40.3%)	39.6% (37.9-41.4%)	35.0% (33.3-36.8%)	40.7% (38.9-42.5%)	38.9% (37.2-40.6%)
Easy	17.2% (15.9-18.5%)	17.5% (16.2-18.8%)	13.5% (12.3-14.6%)	19.0% (17.6-20.3%)	15.8% (14.6-17.1%)
Not stated	0.5% (0.3-0.8%)	0.5% (0.2-0.7%)	1.1% (0.8-1.5%)	0.9% (0.6-1.2%)	0.4% (0.2-0.7%)
Self-reported general health					
Poor	29.5% (27.8-31.2%)	26.3% (24.7-27.9%)	27.6% (26.0-29.3%)	26.4% (24.8-28.0%)	27.3% (25.7-28.9%)
Good	69.8% (68.1-71.5%)	73.3% (71.7-74.9%)	71.5% (69.9-73.2%)	73.2% (71.5-74.8%)	71.7% (70.1-73.4%)
Not stated	0.7% (0.4-1.1%)	0.4% (0.2-0.6%)	0.8% (0.5-1.1%)	0.4% (0.2-0.7%)	0.9% (0.6-1.3%)
Self-reported mental health					
Poor	15.0% (13.7-16.3%)	14.8% (13.5-16.0%)	16.5% (15.2-17.8%)	19.1% (17.8-20.5%)	19.1% (17.7-20.5%)
Good	84.4% (83.1-85.7%)	85.1% (83.8-86.3%)	82.8% (81.5-84.1%)	80.4% (79.0-81.8%)	80.3% (78.9-81.7%)
Not stated	0.6% (0.3-0.9%)	0.2% (0.0-0.3%)	0.8% (0.5-1.1%)	0.4% (0.2-0.7%)	0.6% (0.4-0.9%)
Perceived stress					
Low stress	85.2% (83.9-86.5%)	84.8% (83.5-86.1%)	86.5% (85.4-87.7%)	86.2% (84.9-87.4%)	84.8% (83.6-86.1%)
High stress	14.2% (12.9-15.4%)	15.0% (13.7-16.3%)	13.0% (11.8-14.1%)	13.4% (12.2-14.6%)	14.5% (13.3-15.7%)
Not stated	0.6% (0.3-0.9%)	0.2% (0.0-0.3%)	0.5% (0.3-0.7%)	0.5% (0.2-0.7%)	0.7% (0.4-1.0%)
Perceived diet healthfulness					
Poor	40.1% (38.3-41.9%)	38.2% (36.5-40.0%)	38.0% (36.3-39.8%)	36.2% (34.4-37.9%)	35.5% (33.8-37.2%)
Good	58.9% (57.1-60.7%)	61.4% (59.7-63.2%)	61.0% (59.2-62.7%)	63.1% (61.3-64.8%)	63.6% (61.9-65.3%)
Not stated	1.0% (0.6-1.4%)	0.3% (0.2-0.5%)	1.0% (0.6-1.4%)	0.8% (0.5-1.1%)	0.9% (0.6-1.3%)

¹Percentages may not sum to 100% due to rounding.

Supplemental table 7.13: Select determinants and consequences of food insecurity among adults aged 18 to 100 years participating in the International Food Policy Study in 2018, 2019, 2020, 2021, and 2022, in the United Kingdom (n = 21,484)¹.

