THE **HUNGER** REPORT

An In-depth Look at Food Insecurity in Singapore

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ABOUT THIS REPORT

This report provides a detailed account of the first nationally representative study on the largely hidden problem of food insecurity in Singapore.

While there are previous reports which have delved into food insecurity in Singapore (Tan, Kaur-Gill, Dutta & Venkataraman, 2017; Glendinning, Shee, Nagpaul & Chen, 2018) via small-scale investigations, the current report takes a countrywide perspective on the issue and furnishes nationally representative data on the prevalence, causes and consequences of food insecurity in the island nation. The fundamental aim of the report is to help readers understand the profiles of individuals/households that experience food insecurity and the socio-psychological impact it has on their lives. The survey identified 10.4% resident households that had experienced food insecurity in the 12 months prior to the data collection period of July to December 2019.

This report will serve as a reference for household food insecurity in Singapore and may be of practical value to policymakers, researchers, academic faculty, students and food support organisations that are interested in understanding the face of food insecurity in developed nations such as Singapore. It provides detailed statistical analyses of several factors governing food insecurity. Core findings are bolded and italicised for easy reference.

The production of this report would not have been possible without the untiring support of our field interviewers (Akshit Kariwala, Anastasia Hoon, Brendan Hoe, Daniel Wong, Edwin Goh, Gabrielle See, Lynn Yan, Madeleine Tan, Peck Lin Huin, Remee Ocampo, Richie Tan, Subhradip Sikdar, Wan Yun Tan, Wendy Gan, Wei Ching Ong and Xin Yuan Lim), who knocked on the doors of close to 1,700 households in Singapore. We would like to express our gratitude to each of them.

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LIST OF ILLUSTRATIONS

ABOUT THE FOOD BANK SINGAPORE

Established in 2012, the Food Bank Singapore FBSG (https://foodbank.sg/) is Singapore's first food bank and aims to be the prevailing centralised coordinating organisation for all food donations in Singapore.

Driven by its mission to eradicate food insecurity of all forms in Singapore by 2025, the registered charity bridges potential donors and member beneficiaries by collecting and redistributing donated food. Its members are registered charity or non-profit organisations with a designated meal programme for low-income and underprivileged individuals and families.

Through a network of more than 360 such organisations of all sizes, the food bank serves more than 100,000 families and more than 300,000 people with all kinds of food—from fresh to cooked.

Among its many programmes are the following:

- Bank Boxes, which are placed in buildings across Singapore for people to drop in food donations
- The Fresh Food Truck, which collects dented and bruised fruits and vegetables from Pasir Panjang Wholesale Centre to be redistributed to people in need
- Food drives for corporations to generate food donations as well as raise awareness about food insecurity and wastage
- The Food Pantry 2.0 in Toa Payoh, which features vending machines that stock food items with a relatively short shelf life—four weeks or less—at just $2 each
- The Feed the City community engagement initiative, which provides meals to the needy

FBSG has become the voice of food resource planning and management, including working closely with government agencies to address issues on the ground. As a leader, it helps food banks around the region to collectively combat food insecurity. This is something that its founders—Nichol Ng and Nicholas Ng—are passionate about.

Thanks to its network and its experience in the food industry, FBSG can provide insight and better access to sources of excess food. Backing them is a team that shares the same vision and passion.

EXECUTIVE SUMMARY

TThe reality is that about 10% of Singaporean households (citizens and/or permanent residents) in this nationally representative study of close to 1,200 surveyed households experienced food insecurity at least once in the last 12 months, with two out of five of these households experiencing food insecurity at least once a month. This is not a percentage that can be overlooked.

Despite Singapore being ranked by the Economist Intelligence Unit as the most food-secure nation in the world on the Global Food Security Index in 2019, this study reveals a paradox. Singapore has done well in terms of achieving sufficiency of food supply through a strategic diversification of food sources, but this progress has not prevented the island nation from reporting severe levels of food insecurity in close to 3.5% of individuals participating in this nationally representative study.

