

# The invisible crisis: the determinants of local food insecurity in Gauteng municipalities, South Africa

Determinants  
of local food  
insecurity

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## Abstract

**Purpose** – The purpose of this study is to estimate the determinants of household food insecurity in the Gauteng City-Region, South Africa. This is motivated by the fact that food insecurity remains a key challenge at the household level in South Africa. Furthermore, the Gauteng Province has been rapidly urbanising due to a migrant influx, both locally and internationally. The findings will assist the country in achieving its mandate on the local economic development policy, Agenda 2063 and the Sustainable Development Goals 1 and 2.

**Design/methodology/approach** – The study adopted a quantitative cross-section design, utilising the binary logistic regression technique, drawing on the Gauteng City-Region Observatory Quality of Life 2020/2021 data, consisting of 13,616 observations, randomly drawn from nine municipalities in Gauteng City-Region.

**Findings** – The main findings of the study highlight unemployment, health status, education, household size, indigency and income as the main determinants of food insecurity in Gauteng City-Region. Policies towards sustainable urban agriculture, improving access to education, increasing employment and income, and health for all can help improve the food insecurity status of households in the Gauteng City-Region.

**Research limitations/implications** – Further studies would require an in-depth assessment of household coping mechanisms, as well as the influence of household income (notably government social grants) and access to credit on household food security status, to better understand the dynamics of food security in the Gauteng City-Region.

**Practical implications** – Determinants of food insecurity should be considered when developing and implementing policies to reduce food insecurity in urban municipalities.

**Social implications** – The study is of interest as it interdicts food insecurity issues, which have an effect on socio-economic well-being.

**Originality/value** – The study adds value by providing evidence on the determinants of food insecurity in an urban setting in a developing country. Gauteng is the richest of all provinces in South Africa and is also at the receiving end of internal and international migration. Factors affecting food insecurity have changed in the nine cities. This compromises nutrition safety and calls for targeted policy interventions.

**Keywords** Binary logistic model, Household food insecurity, Gauteng City-Region

**Paper type** Research paper

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## 1. Introduction

Food serves as one of the critical needs a person requires for daily survival; hence, it is recognised as a fundamental human right (Oduniyi and Tekana, 2020). Food security is defined as the physical and economic ability of the population to have access to nutritious, safe and sufficient food that satisfies dietary requirements. Socio-economic factors such as income, gender, household size and level of education can impact food security either positively or negatively (Oduniyi and Tekana, 2020). Food insecurity issues relate to the challenge of poverty that is mainly confronting people living in the Gauteng City-Region. A large proportion of households in the Gauteng City-Region live depending on a government grant, while others receive an income that is less than or equivalent to US\$1 per day (Oduniyi and Tekana, 2020).

In South Africa, access to food is a human right prescribed by the supreme law. This constitutional mandate also ascribes to the 50-year strategy of the African Union, Agenda 2063 and Sustainable Development Goals, which aim to accelerate sustainable development. Mazenda and Mushayanyama's (2021) findings show that household food insecurity has been constant in the Gauteng City-Region for a period ranging from 2000 to 2020. The Gauteng City-Region has implemented programmes to reduce food insecurity, foster economic growth and create employment, such as Tshepo youth programmes and Extended Public Works programmes. Despite these interventions, food insecurity is still prevalent in the Gauteng City-Region.

Various biophysical, socio-economic, institutional and political factors influence the state of food insecurity, especially in metropolitan areas where food insecurity has been identified as an "invincible crisis" (Crush and Fayne, 2010). There have been limited studies that have focused on the determinants of food security in the Gauteng City-Region, notably Akinboade *et al.* (2016) and Akinboade and Adeyefa (2017). Other studies have assessed the determinants of food security in a particular subset of the Gauteng City-Region.

