Proposal for Examining the Association between Food Insecurity and Mental Health and Wellbeing: Analysis of Data from the Canadian Community Health Survey Cycle 2.2

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During the COVID-19 pandemic, it is estimated that 11.2 percent of Canadians are food insecure in 2020 (Statistics Canada, 2022). Another study, conducted in 2020, showed that households experiencing moderate or severe food insecurity reported fair or poor mental health at rates that are more than double that of food-secure households (Polsky & Gilmour, 2020). Our current study will explore if there is a similar association between food security and mental health during the pre-COVID time period with the use of data drawn from Canadian Community Health Survey (CCHS) conducted in 2004 and 2005 . If an association is found, we can shed light on a social and health issue that potentially impacts millions of Canadians on an ongoing basis. And possibly provide guidance on future interventions that can better the well-being of this vulnerable group. Food insecurity can be defined as "uncertain, insufficient or inadequate food access, availability and utilization due to limited financial resources, and the compromised eating patterns and food consumption that may result." (Health Canada, 2012, para. 2). This definition is drawn from the Household Food Security Survey Module (HFSSM) and is a validated tool used by CCHS in measuring food insecurity in Canada (Health Canada, 2012). In this proposed study, self-reported mental health as part of daily life is the focus, while mental illnesses such as psychosis and clinically diagnosed depression and anxiety are not excluded from the study.

Conceptual Framework and Literature Review

Literature Search Strategy

We conducted a literature review during the first week of October 2022, looking at peer-reviewed articles published between October 1st, 2017 and September 30th, 2022. Key search words used broad and methodological terms including "food security," "food insecurity," "mental health," "wellbeing," and "stress." To focus this review, we opened our search to studies with participants of all ages. To be selected for review, studies had to meet all of the following inclusion criteria: Peer-review journal articles with full-text available in English investigating the relationship between food security status and mental health as part of daily living in human participants. Studies conducted on a global scale and in select countries

including Canada, the U.S., European countries, and Australia were included to gain insight into how countries with structural similarities to Canada experience and navigate issues surrounding food insecurity and mental health. It may also provide insight into useful interventions that can be applied to Canadians. Studies conducted on special populations such as homeless people, refugees, war/armed conflict or disaster victims, pregnant women, and post-secondary students were excluded because these populations are subject to other extraordinary circumstances affecting mental health and overall well-being. Studies conducted on residents in the three territories, Indigenous Peoples, persons living in institutions, and full-time members of the Canadian Forces were also excluded since these populations were not part of the CCHS, thus they cannot be the focus of our proposed research topic. We also excluded case reports, case series, and non-research articles such as commentaries, editorials, and opinions because they are lower on the hierarchy of evidence and may not provide high-quality insight into our topic. Lastly, studies where the association between food insecurity and mental health status could not be independently examined—due to the inclusion of unrelated variables—were excluded as they examined associations beyond the scope of this review.

The literature review was conducted using the following databases: PubMed and the Cumulative Index to Nursing and Allied Health (CINAHL). We searched both databases to cast a wide net and avoid missing pertinent literature. PubMed is a free and accessible database open to the public encompassing over 34 million citations and abstracts of biomedical and life science literature along with other related disciplines from resources such as MEDLINE, PubMed Central (PMC), and Bookshelf (NCBI, n.d.). It is a product of the U.S. National Library of Medicine (NLM) housed within the National Center for Biotechnology Information (NCBI), which is responsible for its ongoing maintenance (NCBI, n.d.). Within PubMed, we used the clinical queries tool, specifically the therapy and etiology filters which are search strategies based on methodological criteria. Filters relevant to our inclusion criteria were also used. The CINAHL is a database of nursing journals and publications from the National League for Nursing and the American Nursing Association with over 1096 open access journals (EBSCO, n.d.). We used the

advanced search function to search keywords and studies using food security as the primary heading, and the search option filters to limit our results to the inclusion criteria.

Literature Search Results

Our search initially revealed 402 articles. After the removal of duplicates and a series of screening as outlined in Figure 1 (see Appendix A), our search revealed a total of 19 articles that met our selection criteria and were included in this review. Articles spanned over a number of countries: 2 from Canada, 11 from the U.S., 2 from European countries, and 4 on a global scale. Out of the 19 studies, 15 were quantitative and 4 were qualitative in design. Of the 15 studies that were quantitative, 13 were cross-sectional, 1 was a cohort study, and 1 was a systematic review and meta-analysis. Of the 4 qualitative studies, 2 were systematic reviews, 1 was cross-sectional, and 1 was a scoping review.

Upon analyzing the main findings that emerged from our literature search, we found that the association between food insecurity status and mental health and wellbeing has been well established in a variety of contexts and was discussed by Bruening et al. (2017) and Maynard et al. (2018) as being a bidirectional association (See Table 1, Appendix B). However, this was not the only finding that was outlined, and a theme emerged among most of the articles, wherein the association between food insecurity status and mental health and well-being was moderated by certain factors. These factors include both sociodemographics, such as age, gender, region, income, and immigration status and environmental factors, namely, community support and family dynamics. Although the association between food insecurity status and mental health and well-being is important to examine in and of itself, exploring the ways in which this relationship is modified can inform researchers regarding its complexity.

The Role of Sociodemographics: Income

The role of income in the association between food insecurity and mental health and wellbeing has been well studied across many contexts. Within this literature review, five cross-sectional studies examined the role of income and related indicators in the relationship between food insecurity and mental health and wellbeing as outlined in Table 2 (see Appendix B). As the COVID-19 pandemic had drastic effects on factors such as lifestyle and income, Aguiar et al. (2022) and Yenerall and Jensen (2021) both

examined the changes in income during the COVID-19 pandemic in relation to food insecurity and mental health and wellbeing, among Portuguese and U.S. adults, respectively. The two studies found that both mental health measures and COVID-19-induced reduction in income were associated with food insecurity. Furthermore, as evidence of the complexity of the association between food insecurity and mental health, Aguiar et al. (2022) found that education level also moderated this association. Moreover, examining similar associations between finances, food insecurity, and mental health during COVID-19, Islam et al. (2022) found concurrent results as well as a moderating effect of ethnicity, such that among their sample of Asian Americans, Filipino and Vietnamese individuals were more likely to report financial difficulties and food insecurity, which were both associated with self-reported negative mental health symptoms. Lastly, Marshall et al. 's (2021) findings were consistent with aforementioned patterns, and their sample of older U.S. adults established associations between mental health, other financial constraints, and food insecurity status.