As expected, the current study found that food-insecure households were more likely than food-secure households to reside in 1- or 2-room HDB flats. However, food insecurity was spread across larger housing type configurations as well. Household heads of food-insecure families tended to have lower educational attainment compared to their food-secure counterparts. Low income is typically positively correlated with the experience of food insecurity; this report reiterates that income is a persistent factor in food insecurity, with 79% of the reasons cited for food insecurity being centred on financial constraints. Non-monetary concerns such as time constraints, restricted mobility, incarceration, spouse bereavement and family breakdown were also reported.

Food insecurity is associated with both physical and mental health detriments. Food-insecure participants were more likely to be in the high-risk body mass index (BMI) category compared to food-secure participants and were more likely to eat only one main meal a day. Psychologically, food-insecure participants reported a slew of negative emotions such as feeling sad, embarrassed and hopeless.

In terms of food assistance, only 22% of food-insecure households were receiving food support from an organisation at the time of being interviewed. Despite the inadequate outreach, a small proportion (20%) of those receiving help reported that food relief made a lasting impact on their lives. Even so, there was significant disenchantment with food support, perhaps because food assistance cannot be a long-term solution to food insecurity if the root cause is income related.

Recommendations discussed in the report include the following.

Tackle misalignment of food support: This study finds that the majority of food-insecure households are not receiving adequate food support. There needs to be more strategic coordination of food support to these households. Geographical mapping of areas where vulnerable households reside can aid in identifying food-insecure neighbourhoods and informing food aid organisations. At the national level, more strategic coordination of food support should involve multi-sector partnerships that encompass the relevant and diverse stakeholders in the food support ecosystem. These include the government and non-profit and private sectors.

Prioritising nutritious and healthy eating among Singapore households: Only 40% of the individuals who participated in the survey had a BMI in the healthy range, regardless of their food security status. Rigorous national campaigns to encourage healthy eating should continue and be further amplified. As cost was listed as a major deterrent to choosing healthier food options, this aspect should be further explored. If healthier food options do not necessarily mean higher costs, this message should be incorporated into healthy eating campaigns.

Increasing the level of awareness about food insecurity in Singapore: Only 28% of food-secure participants reported having personal affiliations with food-insecure families. The lack of awareness about food insecurity in Singapore, especially among food-secure households, warrants attention and action. Information and education on food insecurity is required in order to cultivate empathy and awareness that this is a pertinent issue in Singapore.

01

WHAT IS FOOD INSECURITY?

As defined in an earlier report by the Lien Centre for Social Innovation (Glendinning et al., 2018), food security is achieved 'when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life'. In contrast, household food insecurity comes about when a household does not have, or is not confident of having, 'economic and physical access to sufficient, acceptable food for healthy life'. Further, absence of hunger is not seen as a sign of food security. Limited access to adequate nutritious food for a stretch of time (weeks or months) may deem a household to be food insecure. According to Anderson (1990), food insecurity occurs whenever the availability of nutritionally adequate and safe foods or the ability to acquire acceptable foods in socially acceptable ways is limited or uncertain.

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The current study utilised the Household Food Security Survey Module to determine food security status (see 'Methodology' section for details). According to McKay, Haines and Dunn (2019), in order to achieve food security four dimensions need to be taken into account. The first, availability, refers to the reliable and consistent provision of quality food for an active and healthy life and may include home food production, transportation and exchange systems for food. The second, access, refers to sufficient economic and physical resources to acquire food. The third, utilisation, refers to the ability to transform food into meals; and the last, the dimension of stability, recognises that food insecurity may be transient, cyclical or chronic.

Severity levels of food insecurity may range from concerns and adjustments in household food management—including reduced quality of diet—to households with children who have reduced children's food intake to an extent that it implies the children have experienced the physical sensation of hunger. In the middle of the range lie households where the intake of food is reduced for the adults but is not observed among the children.