For instance, Mokwena (2016) focused on households receiving social grants. Malatsi (2019) and Ruysenaar (2013) focused on community gardens. Crush and Frayne (2011) limited their studies to supermarkets and the informal food economy. Other studies just focused on the food security status in the Gauteng City regions, with less emphasis on the determinants (Mojela *et al.*, 2018; Mazenda and Mushayanyama, 2021). There is a gap in the studies that focus on the determinants of food security in the Gauteng City regions, especially provided the varying methodologies. Determinants of food security can be at the macro, meso and micro scales. These factors are context-based, and some are peculiar to the Gauteng City-Region. Akinboade *et al.* (2016) identified factors such as location, dependency ratio, educational levels, social grants and income affecting food security in Gauteng. Other indirect determinants include unemployment, crime, rapid urbanisation, currency depreciation, elimination of subsidies, inequality and job losses, amongst other factors (Akinboade *et al.*, 2016). Akinboade and Adeyefa (2017) identified that depending on the state of food security status, income levels, source of income, social grants, location, gender, age and educational level of the household head were significant. In this regard, due to the heterogeneity of societal characteristics, national studies on food security determinants have left little room for generalisation (Akinboade *et al.*, 2016). Furthermore, they are silent on the spatial dimensions of food security (Akinboade and Adeyefa, 2017). This necessitates a study that is peculiar and context-specific to the Gauteng City-Region. This study hypothesises that gender (particularly being male), race (particularly being white), unemployment, good physical health status, availability of food support, higher levels of education, age (particularly being young), smaller household size, availability of grant support, availability of indigence rebates and higher levels of income are significant in reducing food insecurity in the Gauteng City-Region. Thus, the research questions to be addressed are: what are the significant determinants of household food insecurity in the Gauteng City-Region? What policy recommendations can be suggested to reduce food insecurity in the Gauteng City-Region?

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The study uses the binary logistic regression technique as the estimation technique. The choice of this approach is influenced by literature on household food security (Ngema *et al.*, 2018). The advantage of using the binary logistic regression technique is that the model is less dependent on over-fitting, while it can over-fit when using higher-dimensional data (Gujarati, 2015).

The article is organised as follows: first, the introduction, followed by Section 2 that presents the literature review. Following that is Section 3, which explains the methodological approach. Next, results and discussions are presented in Sections 4 and 5, respectively. Section 6 outlines policy recommendations, and finally, the conclusion is presented in Section 7.

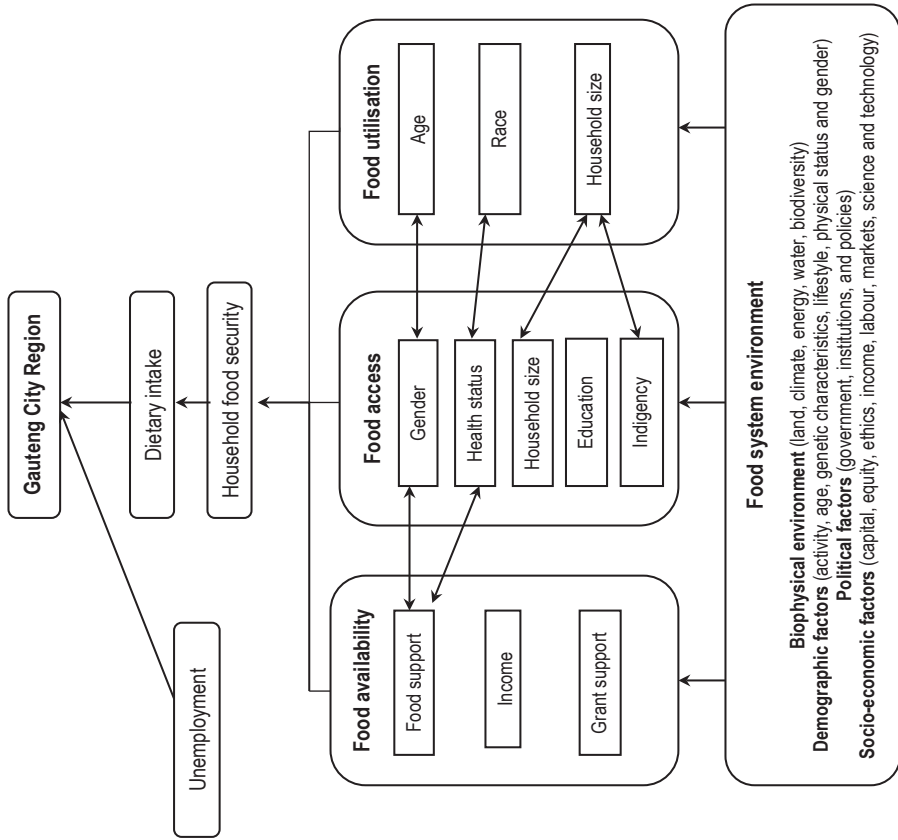
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## 2. Literature review