Year	2018 (n = 5,516)	2019 (n = 3,703)	2020 (n = 4,075)	2021 (n = 4,032)	2022 (n = 4,158)
	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
Employment status					
Working	46.5% (44.9-48.1%)	48.2% (46.3-50.1%)	48.2% (46.5-49.8%)	48.5% (46.7-50.2%)	50.4% (48.7-52.1%)
Not working	41.4% (39.9-43.0%)	40.6% (38.7-42.5%)	40.5% (38.9-42.1%)	40.0% (38.3-41.8%)	39.3% (37.7-40.9%)
Unemployed	11.0% (9.9-12.1%)	10.4% (9.1-11.7%)	10.6% (9.5-11.6%)	10.3% (9.1-11.5%)	9.6% (8.6-10.7%)
Not stated	1.1% (0.7-1.5%)	0.9% (0.5-1.2%)	0.8% (0.5-1.1%)	1.2% (0.8-1.6%)	0.6% (0.4-0.9%)
Perceived income adequacy					
Difficult	25.0% (23.6-26.4%)	24.4% (22.7-26.1%)	20.3% (19.0-21.7%)	21.5% (19.9-23.0%)	30.5% (28.9-32.0%)
Neither	36.2% (34.7-37.7%)	37.0% (35.1-38.8%)	38.9% (37.2-40.5%)	36.1% (34.3-37.8%)	37.8% (36.2-39.4%)
Easy	37.9% (36.4-39.4%)	37.6% (35.7-39.4%)	39.6% (38.0-41.2%)	41.2% (39.5-43.0%)	30.8% (29.3-32.3%)
Not stated	0.9% (0.6-1.2%)	1.1% (0.7-1.5%)	1.2% (0.8-1.6%)	1.2% (0.8-1.7%)	0.9% (0.5-1.2%)
Self-reported general health					
Poor	37.2% (35.7-38.8%)	35.9% (34.0-37.7%)	34.5% (32.9-36.1%)	34.1% (32.4-35.8%)	35.8% (34.2-37.4%)
Good	60.5% (58.9-62.1%)	62.5% (60.6-64.4%)	64.2% (62.6-65.9%)	63.8% (62.1-65.6%)	62.9% (61.2-64.5%)
Not stated	2.3% (1.7-2.8%)	1.6% (1.1-2.2%)	1.2% (0.9-1.6%)	2.0% (1.5-2.6%)	1.3% (0.9-1.7%)
Self-reported mental health					
Poor	28.1% (26.6-29.5%)	29.1% (27.3-30.9%)	31.6% (30.0-33.2%)	28.9% (27.3-30.6%)	32.1% (30.5-33.7%)
Good	69.9% (68.4-71.4%)	69.2% (67.4-71.0%)	67.3% (65.7-68.8%)	69.2% (67.5-70.8%)	66.6% (64.9-68.2%)
Not stated	2.0% (1.5-2.5%)	1.7% (1.1-2.2%)	1.1% (0.8-1.5%)	1.9% (1.4-2.4%)	1.4% (1.0-1.8%)
Perceived stress					
Low stress	80.1% (78.8-81.4%)	80.3% (78.7-81.8%)	82.1% (80.8-83.4%)	79.9% (78.4-81.4%)	79.4% (78.0-80.8%)
High stress	17.7% (16.5-18.9%)	18.1% (16.6-19.6%)	16.6% (15.4-17.9%)	18.5% (17.1-19.9%)	19.3% (17.9-20.6%)
Not stated	2.2% (1.7-2.7%)	1.6% (1.1-2.1%)	1.3% (0.9-1.7%)	1.6% (1.2-2.1%)	1.3% (0.9-1.8%)
Perceived diet healthfulness					
Poor	37.5% (36.0-39.1%)	37.4% (35.5-39.3%)	36.8% (35.1-38.4%)	34.3% (32.6-36.0%)	36.7% (35.1-38.4%)
Good	59.9% (58.4-61.5%)	61.0% (59.0-62.9%)	61.7% (60.1-63.4%)	63.8% (62.1-65.6%)	61.6% (60.0-63.3%)
Not stated	2.5% (2.0-3.1%)	1.7% (1.1-2.2%)	1.5% (1.1-1.9%)	1.9% (1.4-2.4%)	1.7% (1.2-2.1%)

¹Percentages may not sum to 100% due to rounding.

Supplemental table 7.14: Select determinants and consequences of food insecurity among adults aged 18 to 100 years participating in the International Food Policy Study in 2018, 2019, 2020, 2021, and 2022, in the United States (n = 21,161)¹.