While enough attention has been paid to the problem of hunger and food insecurity in developing nations, the prevalence of food scarcity and food deprivation among the poor in many affluent nations is now gaining recognition. National reports from a host of developed countries such as the US, UK, Canada, Netherlands and Australia are available. However, there is no report or study in Singapore from which a national prevalence rate of food insecurity can be derived. The current study aims to make a novel attempt in generating such insights through the use of validated food insecurity measures.

02

THE CURRENT STUDY

Study Sample

In order to ensure that the survey sample was nationally representative, participants were recruited via two customised random samples of residential addresses from the Department of Statistics, Singapore. While our target sample size was 1,000 participants, we sampled 2,500 addresses due to an expected non-response rate of 40%. The actual response rate of the current study was 56.7%. The field interviewers collected survey data between July and December 2019. The sampling process was based on the following criteria.

Sample 1: 1,500 addresses

This customised frame comprised addresses with at least one Singaporean or permanent resident (PR) and was divided into their detailed housing types: HDB 1- to 2-Room, HDB 3-Room, HDB 4-Room, HDB 5 Rooms and Larger, Landed Properties, Condominiums and Other Private Flats, and Others. The number of addresses to be selected from each detailed housing type was proportionate to the housing type distribution in Singapore. Within each detailed housing type, the addresses were further distributed proportionately by planning region (Central, East, North, North-East, West). The required number of addresses were then randomly selected from each planning region.

Sample 2: 1,000 addresses

This customised frame consisted of only HDB 1- to 3-room flats with at least one Singaporean or PR and was divided into their detailed housing types: HDB 1- to 2-Room and HDB 3-Room. Similar to sample 1, the number of addresses to be selected from each detailed housing type was proportionate to the housing type distribution of the frame. Within each detailed housing type, the addresses were further distributed proportionately by planning region (Central, East, North, North-East, West). The required number of addresses were then randomly selected from each planning region.

This oversampling of HDB 1- to 3-room flats was done to cover a substantial number of low-income households that would be likely to experience food insecurity. Adequate coverage of such households and their views and insights would enable us to better understand the food insecurity situation. Due to this oversampling, weighting was done for the analysis.

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Rationale behind Weighted and Unweighted Distribution

This study is guided by a two-fold objective: first, it aims to provide a representative statistic of food insecurity in Singapore; and second, it aims to closely examine a representative sample of food-insecure households in Singapore and zoom in on their socio-demographic profile as well as the extent, causes and consequences of food insecurity experienced. In order to address this dual purpose, analysis is done in two ways: weighted and unweighted distribution analysis.

Importance of Weighted Distribution: Despite our best efforts to ensure the representativeness of the study sample using the above random sample frames, the sample statistics matched the national distributions only in some categories of demographic variables but not all. This was also because we over-sampled the HDB 1- to 3-room households. Hence, we decided to weight the sample distribution in order for it to be closely matched to the national distribution on the demographic variables that we were interested in. If the sample data is not representative of the larger population, the ability to make inferences about the population based on analysis of the sample data is reduced. Weighting some observations more than others can be thought of as rebalancing the sample data so that any subsequent analysis better reflects what we would expect if we could analyse the entire population. Thus, the weighting process enabled us to make some generalised conclusions about food insecurity in Singapore.

We weighted our sample distribution to match the national distribution on three main variables: housing type, ethnicity and highest educational level attained. Due to large amounts of incomplete data on the variable of income, we did not include it in our analysis and used housing type as a proxy for income level. In Singapore, housing type is correlated with income and can be used as a proxy measurement for socioeconomic status (Ng, Tan, Gunapal, Wong & Heng, 2014; Lwin, Malik, Kang & Chen, 2018). Following the weighting process, the sample distributions were statistically similar to the latest (2018–19) general population distributions retrieved from the Singapore Department of Statistics website (https://www.singstat.gov.sg/), thus giving us confidence in the representativeness of our findings. We chose the above three variables as they have been shown in previous studies to strongly influence