The Role of Sociodemographics: Age, Gender, Region, and Immigration Status

Other sociodemographic factors, such as age, gender, region of residence, and immigration status were also investigated in studies listed in Table 3 (See Appendix B). In an international sample of respondents to the World Gallup Poll, Jones (2017) found that individual-level food insecurity status and poor mental health were associated and that the severity of food insecurity predicted poorer mental health. Interestingly, these associations were moderated by age and region; the association was also stronger among older adults, and only present in middle- and high-income countries. These findings were in line with results from Pourmotabbed et al.'s (2020) meta-analysis that reported region-specific findings, where the association between food insecurity and anxiety was stronger in North American households. Pourmotabbed and colleagues also found moderating effects of age as the risk of depression that was associated with food insecurity increased among adults over the age of 65. Although Jones (2017) had not established a moderating effect of sex, Pourmotabbed et al. (2020) did establish a moderating effect of gender, specifically that food-insecure men had a greater risk of depression compared to their women counterparts. This contradicts findings by Hammami et al. (2020) and Ciciurkaite and Brown (2018),

which found that food insecure women and female youth experienced a disproportionately stronger association to poor mental health than their male counterparts. Ethnicity was also found to be a factor differentiating the effects of food insecurity and its association to mental health. Food-insecure African Americans experiencing hunger exhibited disproportionately higher levels of serious psychological distress, up to six times higher than people living above 200% U.S. federal poverty level (Allen et al., 2017). In terms of immigration status, a study conducted on an international sample of adults from the 2014-2019 Gallup World Poll found that food insecurity and mental wellbeing were associated in a dose-response manner and as food insecurity status deteriorated, so did mental wellbeing (Dou et al., 2022); immigration moderated the association as immigrants were more likely to experience lower mental wellbeing than their non-immigrant counterparts (Dou et al., 2022).

The Role of Environmental Factors: Community Support

Community support was a common factor examined in combination with food security and mental health across studies listed in Table 4 (see Appendix B). Since emotional and social support are known moderators of mental health and overall wellbeing, Lund et al. (2021) examined these factors' effects on mental distress in U.S. adults experiencing adverse social determinants of health (one being food insecurity). They found that individuals who experienced frequent mental distress, as well as low levels of emotional and social support, were more likely to be housing insecure, food insecure, and financially unstable (Lund et al., 2021). Hammami et al. (2020) also investigated the role of social support from peers, family, teachers, schools and neighborhoods on mental health in food-insecure youth who experienced hunger. They discovered that although social support helped improve mental health, it did not fully alleviate the negative effects of hunger on mental health (Hammami et al., 2020). Lastly, Pak and Kim (2020) found that the use of nutritional support programs, such as the Supplemental Nutrition Assistance Program (SNAP), did not modify the association between food insecurity and depressive symptoms in Americans.It was instead associated with reduced self-esteem, suggesting the presence of stigma linked with accessing nutritional support programs, further harming mental health. Based on these findings, community support can play a role in alleviating some of the negative mental health effects

associated with food insecurity; however, nutrition support programs that alleviate food insecurity but accompanied with stigma are linked to worsened mental health outcomes.

The Role of Environmental Factors: Family Dynamics

Family dynamics were also investigated as a main factor affecting the experience of food insecurity and mental health across many studies as outlined in Table 5 (see Appendix B). An investigation into women's experience of food insecurity—with a focus on women's roles and family structures—found that lone mothers and migrant women were particularly vulnerable to food insecurity, and that unhealthy physical, social, and mental health were embedded in the experience of food insecurity (Bell et al., 2022). Marital status, parental status, and gender were established as predictors of depressive symptoms in U.S. adults in a study by Ciciurkaite and Brown (2018) who found that marriage reduced psychological distress in men and that having children under the age of 18 is a protective factor against psychological distress in women, although the psychological benefits of having children in the households were reduced in low and very low food insecure households compared to their food secure counterparts (Ciciurkaite & Brown, 2018). Well-beginnings may be explained by a qualitative study by Lindow et al. (2022) who found that parents' mental health is affected through feelings of guilt and shame due to their inability to purchase nutritious foods for their children. Similarly, results from a primary study on U.S. parents by Ling et al. (2022) found that food-insecure parents had high levels of stress, anxiety, and depression while parents reporting child food-insecurity had even greater depressive symptoms. A study by Johnson and Markowitz (2018) found that the presence of food insecurity in families with young toddlers and preschoolers is associated with more familial conflicts leading to poorer mental health among family members. Furthermore, households in which parents are unable to shield their children from food insecurity are associated with more severe food insecurity and poorer mental health outcomes compared to households where parents are able to provide adequate shielding (Ovenell et al., 2022). These findings suggest that family structure and dynamics (e.g., parental status and marital status) affect experiences of food insecurity and related mental health outcomes, emphasizing the importance of treating the family as a whole to promote mental wellbeing in parents and children (Ling et al., 2022).

In summary, we searched the literature and found 19 articles spanning over various countries on food security and mental health status. Most studies were quantitative and a few were qualitative, and many explored sociodemographic and environmental moderating factors, giving us comprehensive insights on the topic.

Some key knowledge gaps were found that should be addressed in future studies. First, very few studies examine the association between food insecurity and mental health in the Canadian context, which hinders the generalizability of the findings to the Canadian population. Although Ovenell et al. (2022) examined the link between food insecurity and mental health using CCHS data, they did not look at additional social determinants of health as moderators responsible for linking food insecurity and mental health. Second, the majority of the studies used different food-insecurity and mental health measures, increasing the difficulty of across-study comparisons, creating a need for additional research using more universal measures. While the association between the two variables has been well-established, there is limited literature on the causal relationship between food insecurity and mental health. Due to the nature of our secondary research, however, we cannot address this limitation. Furthermore, even though social support programs were found to be associated with changes in mental health status, the independent effect of each type of support remains unclear. Therefore, this topic should be further explored in future studies to better understand which social support program caters to a particular target population.

Mental health and food security status are strongly associated. Therefore, more recognition of the psychological impact that food insecurity has on mental health and overall health is of great importance. In order to improve mental health, there needs to be an integrative approach to addressing food insecurity via formal and informal programs based on environmental, social, and psychological care principles that support food security status. Similarly, mental health must be addressed by adopting appropriate interventions. Moreover, it is crucial for clinicians and other healthcare practitioners to learn more about the association between food security and mental health because they play a critical role in assessing the health status of patients. It is important to keep these issues on the table to pressure government action by reflecting the negative consequences of food insecurity on health and well-being. Therefore, we want to

further investigate the association between food security status and mental health status by analyzing the CCHS data and confirm the generalizability of the literature findings to the Canadian context.