Year	2018 (n = 4,630)	2019 (n = 3,925)	2020 (n = 4,593)	2021 (n = 4,071)	2022 (n = 3,942)
	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
Employment status					
Working	42.3% (40.5-44.0%)	40.9% (39.0-42.7%)	39.8% (38.2-41.5%)	45.6% (43.8-47.4%)	44.5% (42.7-46.3%)
Not working	43.4% (41.6-45.2%)	45.6% (43.8-47.5%)	44.6% (43.0-46.3%)	42.5% (40.7-44.2%)	41.9% (40.1-43.7%)
Unemployed	10.7% (9.4-12.0%)	10.4% (9.2-11.6%)	12.0% (10.8-13.2%)	9.4% (8.2-10.5%)	10.0% (8.9-11.2%)
Not stated	3.6% (2.8-4.4%)	3.1% (2.4-3.8%)	3.6% (2.9-4.3%)	2.6% (2.0-3.2%)	3.6% (2.8-4.4%)
Perceived income adequacy					
Difficult	29.6% (27.9-31.3%)	30.6% (28.9-32.4%)	30.6% (29.0-32.2%)	24.4% (22.8-26.0%)	33.1% (31.4-34.8%)
Neither	34.8% (33.0-36.5%)	34.5% (32.7-36.2%)	34.4% (32.8-36.1%)	32.0% (30.3-33.7%)	32.4% (30.6-34.1%)
Easy	34.7% (33.1-36.4%)	33.4% (31.7-35.1%)	33.4% (31.8-34.9%)	42.0% (40.2-43.7%)	33.6% (32.0-35.3%)
Not stated	0.9% (0.5-1.3%)	1.5% (1.0-2.0%)	1.5% (1.1-2.0%)	1.6% (1.1-2.1%)	0.9% (0.5-1.4%)
Self-reported general health					
Poor	25.3% (23.7-26.9%)	27.3% (25.5-29.0%)	24.4% (22.9-25.9%)	26.3% (24.6-27.9%)	25.3% (23.7-26.9%)
Good	73.4% (71.8-75.1%)	71.8% (70.0-73.5%)	74.2% (72.7-75.7%)	72.3% (70.6-74.0%)	73.2% (71.6-74.9%)
Not stated	1.3% (0.8-1.8%)	1.0% (0.6-1.3%)	1.4% (1.0-1.8%)	1.4% (1.0-1.9%)	1.5% (1.0-2.0%)
Self-reported mental health					
Poor	17.3% (15.9-18.7%)	20.7% (19.1-22.3%)	20.3% (18.9-21.7%)	22.8% (21.3-24.4%)	22.8% (21.3-24.4%)
Good	81.5% (80.0-82.9%)	78.4% (76.8-80.0%)	78.6% (77.2-80.0%)	75.9% (74.3-77.5%)	75.6% (74.0-77.2%)
Not stated	1.2% (0.7-1.7%)	0.9% (0.5-1.3%)	1.1% (0.8-1.5%)	1.3% (0.8-1.7%)	1.6% (1.1-2.1%)
Perceived stress					
Low stress	80.1% (78.6-81.6%)	79.6% (78.1-81.2%)	77.6% (76.2-79.0%)	80.6% (79.2-82.0%)	76.3% (74.8-77.9%)
High stress	18.7% (17.3-20.1%)	19.0% (17.5-20.6%)	21.3% (19.9-22.6%)	17.9% (16.6-19.3%)	22.3% (20.8-23.8%)
Not stated	1.2% (0.7-1.7%)	1.3% (0.8-1.8%)	1.1% (0.8-1.4%)	1.5% (1.0-1.9%)	1.4% (0.9-1.9%)
Perceived diet healthfulness					
Poor	34.7% (33.0-36.5%)	36.2% (34.4-38.0%)	34.6% (32.9-36.2%)	37.2% (35.5-39.0%)	32.4% (30.7-34.1%)
Good	63.6% (61.8-65.3%)	62.7% (60.9-64.6%)	64.1% (62.5-65.8%)	61.1% (59.3-62.8%)	66.1% (64.4-67.8%)
Not stated	1.7% (1.1-2.3%)	1.1% (0.7-1.5%)	1.3% (0.9-1.7%)	1.7% (1.2-2.2%)	1.5% (1.0-2.0%)

¹Percentages may not sum to 100% due to rounding.

Supplemental table 7.15: Select determinant and consequence of food insecurity among adolescents aged 10 to 17 years participating in the International Food Policy Study in 2019, 2020, 2021, and 2022, in Australia (n = 5,232)¹.