Housing Type Singapore Population Stats vs Current Study Sample Stats

	SG Percent	Sample Percent	Weight Assigned = population % divided by sample %
HDB 1- & 2-room flats	6.1	32.6	0.187
HDB 3-room flats	17.6	15.9	1.106
HDB 4-room flats	31.7	27.1	1.160
HDB 5-room flats/executive flats	23.2	19.9	1.160
Private condominiums /other private flats	15.9	4.6	3.456
Landed property	5.1	0.9	5.666
Total	100.0	100.0	

Exhibit 2.1. Example of Weighting Sample Distribution per Population Distribution

food insecurity (Hernandez, Reesor & Murillo, 2017; Tabrizi, Nikniaz, Sadeghi-Bazargani, Farahbakhsh & Nikniaz, 2018; McKay, Haines & Dunn, 2019). As an example, the weighting process for the housing type distribution is shown in Exhibit 1. The national level statistics for housing type were retrieved from the Singapore Department of Statistics website. These statistics were then compared to the sample statistics, and corresponding weights were assigned in order to balance the sample distribution and map it closely to the national distribution.

Importance of Unweighted Distribution: In line with our intent to get deep insights into food-insecure households in Singapore, we over-sampled the HDB 1- to 3-room flats. As expected, we found that the majority of food-insecure households resided in such flats. While the weighted distribution above enabled us to compare food-secure and food-insecure households, the unweighted distribution of food-insecure households facilitated a closer examination of the experiences of food-insecure households. Hence, some sections of our analysis below use the unweighted sample of food-insecure households to apprise readers of what this group looks like in and of itself.

Methodology

Data was gathered in two distinct phases for this research project:

01 Survey of Singapore citizens and PRs

02 Qualitative interviews with food-insecure Singapore citizens and PRs

Phase 1: Survey of Singapore Citizens and PRs

Doors of all addresses were knocked on, and the participants' consent was obtained before the survey was carried out. The surveys were conducted face to face by a trained field interviewer, and all participants received $10 or $30 in NTUC vouchers as a token of appreciation for their participation. The field interviewers requested to speak to a household member who was at least 18 years old and able to speak about the food situation in the household. The amount of incentive depended upon the survey length (it was longer for food-insecure and shorter for food-secure participants). A total of 1,206 usable surveys were collected.

Survey Tool: The Household Food Security Survey Module (HFSSM) previously used in the 2004 Canadian national report on income-related household food insecurity in Canada was used to determine food security status. This module is composed of 18 items—a ten-question Adult Food Security Scale to measure food security among adults in the household and an eight-question Child Food Security Scale to measure food security among children in the household.

Children and adults were defined as food secure, moderately food insecure or severely food insecure depending on the number of affirmative responses given to the scale questions (Collins, 2009). Exhibit 2 shows the definitions of food security, moderate food insecurity and severe food insecurity, and how they correspond to the questions on the HFSSM. The HFSSM is a household measure: it assesses the food security situation of adults and children as a group within a household, but not the food security status of each individual member residing in the household. Therefore, it is possible that all members of a household may not share the same food security status.

In addition to the above classification, we also computed a composite food insecurity score by summing the raw scores on each of the adult items of the HFSSM. Under this computation, scores ranged from 7 (lowest) to 21 (highest). Higher scores indicated greater food insecurity. The derivation of the overall food insecurity score for each household facilitated analyses of food insecurity with some of our continuous variables such as mental well-being and level of awareness of food insecurity.

While the HFSSM measures food insecurity due to a lack of money or resources, we were interested in understanding other factors that may predispose households to food insecurity. Hence, we added more questions to cover the non-monetary reasons behind food insecurity. Further, we asked questions about food assistance (frequency, benefits, adequacy), consequences of food insecurity, perceptions about food insecurity, and psychological well-

being. Specifically for psychological well-being, we used Kessler et al.'s (2002) six-item non-specific Psychological Distress Scale. Sample questions include, 'In the last 30 days, how often did you feel... restless and fidgety, worthless etc.?'