Food insecurity is defined as the state of being without reliable access to a sufficient quantity of affordable, nutritious food (Mkhatshane, 2019). Sen's capability approach conceptualises the proficiencies as real prospects to realise the desires of the individuals, such as a state of stability and activity engagement (Miller and Thomas, 2020). Furthermore, this approach adopts a holistic perception of capabilities, stipulating that the population must achieve specific abilities and realising that the freedom to obtain a form of livelihood is absent if it forces one to sacrifice another critical aspect of livelihood. This approach also highlights mechanical and individual challenges that can hinder capabilities, such as unemployment, race, health status and household size (Miller and Thomas, 2020). Mkhatshane (2019) stipulates that the concept of food security evolves and is defined differently globally. The evolution of food security concept stems from the changing policies over the past 30 years. In the 1950 and 1960s, food security was associated with self-sufficiency in major staples. By 1974, it was defined as the availability of adequate food supplies to maintain and supply a growing population (Megbowon and Mushunje, 2018). The Food and Agriculture Organisation (FAO) expanded its concept in 1983 when it included the aspect of the security equation by implying that there should be a balance between the demand and supply of food. The population needs to have access to both physical and economic means to enable access to basic needs to sustain a healthy livelihood. Finally, Mkhatshane (2019) suggested the food stability concept, wherein a household has adequate food and achieves food security to withstand any sudden economic or climatic crisis. According to Ningi *et al.* (2021), the four food concepts are critical for a sustainable, healthy nation. Food insecurity arises when one or more of these concepts is vulnerable. However, achieving food security in one concept does not mean achieving food security in another.

Food insecurity is classified into two severity levels: Low food security: These are food-insecure households with lower diet quality and variety, as well as little, if any, evidence of lower food intake. Very low food security: These are severely food-insecure households, which have reported several indications of lower food intake and altered eating patterns, such as meal skipping (United States Department of Agriculture, 2021; Ngema *et al.*, 2018). Researchers utilise various determinants to examine communities' food status (Mkhatshane, 2019). Mangwa (2019) suggests that the food insecurity determinants of a household may be different according to the global, regional and national levels. Therefore, food insecurity is perceived as a multidimensional phenomenon that could be controlled by factors such as civil conflicts, natural disasters, climate change and social norms. Figure 1 shows the conceptual framework for the determinants of food insecurity in the Gauteng City-Region.

Empirical evidence on the determinants of food security emphasises the vital role of the following factors: food support, income, household size, education, grant support and indigency (Harris-Fry *et al.*, 2015). To concur with this, Akinboade and Adeyefa (2017) highlight that there are various factors that contribute to the lack of food security at household level. These factors include income (Ngema *et al.*, 2018), household size, female-headed households (Dunga, 2020), education, age and unemployment (Mwanga, 2019).



Source(s): Harris-Fry *et al.* (2015: 4)

**Figure 1.**  
Conceptual framework  
for determinants of  
household food  
security

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Ngema *et al.* (2018, p. 8) posit that income remains a significant variable in food security studies. Akinboade and Adeyefa (2017) stipulate that child support grants empower women to control and make financial household decisions (Mwanga, 2019; Ngema *et al.*, 2018). Women's access to food and food insecurity also decreased (Ningi *et al.*, 2021).

Research findings on age reflect that households consisting of pensioners are more likely to be food-secure, whereas those with younger dependents are less likely to be food-secure (Ngema *et al.*, 2018). Furthermore, Dunga (2020) and Mwanga (2019) posit that a large household with employed members increases the chances of food security. Mwanga (2019) stipulates that education is a social capital that positively affects household food security when the household head has attained a high educational level. Akinboade and Adeyefa (2017) indicated that the level of education an individual has shows how well they can find work in the labour market.

According to Mbwana *et al.* (2016), households' education status is linked with food insecurity. It is an important factor in food access, production and utilisation. Besides enhancing the household's income as well as access to food, education offers numerous employment opportunities, which change the economic position of a household member. The acquisition of education assists food producers to adopt the latest technology in their production systems, which addresses food insecurity and generates additional income. Furthermore, a higher qualification amongst the household members triggers healthy and nutritious food intake. Therefore, education reduces food insecurity while ensuring that social ills such as malnutrition are minimised amongst children and households (Drammeh *et al.*, 2019).