Year	2019 (n = 1,431)	2020 (n = 1,590)	2021 (n = 831)	2022 (n = 1,380)
	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
Perceived income adequacy				
Not enough	24.6% (22.3-26.9%)	19.5% (17.5-21.4%)	22.2% (19.2-25.1%)	24.9% (22.5-27.2%)
Enough	74.5% (72.2-76.9%)	79.5% (77.5-81.5%)	76.0% (73.0-79.0%)	73.9% (71.5-76.3%)
Not stated	0.9% (0.3-1.4%)	1.1% (0.6-1.6%)	1.8% (0.9-2.8%)	1.2% (0.6-1.9%)
Perceived diet healthfulness				
Unhealthy	7.8% (6.4-9.2%)	7.3% (5.9-8.6%)	8.7% (6.6-10.8%)	6.0% (4.7-7.3%)
Healthy	91.8% (90.4-93.3%)	92.4% (91.1-93.7%)	90.5% (88.3-92.6%)	93.3% (91.9-94.6%)
Not stated	0.4% (0.0-0.7%)	0.3% (0.1-0.6%)	0.8% (0.2-1.4%)	0.7% (0.3-1.2%)

¹Percentages may not sum to 100% due to rounding.

Supplemental table 7.16: Select determinant and consequence of food insecurity among adolescents aged 10 to 17 years participating in the International Food Policy Study in 2019, 2020, 2021, and 2022, in Canada (n = 14,479)¹.

Year	2019 (n = 3,674)	2020 (n = 3,890)	2021 (n = 3,352)	2022 (n = 3,563)
	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
Perceived income adequacy				
Not enough	17.3% (16.1-18.6%)	17.9% (16.6-19.1%)	18.3% (16.9-19.7%)	23.0% (21.6-24.5%)
Enough	81.4% (80.1-82.7%)	80.5% (79.3-81.8%)	80.6% (79.2-82.0%)	75.3% (73.8-76.7%)
Not stated	1.3% (0.9-1.7%)	1.6% (1.2-2.0%)	1.0% (0.7-1.4%)	1.7% (1.3-2.1%)
Perceived diet healthfulness				
Unhealthy	5.8% (5.0-6.6%)	4.8% (4.1-5.5%)	6.0% (5.1-6.8%)	7.1% (6.3-8.0%)
Healthy	93.7% (92.9-94.5%)	94.7% (94.0-95.4%)	93.0% (92.1-93.9%)	91.8% (90.9-92.8%)
Not stated	0.5% (0.2-0.7%)	0.5% (0.3-0.8%)	1.0% (0.7-1.4%)	1.0% (0.7-1.4%)

¹Percentages may not sum to 100% due to rounding.

Supplemental table 7.17: Select determinant and consequence of food insecurity among adolescents aged 10 to 17 years participating in the International Food Policy Study in 2019, 2020, 2021, and 2022, in Chile (n = 5,545)¹.

Year	2019 (n = 1,252)	2020 (n = 1,615)	2021 (n = 1,095)	2022 (n = 1,583)
	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
Perceived income adequacy				
Not enough	30.6% (27.9-33.3%)	32.7% (30.3-35.1%)	21.9% (19.0-24.7%)	38.2% (35.6-40.9%)
Enough	68.5% (65.7-71.2%)	66.2% (63.8-68.6%)	75.9% (73.0-78.9%)	60.4% (57.7-63.1%)
Not stated	0.9% (0.4-1.5%)	1.2% (0.7-1.7%)	2.2% (1.1-3.4%)	1.4% (0.8-2.0%)
Perceived diet healthfulness				
Unhealthy	9.0% (7.3-10.7%)	6.4% (5.1-7.6%)	7.5% (5.7-9.2%)	6.3% (5.0-7.7%)
Healthy	90.6% (88.9-92.3%)	93.0% (91.7-94.3%)	91.9% (90.1-93.8%)	93.3% (91.9-94.6%)
Not stated	0.4% (0.1-0.8%)	0.6% (0.2-1.0%)	0.6% (0.0-1.2%)	0.4% (0.1-0.7%)

¹Percentages may not sum to 100% due to rounding.

Supplemental table 7.18: Select determinant and consequence of food insecurity among adolescents aged 10 to 17 years participating in the International Food Policy Study in 2019, 2020, 2021, and 2022, in Mexico (n = 6,656)¹.