Phase 2: Qualitative Interviews with Food-Insecure Singaporeans and PRs

Following the surveys in Phase 1, qualitative interviews were carried out to delve into the lived experiences of individuals identified as food insecure in Phase 1. Twenty participants were randomly selected from a list of food-insecure participants who had indicated during the survey that they were willing to be contacted for this phase. The interviews were semi-structured, and interviewees were asked questions regarding the challenges faced in obtaining food, the psychological and physical health impacts of food insecurity, the kind of support availed of, quality of food support received, how food support might be improved, etc. The interviews were audio-recorded and transcribed with the consent of interviewees and were used in the 'Real Stories' section below to capture a snapshot of the lived experiences of food-insecure households.

The interviews were audio-recorded and transcribed with the consent of interviewees and were used in the 'Real Stories' section below to capture a snapshot of the lived experiences of food-insecure households.

Category Labels	Category Description	
	10-Item Adult Food Security Scale	**8-Item Child Food Security Scale**
Food-Secure	no, or one, indication of difficulty with income-related food access	no, or one, indication of difficulty with income-related food access
	0 or 1 affirmative response	0 or 1 affirmative response
Food-Insecure, Moderate	Indication of compromise in quality and/ or quantity of food consumed	Indication of compromise in quality and/ or quantity of food consumed
	2 or 5 affirmative responses	2 or 4 affirmative responses
Food-Insecure, Severe	Indication of reduced food intake and disrupted eating patterns	Indication of reduced food intake and disrupted eating patterns
	≥6 affirmative responses	≥5 affirmative responses

Exhibit 2.2. Food Security Status Determined by the Number of HFSSM Questions Answered Affirmatively by the Respondent on Behalf of the Household

03

R E S U L T S

The results are divided into seven subsections. The 'Descriptive Results' section provides a glimpse of the unweighted sample distributions with regard to socio-demographic variables. The 'Inferential Results' section reports the findings from the weighted distributions in order to draw some generalised conclusions about food insecurity in Singapore. The subsequent five sections take a closer look at food-insecure households, covering the causes of food insecurity, the impact of food insecurity, findings on food assistance, awareness of food insecurity, and finally some real stories of food-insecure households.

Descriptive Results

The demographic characteristics of our study sample are presented in Table 1, split by food security status. Note that the table represents the unweighted distribution and allows for a closer look at the food-insecure group's socio-demographic profile. The percentages should **not** be used to generalise to the Singapore population as they are merely descriptive of our sample. Generalisable statistics are found in the inferential results.

Demographic Variable	Food Security Status	
	Food-Secure N (% of total)	Food-Insecure N (% of total)
Total	997 (82.7)	209 (17.3)
Age (years)		
18–35	202 (16.7)	58 (4.8)
36–50	227 (18.8)	44 (3.6)
51–65	275 (22.8)	45 (3.7)
66–80	243 (20.1)	53 (4.4)
> 80	50 (4.1)	9 (0.7)
Family Size		
1–4 persons	795 (66.0)	168 (13.9)
5 or more persons	201 (16.7)	41 (3.4)
Gender		
Male	432 (35.9)	100 (8.3)
Female	563 (46.8)	109 (9.1)
Marital Status		
Married	613 (50.8)	97 (8.0)
Single	250 (20.7)	65 (5.4)
Divorced/Separated	56 (4.7)	25 (2.1)
Widowed	78 (6.5)	22 (1.8)
Employment Status		
Employed full-time	375 (31.1)	46 (3.8)
Employed part-time	100 (8.3)	27 (2.2)
Self-employed	65 (5.4)	7 (0.6)
Unemployed	457 (37.9)	129 (10.7)