Problem Statement/Research Question

The literature provided extensive evidence of the association between food security and mental health and yet such study has not been done in Canada within the time frame where the CCHS Cycle 2.2 was conducted. In the current study, food security will be run in statistical tests as an independent variable and mental health as a dependent variable. Food security is defined based on the definition employed by HFSSM as mentioned in the introduction. Mental health is defined as self-perceived mental health as part of daily living. CCHS has a good representation of these two variables as shown in Table 6 (see Appendix C). Based on previous research, we hypothesize Canadians with lower food security will self-report worse mental health.

Proposed Research Methodology

To examine our research question, we will conduct secondary analysis on data from the Canadian Community Health Survey Cycle 2.2 (CCHS 2.2). The CCHS is a cross-sectional survey administered nationally, which includes a large survey (cycle .1) and a smaller survey (cycle .2) that collect data regarding the population's general health and more specific health-related topics, respectively (Statistics Canada, 2005a). We will be using data from CCHS 2.2, which was administered between January 14, 2004 and January 21, 2005 (Statistics Canada, 2005a). Within this period, data was collected in four quarters: 1) Quarter 1: January 1–March 31, 2004, 2) Quarter 2: April 1–May 31, 3) Quarter 3: June 1–August 31, and 4) Quarter 4: September 1–January 21, 2005 (Statistics Canada, 2005a, p. 22). CCHS 2.2 collected data from the ten Canadian provinces, and was not administered in the three territories. Within the provinces, individuals of all ages were permitted to be surveyed, but had to live in private dwellings to be qualified (Statistics Canada, 2005a, p. 15). Importantly, certain populations that were excluded from the survey were "individuals living on Indian Reserves and on Crown Lands, institutional residents, full-time members of the Canadian Forces and residents of certain remote regions" (Statistics Canada, 2005a, p. 15). The CCHS 2.2 sample size included 35,107 respondents (Statistics Canada, 2005a,

p. 47). Our secondary analysis will include both descriptive and inferential statistics—conducted using IBM SPSS Statistics Version 28.

Using the data collected from the CCHS comes with strengths and limitations. In terms of strengths, the CCHS 2.2 sample size is very large and representative of around 98% of the ten provinces' populations (Statistics Canada, 2005a, p. 15). This extensive sampling frame provides the advantage of possibly generalizing findings to a large part of the Canadian population. Nevertheless, the exclusion of aforementioned groups from the sampling frame limits generalizability of results. Another strength of CCHS 2.2 is that it covers a variety of health topics, including 18 general health modules and a 24-hour dietary recall. A few other limitations are that the CCHS's cross-sectional design does not allow for inferences regarding the causality or directionality of associated variables. Furthermore, due to its survey design, it is vulnerable to survey-related biases, such as response bias. Lastly, the CCHS data available for secondary analysis does not include the original raw data and contains many derived variables, which can prevent certain analyses and an in-depth understanding of how data has been compiled and stratified.

Implications of Proposed Project

Food insecurity and mental health is affecting millions of Canadians (Polsky & Gilmour, 2020; Statistics Canada, 2022). If food security and mental well-being are associated (even during pre-COVID time), it may imply that interventions, such as participation in urban agriculture (Audate et al., 2019), that benefit both food security and mental well-being, or the concurrent implementation of food security and mental health interventions, may be more effective in improving the overall well-being of this subset of vulnerable Canadians. Evidence of association will also support two forms of future studies. Future longitudinal studies that observe the changes in food security and mental health status in a population can indicate the temporality order of the two variables and help establish the causal relationship. And future interventional studies can compare the effectiveness of interventions that target both food security and mental health with interventions that focus only on food security.

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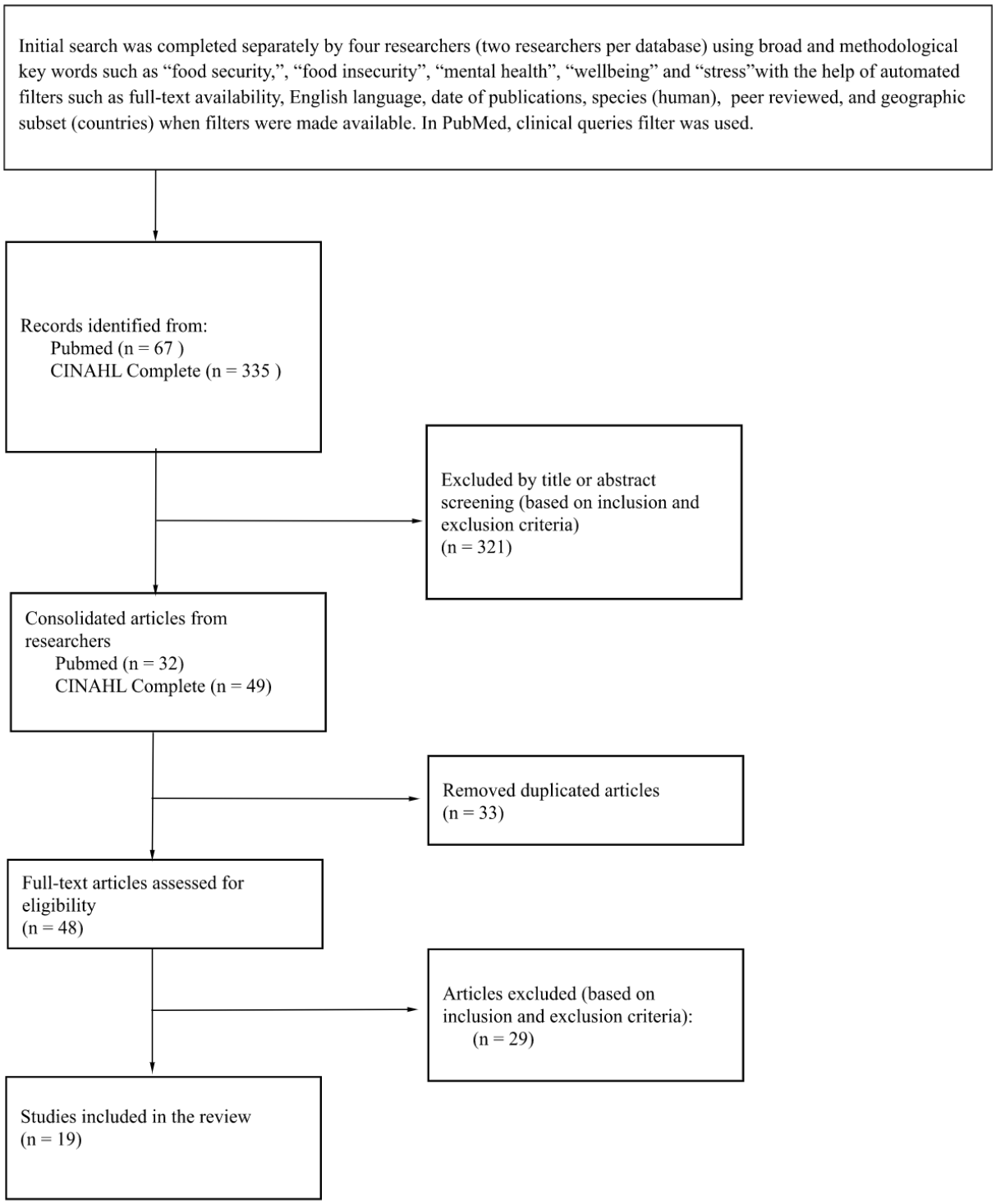
Appendix A