Year	2019 (n = 1,616)	2020 (n = 1,822)	2021 (n = 1,615)	2022 (n = 1,603)
	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
Perceived income adequacy				
Not enough	28.4% (25.8-31.0%)	37.7% (34.9-40.4%)	30.5% (27.8-33.3%)	32.6% (29.8-35.4%)
Enough	71.1% (68.5-73.7%)	61.7% (58.9-64.5%)	68.4% (65.7-71.2%)	66.7% (63.8-69.5%)
Not stated	0.5% (0.2-0.8%)	0.6% (0.2-1.0%)	1.0% (0.3-1.7%)	0.7% (0.3-1.2%)
Perceived diet healthfulness				
Unhealthy	8.4% (6.7-10.0%)	5.8% (4.5-7.1%)	8.0% (6.3-9.7%)	8.5% (6.7-10.2%)
Healthy	91.3% (89.7-93.0%)	94.1% (92.8-95.4%)	91.7% (89.9-93.4%)	91.1% (89.3-92.9%)
Not stated	0.3% (0.0-0.6%)	0.1% (0.0-0.2%)	0.3% (0.0-0.9%)	0.4% (0.0-1.0%)

¹Percentages may not sum to 100% due to rounding.

Supplemental table 7.19: Select determinant and consequence of food insecurity among adolescents aged 10 to 17 years participating in the International Food Policy Study in 2019, 2020, 2021, and 2022, in the United Kingdom (n = 6,196)¹.

Year	2019 (n = 1,518)	2020 (n = 1,518)	2021 (n = 1,563)	2022 (n = 1,597)
	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
Perceived income adequacy				
Not enough	26.8% (24.5-29.2%)	22.6% (20.4-24.8%)	21.2% (19.1-23.4%)	29.0% (26.6-31.4%)
Enough	72.0% (69.6-74.4%)	76.3% (74.1-78.5%)	77.2% (74.9-79.4%)	68.6% (66.2-71.1%)
Not stated	1.2% (0.6-1.8%)	1.1% (0.6-1.6%)	1.6% (0.9-2.3%)	2.4% (1.5-3.2%)
Perceived diet healthfulness				
Unhealthy	8.9% (7.4-10.4%)	7.7% (6.3-9.1%)	8.6% (7.1-10.1%)	8.4% (6.9-9.9%)
Healthy	90.4% (88.9-92.0%)	91.8% (90.4-93.2%)	90.9% (89.3-92.4%)	90.5% (88.9-92.1%)
Not stated	0.7% (0.3-1.2%)	0.5% (0.1-0.9%)	0.5% (0.1-0.9%)	1.1% (0.5-1.7%)

¹Percentages may not sum to 100% due to rounding.

Supplemental table 7.20: Select determinant and consequence of food insecurity among adolescents aged 10 to 17 years participating in the International Food Policy Study in 2019, 2020, 2021, and 2022, in the United States (n = 6,651)¹.

Year	2019 (n = 1,599)	2020 (n = 1,582)	2021 (n = 1,734)	2022 (n = 1,736)
	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
Perceived income adequacy				
Not enough	29.6% (27.2-32.1%)	22.7% (20.0-25.5%)	30.3% (28.0-32.6%)	30.4% (27.8-33.0%)
Enough	69.6% (67.2-72.1%)	76.4% (73.6-79.1%)	67.6% (65.2-70.0%)	68.5% (65.9-71.2%)
Not stated	0.7% (0.2-1.2%)	0.9% (0.4-1.4%)	2.1% (1.3-2.8%)	1.0% (0.5-1.6%)
Perceived diet healthfulness				
Unhealthy	9.7% (8.1-11.3%)	7.1% (5.5-8.7%)	9.7% (8.2-11.3%)	7.8% (6.3-9.3%)
Healthy	90.0% (88.3-91.6%)	92.6% (91.0-94.2%)	89.6% (88.0-91.2%)	91.4% (89.8-92.9%)
Not stated	0.3% (0.1-0.6%)	0.3% (0.0-0.6%)	0.6% (0.2-1.0%)	0.8% (0.4-1.2%)

¹Percentages may not sum to 100% due to rounding.

Supplemental table 7.21a: Adjusted relative risk ratio of few, several, or many experiences of food insecurity 2020, 2021, or 2022 compared to 2019 among adolescents aged 10 to 17 years, by country and year-by-characteristics interaction, International Food Policy Study (n = 44,759)¹.