Demographic Variable	Food Security Status	
	Food-Secure N (% of total)	Food-Insecure N (% of total)
Total	997 (82.7)	209 (17.3)
Ethnicity		
Chinese	713 (59.1)	107 (8.9)
Malay	119 (9.9)	73 (6.1)
Indian	130 (10.8)	23 (1.9)
Others	35 (2.9)	6 (0.5)
Housing Type		
1- & 2-room HDB flats	248 (20.5)	133 (11.0)
3-room HDB flats	161 (13.3)	31 (2.6)
4-room HDB flats	296 (24.5)	31 (2.6)
5-room HDB flats	232 (19.2)	8 (0.7)
Private condominiums /other private flats	49 (4.1)	6 (0.5)
Landed property	11 (0.9)	0
Educational Qualifications		
Below secondary	272 (22.6)	73 (6.1)
Secondary	284 (23.5)	71 (5.9)
Post-secondary	144 (11.9)	38 (3.2)
Diploma	70 (5.8)	10 (0.8)
University and above	227 (18.8)	17 (1.4)

Table 3.1. Food Security Status According to Socio-demographic Status

Next, we move on to the inferential results, which will help to unpack some of the descriptive results and enable us to determine whether the differences/associations are real.

Inferential Results

Who experiences food insecurity in Singapore?

In order to answer the question of who experiences food insecurity in Singapore, we present the food security distribution vis-a-vis three main demographic variables: housing type, ethnicity and educational attainment.

First, we derived an overall percentage of food-insecure households in Singapore. Our sample distribution was not representative of the 2019 national housing type distribution, so we weighted the distribution such that the chi-square goodness of fit test[1] indicated that the number of participants from different housing types in the analysis was not statistically different from proportions found in the general population, $\chi^2(5) = 0.23$, p = .999.

After establishing the representativeness of the weighted spread, we computed the percentage of resident households that experienced food insecurity in the last 12 months.

Figure 1 shows the nationally representative overall percentage of food insecurity in Singapore. A total of 10.4% (95%CI: 8.7-12.3) of resident households experienced food insecurity in the last 12 months. Of these households, 3.5% (95%CI: 2.5-4.6) experienced severe food insecurity, while the remaining 6.9% (95%CI: 5.6-8.6) were moderately food insecure.

With respect to households that experienced both adult and child food insecurity, they made up 3.5% of the overall sample (N = 1194). However, within food-insecure households only (N
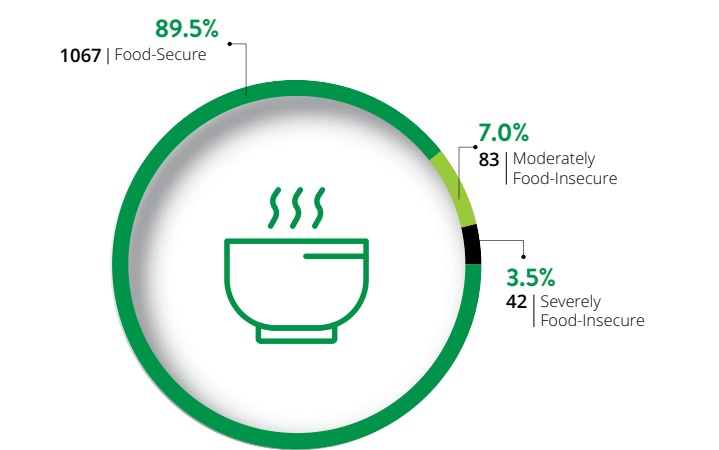

Figure 3.1. Percentage of Sample Resident Households Experiencing Food Insecurity

Food Security Category	Households	
	Without Children	With Children
Food-Secure	720	346
Food-Insecure	83	42

Table 3.2. Households With or Without Children and Food Security Status

= 125), 33% (N = 42) experienced both adult and child food insecurity. Table 2 shows the cross-tabulation of food security status and whether the households had children or not.