Figure 1

Search Strategy Diagram



Appendix B

Table 1

Bidirectional association between food security and mental health

Source Citation	Research Question/ Focus	Population and Sample Size	Study Design	Methods and Measures	Statistical Analysis Methods	Main Outcomes (Author Stated)	Implications for Discussion/ Conclusion	Researcher Notes (limitations and follow up)
Bruening et al., 2017	Causal directionality in the relationship between food insecurity and emotional well-being among US-based populations	• 12 longitudinal studies assessing measures of food insecurity and emotional well-being of children and adults in the U.S.	Systematic literature review / Qualitative	Secondary Research Searched MEDLINE (PubMed), PsychInfo, Web of Science and CINAHL Final review included a total of 12 longitudinal studies assessing measures of food insecurity and emotional well-being of children and adults in the U.S.		Food insecurity increases the risk of poor emotional health, and poor emotional health increases the risk of food insecurity	The findings in this article suggests a bidirectional association where food insecurity increases the prevalence of poor emotional health and where increased poor emotional health increases the risk of food insecurity	• Several studies included small / homogeneous samples, limiting generalizability of these studies • A large number of measurement tools and outcome measures analyzed by the studies do not allow for meta-analysis • Emotional health outcomes were measured with several different scales, made it difficult to compare findings across studies

Maynard et al., 2018	Illustrate the state of the literature on food insecurity and mental health among women living in high-income countries	• 39 articles representing 31 unique studies/surveys capturing food insecurity and mental health of women living in high-income countries	Scoping review / Qualitative	Secondary research Used Pubmed, EMBASE, and psycINFO to capture reviews up to May 2016 Included articles that examined the associations between food insecurity and indicators of mental health and focused on high-income countries.		Several longitudinal studies observed relationships between depressive symptoms and food insecurity, with food insecurity increasing the risk of experiencing depressive symptoms, or changes in food insecurity are associated with changes in depressive symptoms	Evidence supports the link between food insecurity and compromised mental health among women in high-income countries with specific bidirectional associations between food insecurity and depressive symptoms	• The range of tools used make it difficult for comparison across studies • Formal quality appraisal of studies was not conducted • The use of abbreviated measures with limited sensitivity and specificity compared to full measures may have potentially restricted the scope of observed relationships

Table 2:

The effect of income as a moderating factor between food security and mental health

Source citation	Research question/ Focus	Population and Sample Size	Study Design	Methods and Measures	Statistical Analysis Methods/ Qualitative Study Philosophy	Main Outcomes (Author Stated)	Implications for Discussion/ Conclusion	Researcher Notes (limitations and follow up)
Aguiar et al., 2022	Relationship between food insecurity and mental health		Cross-sectional / Quantitative	• Primary research • Online questionnaire between November 2020 and February 2021 • Data collected on socio-demographics, food security status, and mental health (i.e., anxiety and depressive symptoms) • Food insecurity measure: The US Household Food Security Survey Module (HFSSM) • Mental health measure: Hospital Anxiety and Depression Scale (HADS)	Crude and adjusted logistic regression models	• Less-educated participants with depressive and anxiety symptoms are more likely to belong to food-insecure households. • Reduction in income during COVID-19 and belonging to food-insecure households were associated.	Mental health issues (i.e., depression and anxiety) are critical factors to consider before introducing interventions to reduce food insecurity rates, or else interventions will be reductive.	• Need to specify the biological, psychological, and social factors that may deteriorate mental health. • Integrative approach based on environmental, social, and psychological care principles is needed.

Islam et al., 2022	Relationships between food insecurity, financial hardship, and mental health outcomes across various Asian ethnic groups in the United States during COVID-19	312 sample of self-identified Asian American ethnic groups from a weighted sample of 10,760 adults aged 18 and older drawn from the AmeriSpeak	Cross-sectional / Quantitative	• Secondary analysis of data from AmeriSpeak panel • Food insecurity measures: 1) Frequency of agreeing with "running out of food" and "not having enough money to get more food," OR 2) Receiving/requesting income assistance from a food pantry or the Supplemental Nutrition Assistance Program in the past 7 days. • Financial hardship measure: Self-reported action respondents would need to take if an unexpected $400 expense occurs. • Mental health measure: Self-reported number of days with symptoms of anxiety, depression, loneliness, and	Descriptive statistics, Chi-square, and Poisson regression	• Among all Asian American groups, Filipino+Vietnamese group and Japanese+Korean group had the highest and lowest prevalence of food insecurity and financial hardship, respectively. • High prevalence of food insecurity and financial hardship was associated with increased self-reported feelings of anxiety and hopelessness.	• Experience of food insecurity and more mental health symptoms were associated among Asian Americans during the COVID-19 pandemic. • Developing culturally and linguistically appropriate resources should be prioritized to help Asian Americans overcome the COVID-19 pandemic's negative impacts on mental health and finances.	• The study had difficulties in recruiting older Asian American population. • The study's cross-sectional design precludes establishing the temporality of the three main factors. • The study's small sample size prevented demonstrating associations between the main variables among disaggregated Asian American groups. • Future research should focus on: 1) investigating the reasons for the association between food insecurity and poor mental health, particularly in the context of Asian American social experiences; 2) The impact of English nativity on the socioeconomic impacts of the pandemic on Asian Americans.