	Australia (n = 5,232)			Canada (n = 14,479)			Chile (n = 5,545)		
	Adjusted relative risk ratio (95% CI)			Adjusted relative risk ratio (95% CI)			Adjusted relative risk ratio (95% CI)		
Year x sex (ref= male)	2020 x female	2021 x female	2022 x female	2020 x female	2021 x female	2022 x female	2020 x female	2021 x female	2022 x female
Few experiences ²	0.98 (0.69-1.41)	0.83 (0.54-1.28)	0.86 (0.59-1.26)	1.01 (0.80-1.27)	1.02 (0.80-1.30)	1.14 (0.90-1.43)	0.98 (0.67-1.43)	0.65 (0.43-0.98)	0.82 (0.56-1.19)
Several experiences ²	1.38 (0.74-2.57)	1.01 (0.47-2.17)	1.16 (0.61-2.22)	0.55 (0.34-0.89)	0.44 (0.27-0.72)	0.84 (0.53-1.31)	1.62 (0.87-3.03)	1.03 (0.48-2.18)	1.41 (0.73-2.70)
Many experiences ²	1.23 (0.66-2.31)	0.74 (0.36-1.50)	1.53 (0.79-2.97)	1.23 (0.76-2.00)	0.98 (0.63-1.53)	1.74 (1.11-2.73)	1.06 (0.51-2.18)	1.00 (0.43-2.32)	1.21 (0.59-2.50)
Year x racial-ethnic identity and cultural diversity (ref= White and/or English-speaking)	2020 x BIPOC and/or speaks language other than English at home ³	2021 x BIPOC and/or speaks language other than English at home	2022 x BIPOC and/or speaks language other than English at home	2020 x BIPOC and/or speaks language other than English at home	2021 x BIPOC and/or speaks language other than English at home	2022 x BIPOC and/or speaks language other than English at home	2020 x BIPOC and/or speaks language other than English at home	2021 x BIPOC and/or speaks language other than English at home	2022 x BIPOC and/or speaks language other than English at home
Few experiences	1.39 (0.87-2.21)	0.95 (0.53-1.68)	0.99 (0.62-1.60)	1.32 (1.01-1.71)	1.05 (0.79-1.38)	1.16 (0.89-1.51)	1.34 (0.72-2.52)	1.42 (0.71-2.86)	1.42 (0.74- 2.75)
Several experiences	2.17 (0.99-4.80)	2.04 (0.80-5.18)	2.09 (0.95-4.61)	2.59 (1.55-4.34)	1.08 (0.63-1.83)	1.26 (0.77-2.06)	1.14 (0.42-3.07)	1.63 (0.52-5.10)	0.89 (0.30- 2.59)
Many experiences	1.11 (0.55-2.26)	1.47 (0.67-3.22)	1.21 (0.58-2.53)	1.44 (0.86-2.41)	0.64 (0.39-1.06)	1.23 (0.76-1.99)	1.38 (0.45-4.18)	4.55 (1.38-14.99)	1.51 (0.48-4.80)

Year x perceived income adequacy (ref= enough)	2020 x not enough	2021 x not enough	2022 x not enough	2020 x not enough	2021 x not enough	2022 x not enough	2020 x not enough	2021 x not enough	2022 x not enough
Few experiences	1.53 (0.91-2.58)	1.70 (0.91-3.17)	0.99 (0.60-1.65)	0.94 (0.68-1.30)	1.06 (0.75-1.50)	0.86 (0.63-1.18)	1.37 (0.76-2.47)	1.16 (0.60-2.24)	2.00 (1.10-3.63)
Several experiences	0.59 (0.28-1.24)	0.70 (0.29-1.70)	0.44 (0.21-0.92)	0.86 (0.51-1.46)	0.62 (0.37-1.05)	0.64 (0.39-1.05)	1.91 (0.88-4.13)	0.98 (0.41-2.34)	2.06 (0.92-4.61)
Many experiences	0.61 (0.30-1.26)	0.57 (0.25-1.30)	0.71 (0.34-1.48)	1.36 (0.79-2.33)	0.65 (0.40-1.06)	0.59 (0.37-0.95)	1.59 (0.65-3.91)	0.60 (0.23-1.52)	2.74 (0.99-7.59)

Supplemental table 7.21b: Adjusted relative risk ratio of few, several, or many experiences of food insecurity 2020, 2021, or 2022 compared to 2019 among adolescents aged 10 to 17 years, by country and year-by-characteristics interaction for levels of the characteristics selected *a priori*, International Food Policy Study (n = 44,759)¹.