Next, we examined the prevalence of food insecurity by housing type. For that, we constructed a cross-tabulation of housing types with food insecurity categories inclusive of observed frequencies, expected frequencies as well as adjusted standardised residuals (see Table 3). A chi-square test for association[2] was run to determine how these two

categorical variables (i.e., housing type and food security status) relate to one another. There was a statistically significant association between the two, $\chi^2(10) = 84.12$, p < .001. However, the association between housing type and food security was small, Cramer's V = 0.188, p < .001. While the chi-square test for association determines whether there is an association between two variables, it does not provide further details of this association (e.g., which cells deviate from independence). A recommended approach is to do a cell-by-cell comparison of the adjusted standardised residuals[3]. As seen in Table 3, the largest adjusted residuals are found in the 1- and 2-room HDB flats and food security grouping cells. While for the food-secure category a negative residual indicates that the observed number of food-secure 1- and 2-room HDB dwellers was lower than the expected frequency, the converse is true for the food-insecure groups. There were far more food-insecure households (observed N

= 25, expected N = 7) than would be expected if there was no association between housing type and food insecurity status[4].

In sum, we can state that food-insecure households are more likely to reside in 1- and 2-room HDB homes compared to food-secure households.

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Housing Type			Food-Secure	Moderately Food-Insecure	Severely Food-Insecure	Total
1- & 2- room HDB		Count	46	15	10	71
		Expected Count	63.6	4.9	2.4	71.0
		Adjusted Residual	-7.1	4.8	5.1	
3-room HDB		Count	178	24	10	212
		Expected Count	189.9	14.8	7.3	212.0
		Adjusted Residual	-3.0	2.7	1.1	
4-room HDB		Count	343	20	16	379
		Expected Count	339.5	26.6	13.0	379.0
		Adjusted Residual	0.7	-1.6	1.0	
5-room HDB		Count	269	7	2	278
		Expected Count	249.1	19.4	9.6	278.0
		Adjusted Residual	4.5	-3.3	-2.8	
Pvt Condo		Count	169	17	3	189
		Expected Count	169.3	13.2	6.5	189.0
		Adjusted Residual	-0.1	1.2	-1.5	
Landed		Count	62	0	0	62
		Expected Count	55.5	4.3	2.1	62.0
		Adjusted Residual	2.8	-2.2	-1.5	

Table 3.3. Housing Type Distribution and Food Security Category Cross-tabulation

The second demographic variable that was used for drawing comparative conclusions was ethnicity. In terms of ethnicity, our study sample was seemingly close to the population level distribution of the ethnic groups published in 2018 but still did not meet the chi-square test of goodness of fit. Hence, the ethnic distribution was weighted in order to map it to the national distribution. The weighted distribution passed the chi-square test of goodness of fit, indicating that ethnicity was similarly distributed in the participants as in the general population ($\chi^2(3) = 3.92$, $p = .270$). In order to determine which ethnic groups experience more food insecurity than others, we looked at the percentages of food-secure and food-insecure individuals in each ethnic community. Figure 2 shows that four out of every ten individuals from the Malay community sample experienced food insecurity. We wanted to check whether this seemingly apparent association between food insecurity and membership of a certain ethnic group was statistically significant. A chi-square test for association was conducted between ethnicity and food security. There was a statistically significant association between the two, $\chi^2(6) = 63.50$, $p < .001$. The association between ethnicity and food security was small, Cramer's V = 0.162, $p < .001$. However, we were interested in knowing which ethnic group contributed the most to this small yet significant association. In order to ascertain that, we examined the adjusted standardised residuals for each cross-tabulation cell. As shown in Table 4, the three largest adjusted standardised residuals were for the Malay ethnic group. For instance, the observed number of Malay families who were food-secure was 30% lower than the expected number (observed N = 90, expected N = 129). Conversely, more than double the number of Malay families fell into the food-insecure category (observed N = 59, expected N = 25) than would be expected if there was no association between ethnicity and food security.

Another set of residuals that were larger than 3 was for the Chinese ethnic group, indicating that they may have a role to play in the association between ethnicity and food insecurity. However, this was not cause for concern because the negative valence of the residuals indicated that the observed count for food insecurity (N = 118) among the Chinese was less than the number of families expected to report food insecurity (expected count N = 143).

Taken together, the above findings indicate that while **food insecurity is prevalent in all ethnic communities in Singapore, the gap between food security and insecurity is smallest for the Malay community**. This finding has important implications for food assistance being culturally appropriate and sensitive.