				hopelessness within the last 7 days.				
Marshall et al., 2021	Relationship between financial hardships and debt indicators and mental health status among older adults	•7,678 participants aged over 50 with/without depressive symptoms and 8,079 participants aged over 50 with/without anxiety from the 2010 Health and Retirement Study • Some participants (15%) had both depressive symptoms and anxiety • Multistage area probability sampling	Cross-sectional / Quantitative	• Secondary analysis of the 2010 Health and Retirement Study in the US • Depressive symptoms measure: Eight-item modified version of the 20-item CES-D scale. • Anxiety measure: Five items of the Beck Anxiety Inventory. • Food insecurity was used as one of the indicators for financial hardship.	Spearman correlation coefficients	Depressive symptoms and anxiety were experienced more by older adults who reported difficulty paying their bills, being food insecure, having medical debt, or delaying medications due to cost.	• Difficulty paying bills and delaying taking medications due to cost had strongest association with mental health symptoms. • Findings suggest that inability to meet financial needs may jeopardize older adults' mental health more than food insecurity does. • Credit card debt was not associated with mental health symptoms.	• Present data cannot establish causality, and future prospective studies are needed. • Findings emphasizes the importance of providing food-insecure or medication-insecure individuals with financial safety nets to reduce mental health risks.

Yenerall & Jensen, 2021	The role of financial resources in understanding the relationship between food security and mental health among U.S. household	2000 US citizen over 18 years of age who are the household's primary food shopper (a national convenience sample)	Cross-sectional / Quantitative	Primary research Data were collected using an online survey administered by Qualtrics in July 2020 Measures of household food security status: • The USDA-ERS six-item short form version of the USDA-ERS U.S. Measures of mental health: • Questions adapted from the Behavioural Risk Factor Surveillance Systems (BRFSS) Analysis of financial resources related to the pandemic: • Monthly income in June 2020 as compared to January 2020	Weighted multinominal and ordered proportional logistic regression	A decline in monthly income and the use of savings to pay for bills are directly associated with both food security status and mental health outcome The use of savings to pay for bills increased the likelihood of either low or very low food security and increased the odds of more days of poor mental health in the past month A decline in monthly income increased the likelihood of very low food security and the odds of more days or poor mental health in the past month	Association among financial resources, food security, and mental health status of households are found during the pandemic During the pandemic, the number of reported poor mental health days were related to job loss and the need to draw from savings to pay for bills.	• The study uses cross-sectional data, and the results cannot be used to infer a causal relationship • The study used a general measure of mental health that only captures days of poor mental health, making it difficult for comparisons with other studies

Table 3:

The effect of age/gender/region/immigration as moderating factors between food security and mental health

Source Citation	Research Question/ Focus	Population and Sample Size	Study Design	Methods and Measures	Statistical Analysis Methods/ Qualitative Study Philosophy	Main Outcomes (Author Stated)	Implications for Discussion/ Conclusion	Researcher Notes (limitations and follow up)
Allen et al., 2018	Relationship between food insecurity (with and without hunger) and both mild to moderate psychological distress (MPD) and serious psychological distress (SPD) among African-Americans	• 4,003 African-American adults from the 2009 and 2011/2012 California Health Interview Survey (CHIS) • Random sampling	Cross-sectional / Quantitative	Secondary analysis of data from the 2009 and 2011/2012 CHIS Psychological distress measure: Kessler-6 scale (8-12 score = MPD) (13+ score = SPD) Food security status measure: Questions from CHIS about food insecurity experiences (e.g., running out of food)	Descriptive statistics and Chi-squared analyses	Prevalence of mild to MPD was higher among food-insecurity-without-hunger individuals while SPD was highest for food-insecurity-with-hunger individuals Compared to those living at or above 200% Federal Poverty Level, odds of SPD was six-times higher in African-Americans with food-insecurity-with-hunger	• Hunger has a significant role in the association between SPD and food insecurity. • Two distinct groups of food insecure individuals with psychological distress: Group 1) transient food insecurity associated with mild to MPD; Group 2) chronic food insecurity associated with SPD. This distinction can be important in the design and implementation of interventions. • Improving the efficacy of formal	• Cross-sectional design limits the ability to interpret causality. • Generalizability limited to California. • Future research should investigate if the same pattern can be found in other ethnicities and when using different mental well-being indicators.

							and informal food support networks can improve the collective health and wellbeing of Black/African-American communities that suffer from food insecurity or hunger. • Expand the utilization and availability of integrated care models.	

Dou et al., 2022	Prevalence of food insecurity and its association with the mental wellbeing of immigrants on a global and regional scale.	• 36,313 immigrants and 705,913 nonimmigrant adults aged 15 years and older in 159 countries globally from the Gallup World Poll (GWP) 2014-2019 • Random sample	Cross-sectional / Quantitative	• Secondary analysis of data from the GWP 2014-2019 • Immigration status measure: Response to the question “Were you born in this country, or not?” • Food security measures: Food Insecurity Experience Scale • Mental wellbeing measure: Negative Experience Index (NEI) and Positive Experience Index (PEI) • Measure of respondents' satisfaction with the community they live in and their likelihood to recommend this community to others: 2-item	Multilevel mixed-effect linear models	• Close to 39% of the immigrants sampled were food insecure. • Food insecurity was dose-responsively associated with lower mental well-being. • Community attachment marginally affected the food insecure-mental wellbeing association. • Immigration status significantly modified the food insecure-mental wellbeing association. • Immigrants experienced lower mental wellbeing than nonimmigrants at the same level of community attachment and food insecurity.	• Food insecurity and poor mental health are associated, and experienced by immigrants worldwide. • A better-perceived living environment may alleviate poor mental experiences, especially among severely food-insecure groups. • Characteristics of immigrants can impact both food insecurity and mental wellbeing. • Immigrants in the Asia and Pacific regions appeared to report worse mental wellbeing than nonimmigrants at moderate and severe food insecurity levels, possibly because the dominant form	• The study design could not determine the directionality of the relationship between food insecurity and mental wellbeing. • Findings could be confounded by unmeasured factors, such as chronic conditions and governmental assistance programs. • The 1-item question assessing immigration status does not discriminate the length of stay and reason for immigration. • The differences in data reference period on food insecurity (in the past 12 months) and mental wellbeing (in the last 24 hours) limited the ability to infer temporality. • Socioeconomic status characteristics differ between the included and excluded immigrant sample and findings may not be generalizable to all