	Mexico (n = 6,656)			United Kingdom (n = 6,196)			United States ⁴ (n = 6,651)		
	Adjusted relative risk ratio (95% CI)			Adjusted relative risk ratio (95% CI)			Adjusted relative risk ratio (95% CI)		
Year x sex (ref= male)	2020 x female	2021 x female	2022 x female	2020 x female	2021 x female	2022 x female	2020 x female	2021 x female	2022 x female
Few experiences ²	1.05 (0.72-1.53)	1.29 (0.88-1.91)	0.96 (0.66-1.40)	1.22 (0.85-1.75)	1.15 (0.79-1.67)	1.13 (0.78-1.65)	Not applicable	Not applicable	Not applicable
Several experiences ²	0.83 (0.43-1.57)	1.15 (0.59-2.24)	0.96 (0.50-1.84)	0.68 (0.34-1.34)	0.52 (0.27-1.03)	0.70 (0.37-1.32)	Not applicable	Not applicable	Not applicable
Many experiences ²	1.29 (0.62-2.70)	1.13 (0.53-2.39)	0.73 (0.34-1.56)	1.12 (0.59-2.11)	0.78 (0.44-1.39)	0.64 (0.35-1.19)	Not applicable	Not applicable	Not applicable
Year x racial-ethnic identity and cultural diversity (ref= White and/or English-speaking)	2020 x BIPOC and/or speaks language other than English at home ³	2021 x BIPOC and/or speaks language other than English at home	2022 x BIPOC and/or speaks language other than English at home	2020 x BIPOC and/or speaks language other than English at home	2021 x BIPOC and/or speaks language other than English at home	2022 x BIPOC and/or speaks language other than English at home	2020 x BIPOC and/or speaks language other than English at home	2021 x BIPOC and/or speaks language other than English at home	2022 x BIPOC and/or speaks language other than English at home
Few experiences	1.61 (0.85-3.07)	0.76 (0.40-1.42)	1.00 (0.55-1.82)	1.93 (1.08-3.43)	1.03 (0.56-1.88)	1.32 (0.74-2.37)	Not applicable	Not applicable	Not applicable
Several experiences	2.13 (0.83-5.42)	1.30 (0.50-3.36)	1.11 (0.44-2.83)	0.85 (0.35-2.06)	0.49 (0.20-1.22)	0.78 (0.35-1.77)	Not applicable	Not applicable	Not applicable
Many experiences	1.44 (0.50-4.14)	0.84 (0.29-2.38)	1.01 (0.37-2.70)	1.00 (0.41-2.44)	1.12 (0.50-2.52)	0.74 (0.31-1.75)	Not applicable	Not applicable	Not applicable

Year x perceived income adequacy (ref= enough)	2020 x not enough	2021 x not enough	2022 x not enough	2020 x not enough	2021 x not enough	2022 x not enough	2020 x not enough	2021 x not enough	2022 x not enough
Few experiences	0.60 (0.34-1.05)	0.53 (0.30-0.96)	1.46 (0.79-2.71)	1.32 (0.82-2.11)	1.16 (0.72-1.86)	0.86 (0.55-1.33)	Not applicable	Not applicable	Not applicable
Several experiences	0.75 (0.35-1.61)	0.53 (0.24-1.15)	1.84 (0.81-4.20)	2.54 (1.19-5.41)	0.84 (0.42-1.69)	1.55 (0.78-3.08)	Not applicable	Not applicable	Not applicable
Many experiences	0.88 (0.36-2.13)	0.62 (0.26-1.48)	1.51 (0.61-3.74)	1.03 (0.50-2.15)	0.44 (0.23-0.85)	0.34 (0.17-0.66)	Not applicable	Not applicable	Not applicable

¹Sample sizes by year are as follows: 11,090 in 2019; 12,017 in 2020; 10,190 in 2021; and 11,462 in 2022.

²Few experiences corresponds to 1–6 affirmations on the Child Food Insecurity Experiences Scale, several experiences corresponds to 7–10 affirmations, many experiences corresponds to 11–20 affirmations.

³Abbreviation: BIPOC, Black, Indigenous, People of Color.

⁴Results for the United States are not shown because the model did not converge.