Drammeh *et al.* (2019) argue that household size is another contributor to food insecurity as household members are expected to share a limited amount of food, especially if household heads possess a lower level of education. A bigger family size puts additional strain on food consumption, which is expected to experience food insecurity in comparison to households with a minimal family size. Furthermore, other factors that affect household food insecurity are household structure, gender and age. Mainly, bigger households are likely to compete for the scarce amounts of food available in the household while normally consuming a limited portion of meals with a high frequency between meals. The food consumed by households with lower levels of education and income tends to be of low nutritional value. Households consisting of many members, especially kids and school-going children, are more likely to fall below the poverty line and are susceptible to food insecurity. Even though food insecurity can have negative effects on people's lives, they can be lessened if other people in the household work (Drammeh *et al.*, 2019).

The prices of food contribute to the food insecurity status of a household, which is linked to food production and supply at the provincial level. When there is a spike in food prices, vulnerable households experience difficulty affording sustainable and nutritious food. In Gauteng Province, poor households spend an average of 8% of their income on food and other household consumables. High food prices compromise nutritional safety. The high prices of food are caused by many socioeconomic factors, such as a lack of food, inflation and a rise in the cost of fuel (Mojela *et al.*, 2018).

The studies mentioned above have a common thread, in that they utilised binary logistic regression analysis or related techniques in analysing the determinants of food insecurity in urban settings in South Africa. This study adds to the literature by looking at how socioeconomic well-being affects food insecurity in a large urban setting and how important these factors are. Factors affecting food insecurity have changed in major cities across the world. This compromises nutrition safety and calls for targeted policy interventions.

### 3. Methodology

This section outlines the source of the dataset, sampling techniques and the inferential approach adopted by the study. The identified variables are detailed based on their relation to

the study, and units of measurement are revealed. Furthermore, the methodological approach shows the expected analysis using equations and a tabular approach.

### 3.1 Data and sampling

Primary data from the Gauteng City-Region Observatory (GCRO) Quality of Life (QoL) collected in 2020 and 2021 was used as a sampling frame for the entire list of the heads of households. The GCRO QoL (2020/2021) is a household-based survey where adults (18+ years old) were randomly selected as respondents. All the respondents were interviewed in person at their dwelling locations. The GCRO QoL (2020/2021) measures the quality of life, attitudes to service delivery, socio-economic circumstances, value-based psycho-social attitudes and other characteristics of the Gauteng City-Region. The survey allowed for a random sampling of 13,616 respondents across 529 wards in the Gauteng City-Region (i.e. City of Ekurhuleni; City of Johannesburg Metropolitan Municipality; City of Tshwane Metropolitan Municipality; Emfuleni Local Municipality; Lesedi Local Municipality; Merafong Local Municipality; Midvaal Local Municipality; Mogale City Local Municipality). All QoL survey data are made freely available under a CC BY-SA 4.0 license. Data can be accessed via the Data First service based at UCT, or on request from the GCRO.

### 3.2 Empirical model: binary logistic regression

The binary logistic regression model is a relevant analytical framework to estimate the dichotomous endogenous variables. The paper adopted food insecurity as a dependent variable, a binary variable with “yes” for food-insecure households and “no” for food-secure households. Therefore, any household experiencing food insecurity is assigned a numeric value of 1, while those with adequate food security status are assigned a numeric value of 0. Thus, the application of binary logistic estimation offers a basis for determining whether a household is food insecure or not. The selection of household food security determinants is guided by several studies, which are [Akinboade and Adeyefa \(2017\)](#), [Mazenda and Mushayanyama \(2021\)](#), and [Ngema et al. \(2018\)](#).

The econometric expression of the binary logistic regression model is specified in [equation \(1\)](#):

$$Z_i = \beta_0 + \sum (\beta_k X_{ki}) \quad (1)$$

where  $X_i$  denotes a group parameter that defines the food security status associated with the specific household. The parameter  $Z_i$  represents the odds associated with whether the household is experiencing food security or not, which is a binary variable assigned with 1 for food insecurity, or 0 otherwise. The constant term is represented by  $\beta_0$ , while the coefficients of all regressors ( $X_i$  to  $X_k$ ) are represented by  $\beta_1$  to  $\beta_k$ .

$$P_i = \frac{e^{Z_i}}{1 + e^{Z_i}} \quad (2)$$

In [equation \(2\)](#),  $1 - P_i$  represents the likelihood of insecurity status of the household, while  $P_i$  is associated with the likelihood corresponding with being food-secure. Thus, the odds determine the portion related to the likelihood of a household to realise food-secure status and the likelihood of experiencing food insecurity by households. When applying the natural logarithm, the estimation is displayed in [equation \(3\)](#):

$$L_i = \ln \left( \frac{P_i}{1 - P_i} \right) = Z_i \quad (3)$$

where  $Z_i$  is portrayed as the natural logarithm associated with the odds ratio linked with whether a household is food insecure or otherwise, which is expressed in estimation equation (4):

$$Z_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \dots + \beta_n X_n + \mu_i \quad (4)$$

where  $Z_i$  denotes a food security status linked with the household, while  $\beta_0$  is the constant term,  $\beta_1$  to  $\beta_n$  represents the coefficients of the explanatory variables included in the model,  $X_1$  to  $X_n$  denotes the included explanatory variables and  $\mu_i$  is the disturbance term.