				Community attachment index			of immigration in these regions is as a temporary labour force and government benefits may not cover this group.	immigrants worldwide.
Jones, 2017	Relationship between individual-level food insecurity and mental health status 149 countries around the world, and the variables that modify this relationship (including global region, age, and sex).	147,826 respondents aged 15 years and older were taken from 100-135 sampling units (clusters of households) of the 2014 Gallup World Poll (GWP). Sampling unit selection: population size probabilities and random sampling. Respondent selection: random sampling.	Cross-sectional / Quantitative	Secondary analysis of telephone/in-person interview survey data from the GWP Individual-level food insecurity measure: Food Insecurity Experience Scale Survey Module for Individuals (FIES SM-I) Mental health status measures: The Negative Experience Index (NEI) and Positive Experience Index (PEI)	• Multiple linear regression models • Multiple logistic regression models	Globally, individual-level food insecurity was associated with lower mental health status, and severity of food insecurity predicted worsened mental health status. Older adults had stronger positive association between food insecurity and NEI, and stronger inverse association between food insecurity and PEI. Region modified the moderating effects of age in	Food insecurity is associated with negative mental health status, and this association exists across contexts and despite sex and world region.	• The cross-sectional design does not permit conclusions about directionality and causality of the association. • Temporality cannot be established due to varying recall periods for the study's three measures. • The two GWP surveying methods (i.e., telephone and in-person) can introduce different biases to respondents' answers and affect within-region analyses for countries that had more in-person surveying.

						within-region analyses: age moderated the association only in middle- and high-income areas. Individual-level food insecurity was associated with higher odds of recent negative feelings. Individual-level food insecurity was associated with lower odds of recent positive feelings.		

Pourmotabbed et al., 2020	Food security as a risk factor for depression, stress and anxiety	372,143 adult participants from 10 different countries collected from 19 studies	Systematic review and meta-analysis / Quantitative	Secondary research Relevant studies were identified by searching Web of Science, Embase, Scopus, and PubMed databases up to January 2019 Included: Observational studies reporting on the association between food insecurity and depression, stress, and anxiety Excluded: Studies on participants under 18 years of age Conducted quality assessment for individual studies	Study-specific maximally adjusted ORs	• There was a positive relationship between food insecurity and risk of depression and stress, but not anxiety. • Subgroup analysis by age showed that subjects older than ≥65 years exhibited a higher risk of depression than younger participants; a greater risk of depression is also found in men than women. • Subgroup analysis according to geographical location illustrated that food insecure households living in North America had the highest risk of stress and anxiety.	Food insecurity has a significant effect on the likelihood of being stressed or depressed, and healthcare services which alleviate food insecurity, could also promote holistic well-being in adults.	• A high percentage of heterogeneity was observed which may be due to the small number of studies (less than ~10 studies) on anxiety. • The study did not undertake an assessment of the grey literature and only worked with studies written in English. • The impact of other potential biases including demographic, lifestyle and clinical variables, and genetic background could not be assessed. • Subgroup analyses had to be undertaken due to high heterogeneity which reduced statistical power.

Table 4:

The effect of community support as a moderating factor between food security and mental health

Source Citation	Research Question/ Focus	Population and Sample Size	Study Design	Methods and Measures	Statistical Analysis Methods/ Qualitative Study Philosophy	Main Outcomes (Author Stated)	Implications for Discussion/ Conclusion	Researcher Notes (limitations and follow up)
Hammami et al., 2020	Gender differences and the role of social support as a moderating factor for Canadian youth's experience of hunger and mental health.	21,750 youth in grades 6-10, from 287 schools across 12 Canadian provinces and territories from the 2017/2018 school-based survey cycle of the Canadian Health Behaviour in School-aged Children study (HBSC-Canada) • Probability sampling	Cross-sectional / Quantitative	Secondary analysis of data on self-reported hunger, mental health, and sources of support from peers, family, teachers, schools, and neighborhoods from the school-based survey cycle of HBSC-Canada. Mental health measures: World Health Organization-5 (WHO-5) mental well-being index. Hunger measure: Students were	Chi-squared test, multivariate analysis, and adjusted gender-specific multilevel regression analysis	All social support factors were positively associated with mental health, but did not overpower the negative effects of hunger on mental health. Perceptions of support were lower in youth having experienced hunger than youth never having experienced hunger. Hunger in female youth was more strongly associated with poor mental health than	Hunger was associated with lower odds of mental health. The associations between social support and mental health as well as hunger and mental health are different across genders based on their differential stress perceptions and coping mechanisms.	The study only measured food-insecurity via hunger, limiting comparison to studies using other food-insecurity measures. A limitation of the study was that measures for support were subjective. Social support was only investigated in terms of emotional support, and did not examine other related factors, such as sense of belonging. Future studies should look at the effects of different forms of social and community support as moderating factors for mental health in

				asked: “Some young people go to school or to bed hungry because there is not enough food at home. How often does this happen to you?” Based on their answer, they were categorized as “ever hungry” and “never hungry.”		hunger in male youth. Some social support factors were more strongly associated with better mental health in female youth than male youth.		food-insecure individuals with and without hunger. The study was limited to the HBSC-Canada sample, which covered schools in all provinces and territories except for Nunavut, thus the sample possibly under-represents certain rural and Indigenous populations. Future studies should compare the effects of different social support measures on mental health and whether these results are related to differences in male/female perceptions of support and hunger. Cross-sectional design could not examine the longitudinal associations between hunger and mental health starting in early-life.