Next, we looked at the educational attainment reported by participants who were also the heads of their household and presumably one of the earning members or the sole earning member of the household. A total of 595 participants reported themselves to be the head of the household. In terms of highest educational qualification achieved by the head of the household, our study sample did not match closely to the population level distribution published in 2019 and did not meet the chi-square test of goodness of fit. Hence, the educational achievement spread was weighted in order to map it to the 2019 national distribution. The weighted distribution passed the chi-square test of goodness of fit, indicating that ethnicity was similarly distributed in the weighted distribution as in the general population ($\chi^2(4) = 0.37$, $p = .989$). Figure 3 shows that the educational level of food-insecure heads of household was markedly lower than that of food-secure
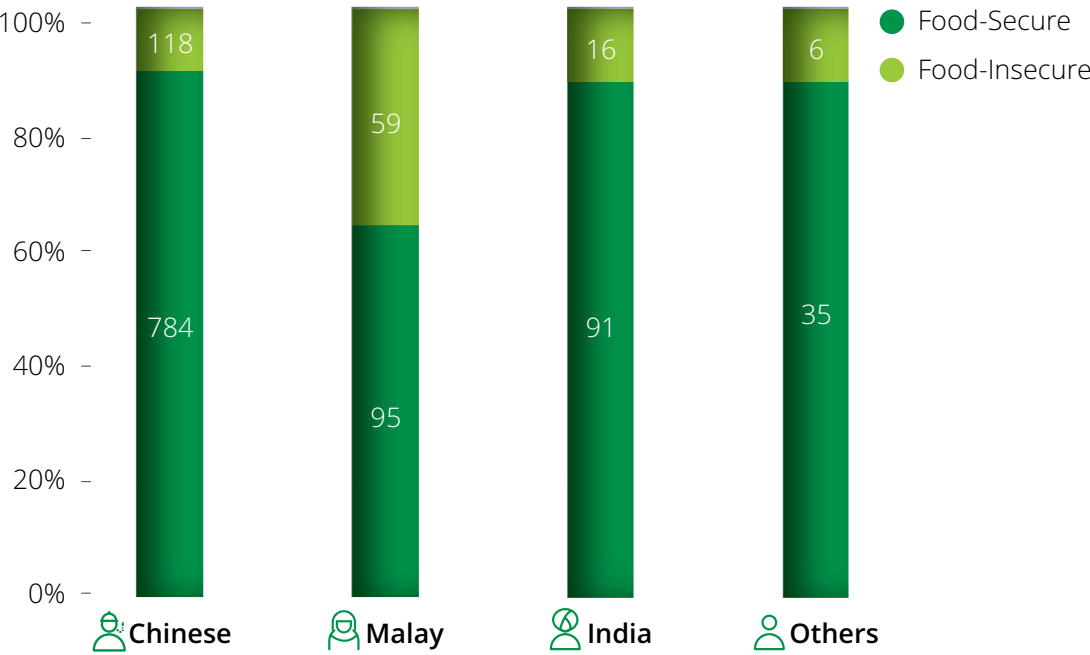
Ethnicity			Food-Secure	Moderately Food-Insecure	Severely Food-Insecure	Total
Chinese		Count	784	75	43	902
		Expected Count	752.9	92.1	56.9	902.0
		Adjusted Residual	5.6	-3.8	-3.8	
Malay		Count	95	33	26	154
		Expected Count	128.5	15.7	9.7	154.0
		Adjusted Residual	-7.8	4.9	5.8	
Indian		Count	91	11	5	107
		Expected Count	89.3	10.9	6.8	107.0
		Adjusted Residual	0.5	0.0	-0.7	
Others		Count	35	4	2	41
		Expected Count	34.2	4.2	2.6	41.0
		Adjusted Residual	0.3	-0.1	-0.4	

Table 3.4. Ethnic Distribution and Food Security Category Cross-tabulation

Figure 3.2. Ethnic Distribution of Food Security