### 3.3 Description of regressors included in the binary logistic regression model

The regressor variables included in the binary logistic analytical framework to estimate the determinants of household food insecurity in the Gauteng City-Region of South Africa are gender, race, number of adults, unemployment, health status, food support, grant application, education, age, household size, grant support, indigence rebates and income. The regressor variables adopted by the study are summarised in Table 1. In addition, the study included continuous variables such as household size, age and number of adults. Gujarati (2015) states that the binary logistic regression model requires binary dependent variables and an assortment of dichotomous and continuous variables.

The age of a household member is determined by the number of years elapsed since birth. Thus, intuitively, it is expected to correlate positively with food insecurity. Ngema *et al.* (2018) argue that age affects the food insecurity status of the household.

The variable household size denotes the number of people living in the same household during the study period. Akinboade and Adeyefa (2017) highlight that huge families are prone to food insecurity and strain the household regarding consistent food security. However, many households might experience food insecurity because additional family members might bring extra income to the family, which could be used to secure food.

A household member's race, which includes African black, coloured, white and Indian, is a categorical variable. The majority of households residing in the Gauteng City-Region are predominantly African blacks; therefore, it is expected that most participants are blacks. The variable gender is binary with two values: either male or otherwise. Males are migrating to

Variable	Description	Expected outcome ( $\pm$ )
Gender	Respondent's sex; 1 = male, 0 = female (categorical-dummy)	$\pm$
Race	Race of the household members (categorical)	$\pm$
Unemployment	Unemployment status of the respondent; 1 = unemployed, 0 = otherwise (categorical dummy)	-
Health status	Health status of the respondents (categorical)	+
Food support	Did the household receive farmer support? (categorical dummy)	+
Grant application	Did anyone who applied for the grant receive it? (categorical dummy)	$\pm$
Education	Education level (categorical)	-
Age	Respondent actual number of years from birth (continuous)	$\pm$
Household size	Number of people in the household (continuous)	$\pm$
Grant support	Does anyone in the household receive a government support grant? (categorical dummy)	$\pm$
Indigence rebates	Does the household receive rebates from the municipality? (categorical dummy)	$\pm$
Income	Household income (categorical)	$\pm$

Source(s): GCRO QoL (2020/2021)

**Table 1.**  
Description of  
variables included in  
the study



other provinces and countries to seek economic activities. Hence, it is expected that females take the lead role as study participants.

Unemployment is a binary variable, with only one variable adopted as a measure, including 1 for unemployment, and 0 for otherwise. Intuitively, the unemployment rate negatively affects household food security, while it is expected to be statistically associated with household food security. Health status is a categorical regressor ranging from excellent health to good health to average health to poor health. Excellent and good health statuses are associated with food-secured households, while poor health is linked with food insecurity. Food support and grant applications are categorical variables expected to lower the chances of food insecurity as grants or food parcels assist households in realising food security.

Education is a categorical regressor with values such as no schooling, primary school, incomplete secondary school, matric and more. It is expected that a higher level of education would positively affect household food security, while a lower level of education would negatively affect household food security. Household size is a continuous variable that is expected to affect household food security either positively or negatively. The larger the household size, the higher the probability of household food insecurity. The smaller the household size, the lower the probability of household food insecurity. Indifference is a categorical variable with either yes represented by one or no represented by zero. When a household receives indigent assistance from the municipality, it is expected to be more food-secure than those without indigent assistance. Income is categorised into different salary brackets. A higher salary is expected to positively affect household food security, while a lower salary is expected to negatively affect household food security.

The identified determinants of food security might affect it either negatively or positively; hence, [Table 1](#) outlines all the included variables with the expected signs.

#### 4. Results and analysis

This section presents the results from the descriptive statistics, binary logistic statistics and diagnostic statistics derived from the log-likelihood ratio, the omnibus test and the Hosmer and Lemeshow test. The dependent variable is food insecurity, which is dichotomous in nature, and binary logistic regression is a relevant framework to analyse food insecurity.