Lund et al., 2021	Relationship between three social determinants of health (i.e., housing insecurity, food insecurity, and financial instability) and life dissatisfactio n, and the moderating effects of emotional and social support and mental distress on this association.	• 25,850 American adults ages 18 and over from Minnesota, Wisconsin, and Ohio surveyed in the 2017 Behavioral Risk Factor Surveillance System (BRFSS).	Cross-sectional / Quantitative	• Secondary analysis of data from the 2017 BRFSS. • Social determinants of health measure (SDOH): SDOH module in the BRFSS. • Life satisfaction measure: 1 item in the 2-item Emotional Support and Life Satisfaction module in the BRFSS. • Emotional support measure: 1 item in the 2-item Emotional Support and Life Satisfaction module in the BRFSS. • Frequent mental distress (FMD) measure: In the previous month, self reporting 14	Descriptive analyses, crude prevalence differences, and Mantel-Haenszel stratified analysis.	• Respondents with the three SDOH were more likely to report overall life dissatisfaction. • FMD and lower social and emotional support were more highly linked to individuals with the three SDOH.	• Emotional and social support mediates the odds of experiencing the SDOH and reporting FMD; therefore, support might be important for mental wellbeing. • Food insecurity was one of the SDOH variables, which were linked to life dissatisfaction, showing a relationship between food insecurity and wellbeing.	• Cross-sectional design cannot establish causality. • Only data from the three states of Minnesota, Wisconsin, and Ohio were used, which limits generalizability • The emotional support measure was based on only one item in the Emotional Support and Life Satisfaction module. This might not capture various types of support. • The study spent little time reviewing the link between food insecurity and mental health since its primary focus was on the link between adverse social determinants of health and life satisfaction.

				days or more of poor mental health.				
Pak & Kim, 2020	Relationship between very low food security and health outcomes in older adults and if participation in the Supplemental Nutrition Assistance Program (SNAP) reduces adverse health consequences associated with very low food insecurity.	• 148,138 observations from 27,281 Americans and 18,524 US households from the 1998-2014 surveys of the Health and Retirement Study (HRS).	Cross-sectional / Quantitative	• Secondary analysis of food insecurity and SNAP data from the 1998-2014 surveys of the HRS. • Food insecurity measure: Participant's answers to the questions, "Since the previous interview/In the last two years, have you always had enough money to buy the food you need?" and "In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money to buy food?" • SNAP participation	Individual fixed regression	• SNAP participants had a higher chance of having clinical depression associated with food insecurity. • SNAP participation was correlated with negative self-attitudes.	The study indicates that the stigma associated with SNAP participation might hinder psychological wellbeing of food-insecure people.	• Welfare stigma in association with depressive symptoms may not be generalizable to younger people, and future research should examine the experience of younger adults. • Future research should use clinically-validated measures of major depression and examine the effectiveness of counseling as an intervention.

				measure: Participants' answers to the questions, “Did you (or other family members who were living here) receive government food stamps at any time since the previous interview/in the last two years?” and “Are you (or other family members who are living (here/there)) still receiving food stamps?” • Measures of mental health: 1) Abridged eight-item version of the 20-item Center for Epidemiologic Studies (CES-D) scale; 2) a binary indicator of clinical depression.				

Table 5:

The effect of family dynamics as a moderating factor between food security and mental health

Source citation	Research Question/ Focus	Population and Sample Size	Study Design	Methods and Measures	Statistical Analysis Methods/ Qualitative Study Philosophy	Main Outcomes (Author Stated)	Implications for Discussion/ Conclusion	Researcher Notes (limitations and follow up)
Bell et al., 2022	Explore women's experience of food insecurity and its effects on nutritional health and well-being	• 23 publications with 22 unique studies reporting the accounts and experiences of nutritional health and well-being of a total of 647 women of childbearing age (between 16 and 55) from a variety of ethnicities reporting food insecurity	Systematic literature review / Meta-ethnography of qualitative studies / Qualitative	Searched Scopus, MEDLINE, EMBASE, CINAHL, Applied Social Science Index (ASSIA) and Web of Science	According to Noblit & Hare's seven phases of meta-ethnography Identified key themes and sub-themes emerging across studies via synthesis of a storyline of women's experience of food insecurity	Identified 2 key themes and subthemes: 1. Accessing sufficient food • Strategic adjustments • Accessing charitable food aid • Informal Support Networks • Healthy Start vouchers (in the UK) 2. Embodying food insecurity • Inability to meet own nutritional needs • Maternal sacrifice • Physical and mental health and wellbeing	There is a lack of qualitative change over time with regards to women's experiences of food insecurity Lone mothers and migrant women were particularly vulnerable to more severe experiences of food insecurity as the only groups of women who articulate resignment to food insecurity There needs to be more recognition of the psychosocial impact of food insecurity on vulnerable women and its impact on their nutritional health and wellbeing	• There needs to be greater recognition of the psychosocial impact of food insecurity on vulnerable women in addition to its impact on their nutritional health and well-being • There is a lack of studies from non-UK European countries • Review is subject to publication bias. • This review includes a diverse range of included studies from different European contexts, which may have different welfare states, social security, food aid, and health care systems making comparison difficult

						Food insecurity directly and tangibly impacts women's nutritional health and wellbeing		
Ciciurkaite & Brown, 2018	• Gender differences in depressive symptoms and alcohol-use and their link to food insecurity. • Marital status and parental status as predictors of depressive symptoms.	• 11,539 non-institutionalized U.S. civilians 18 years and older from the 2011–2012 and 2013–2014 cycles of the National Health and Nutrition Examination Survey (NHANES) • Random sampling	Cross-sectional / Quantitative	• Secondary analysis of data from the 2011–2012 and 2013–2014 cycles of the NHANES. • Depressive symptoms measure: Patient Health Questionnaire (PHQ-9) • Household food insecurity measure: 18-item scale comprised of 12 Likert-type and 6 yes/no questions • Food insecurity conceptualized as a form of chronic strain	Six models of regression	• Food-insecure households experienced higher levels of depressive symptoms than their food-secure counterparts. • Women experienced greater depressive symptoms than men. • Marriage acted as a greater protective factor against psychological distress in men than women. • Having children under 18 years of age was associated with lessened psychological distress in women, however these mental benefits are reduced in low and very low food insecure households.	There are differences in the experience of psychological distress associated with food insecurity, based on gender and family context.	• Cannot establish causality or bidirectionality due to study's cross-sectional design. • Findings support the need to consider gender differences when planning interventions that target both nutrition and psychological and behavioural health. • Food insecurity was measured via economic constraints and did not consider other sources of food insecurity (e.g., disability and old age). • The Patient Health Questionnaire (PHQ-9) is a less commonly used measure, making comparisons across studies difficult. • Although the study controlled for age, income, education, race/ethnicity, and employment, it did not control for other relevant social determinants of health such as social support

								outside of the home environment.
Johnson & Markowitz, 2018	Relationship between household food insecurity and multiple variables of family well-being to highlight previously understudied, policy-amenable mechanisms through which food insecurity threatens healthy development	• 2100-4700 subsample of children with valid food insecurity and income data 185% below poverty line drawn from the first three waves of the Early Childhood Longitudinal Study—Birth Cohort	Cohort Study / Quantitative	Secondary analysis of a data from a cohort study the first three waves of the Early Childhood Longitudinal Study—Birth Cohort (Wave 1 in 2001 and 9 months old; Wave 2 in 2003 and 2 years old; and Wave 3 in 2005-2006 while in preschool), a US nationally representative study of children	Regression models with lagged dependent variables	• Household food insecurity was associated with poorer maternal physical health, increased depressive symptoms and greater frequency and negativity of conflict between parents. • The association between food insecurity and family associations were strongest and most consistent when children were preschool aged. • The transition into food insecurity between toddlerhood and preschool were associated with significantly worse parental physical and mental health outcomes, and more family conflict	• Food insecurity is associated with significant decreases in family health and well-being. • Screening families who are at risk for food insecurity and connecting them with resources is an avenue through which public health practitioners can support family health.	• The study relied exclusively on maternal self-report for both food insecurity and all dependent variables which can introduce possible reporting bias • The results can be a reflection of maternal depressive symptoms that contribute to food insecurity or food insecurity's contributing to increased maternal depressive symptomatology; causality is unclear.

Lindow et al., 2022	Parents' lived experiences of food insecurity based on their household food management, ability to provide for their families, and food insecurity's impact on their mental health.	• 17 low to very low food-insecure parents from San Francisco Bay Area, between ages 28 to 61 years, and identifying as non-Hispanic White, Black/African American, Hispanic and multi-racial, Native Hawaiian/Pacific Islander, or American Indian/Alaskan Native.	Phenomenology / Qualitative	• Primary research • Photovoice study conducted between June 2016-January 2017 • Food insecurity measure: US Department of Agriculture 18-item Household Food Security Survey Module • Researchers formalized research question • Participants took/sent photos over 2 weeks and had a 30-min follow-up semi-structured interview to discuss photos.	Researchers developed codebooks to identify emerging and common themes.	• Four common themes were identified: 1. Food environment promotes unhealthy eating. 2. The use of creative strategies to acquire food with limited resources. 3. Psychological distress due to food insecurity. 4. Treating children to special foods to cultivate normalcy. • Psychological distress revealed itself as feelings of shame, guilt, and distress and was tied to parents' perceived ability to provide adequate or nutritious food for their kids.	Parents experience of food insecurity was often tied to increased psychological distress often revealed as feelings of shame, guilt and distress often tied to their perceived limited capacity in providing adequate or nutritious food for their children	• Participants were asked to interpret the research question broadly, allowing parents to share the narrative of their choice, and help inform policy makers of current issues to consider in future development of food assistance programs. • Further investigation and qualitative analysis regarding mediating factors of parental distress based on sociodemographic factors may reveal differences in experience. • The qualitative analysis provides insight into the variables that contribute to poor mental health in food-insecure individuals, but the lack of measures of negative mental health outcomes limits comparison to the many quantitative studies on the topic. • Limited engagement from participants required that the Photovoice method be adapted.

Ling et al., 2022	Relationship between the effects of adult and child food insecurity on parent's and children's mental well-being	• 408 U.S. parents aged 18 to 65 years (with a mean age of 31) living under the poverty level and with children aged 3-5 years (17% Hispanic, 21% Black)	Primary research / Cross-sectional / Quantitative	Study participants were recruited by email from one urban and one rural Head Start organization and online via the Qualtrics Panel to participate in an online survey Assessment of food insecurity: • The U.S. Household Food Security Survey Module. Measures of well-being: • Parents' stress, anxiety, and depression; and children's sadness, fear, anger, and positive affect using instruments from Health Measures	Multivariate general linear models	• Parents with food insecurity had higher levels of stress, anxiety, depression, and fear in their children compared to those without adult food insecurity. • Parents reporting child food insecurity had greater depressive symptoms than those who did not report child food insecurity. • Black parents had lower stress, anxiety, and depression than their White counterparts.	The study's results underscore the importance of reducing food insecurity in both parents and children as a whole family system to promote mental well-being of low-income families.	• Parents may have under- or overestimated children's mental well-being. In future studies, objective measures, such as cortisol testing, to assess preschoolers' mental well-being are recommended. • The sampling approach may have failed to represent low-income families with very limited internet access or literacy levels. • Self-reported online surveys were completed by parents to avoid in-person interactions due to the COVID-19 pandemic, possibly resulting in social desirability and recall bias.

Ovenell et al., 2022	Relationship between adults' sacrifice of personal nutritional needs in shielding children from malnutrition on mental health and well-being	• 28,871 youth and 74,416 adults from three cycles of the Canadian Community Health Survey living in food insecure households	Secondary research / Cross-sectional / Quantitative	Secondary analysis of data from three cycles (2007-2008, 2011-2012, and 2017-2018) of the Canadian Community Health Survey living in food insecure households	Poisson regression	• About one in six (15.3%) households with children were food insecure and one-third of food insecure households (6.3%) included children who were shielded from experiencing food insecurity. • Shielded youth did not differ significantly from food-secure youth in three of the five outcomes examined. • Unshielded youth compared to food-secure youth showed increased risks for every health outcome investigated. • Adults in food-insecure households also reported worse mental health than food-secure adults but better mental health if children were shielded.	• Shielding is associated with a reduced risk of common psychiatric outcomes and poor mental health in youth and adults, possibly because it is associated with milder forms of food insecurity. • The inability to protect children from having inadequate access to food may compound the psychological strain of food insecurity on mental health and well-being in adults. • Adults might be better able to shield children from milder forms of food insecurity. • Adults with better mental health and well-being are in a better position to shield.	• The effects of parental mental distress on children's mental health cannot be controlled. • The intensity or severity of food insecurity as a factor increasing higher risks in mental health cannot be clearly differentiated from the effect of shielding.

Appendix C

Table 6

CCHS Variables for Proposed Research

Variables	**Details**	**Levels**
Household food security status (Statistics Canada, 2005b)	Derived variable that categorizes respondents based on the pattern of affirmative responses captured on a set of 18 questions that are based on the U.S. model of food security status levels published by the U.S. Department of Agriculture in 2000. Respondents were asked to reflect on their situation in the previous 12 months.	Food Secure Food insecure without hunger Food insecure with moderate hunger Food insecure with severe hunger
Self-rated mental health (Statistics Canada, 2005b)	Derived from variable 'Self-perceived mental health' that captures the respondents' answers to the statement "In general, would you say your mental health is:"	Excellent Very Good Good Fair Poor