##### 4.1 Diagnostic test

Parameter estimation and goodness-of-fit test. The logistic regression model uses maximum likelihood estimation (MLE) to estimate the unknown coefficients (parameters) included in the model. Hence, this study employed the MLE technique to estimate the model's unknown parameters. First, the likelihood ratio (G2) test (log-likelihood test) was used to assess the overall fit of the fitted logistic regression model, drawing on the Nagelkerke R-square. Second, the omnibus test was used to test the significance of individual logistic regression coefficients for each predictor. Finally, the Hosmer–Lemeshow test was employed to assess the goodness of fit of the adopted model.

[Table 2](#) presents the goodness of fit for the adopted model using the likelihood ratio test, where the focus is on the  $R^2$  as an indicator to measure the goodness of fit. This test shows the percentage of variance within the dependent variable explained by the adopted dependent

Step	–2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	2,989.520a	0.082	0.112

**Table 2.**  
Likelihood ratio test

**Source(s):** Authors contribution-based GCRO QoL (2020/2021) dataset



variables. Notably, the  $R^2$  assesses the association's strength between the model and the dependent variable on a scale ranging from 0 to 100%. The inference is that the explanatory variables explain at least 11% of the variation in the model. According to Allison (2014), the Cox and Snell  $R$ -squared value cannot reach 1.0, Nagelkerke modified it. The correction increases the Cox and Snell version to make 1.0 a possible value for  $R$ -squared. The Cox and Snell  $R^2$  of 0.082, and Nagelkerke  $R^2$  of 0.112 show a strong association of the model and the dependent variable (Table 3).

The omnibus test is used to assess whether the estimated variance in the dataset is meaningfully greater than the unexplained variance. This test is applicable to assess the overall significance of the model. The hypothesis underlying the omnibus test highlights that when the  $p$ -value of the chi-square is below 0.05, it shows the goodness of fit. The omnibus test is applied to evaluate the hypothesis regarding the level of significance amongst the adopted factors. This encompasses the chi-square, consisting of steps, blocks and models. The findings show that the value of chi-square is equivalent to 208.54, and it is statistically significant at a 1% level. Therefore, the adopted model confirms the goodness of fit since all  $p$ -values for step, block and model are statistically significant at a 1% level.

The dataset is first aggregated by sequencing the estimated probabilities and formulating the separate groups. The hypothesis underlying the Hosmer–Lemeshow is that the model is good when the  $p$ -value derived from the Hosmer–Lemeshow test is above 0.05. The  $p$ -value derived in Table 4 is equivalent to 0.7, confirming that the adopted model displays goodness of fit. The Hosmer and Lemeshow test was highly insignificant, which shows that the data fit very well with the model selected for analysis of the determinants of household food security.

#### 4.2 Descriptive analysis

Table 5 presents a summary of the determinants of food security in the Gauteng City-Region in South Africa. Gender, a dichotomous variable, shows that female-headed households were more food insecure than their male counterparts, with 50 and 49%, respectively. All races in the Gauteng City-Region participated in the study, in which African blacks constituted the majority with 80%, followed by whites with 13%. Coloureds and Indians constituted 3% each, and other races constituted 0.2%. Therefore, 44% of the household heads were employed, and 56% were unemployed.

At least 99% of households had a good health status, compared to about 1% who had poor health. In addition, 87% of the households had received food support in many forms. In terms of educational status, 31% of households did not complete high school (matric).

Omnibus Tests of Model Coefficients

		Chi – square	df	Sig.
Step1	Step	208.542	13	0.00
	Block	208.542	13	0.00
	Model	208.542	13	0.00

Source(s): Authors contribution-based GCRO QoL (2020/2021) dataset

Table 3.  
Omnibus test

Step	Chi – square	df	Sig.
1	4.845	8	0.774

Source(s): Authors contribution-based GCRO QoL (2020/2021) dataset

Table 4.  
Hosmer and  
Lemeshow test

Variable		Obs	Mean	Std.Dev	Min	Max	Frequency	%
Gender	Male	13,616	1.5	0.004	1	2	6,800	50
	Female	13,616					6,816	50
Race	African	13,616	1.5	0.009	1	5	10,954	80
	Coloured	13,616					433	3
	Indian	13,616					417	3
	White	13,616					1,789	13
	Other	13,616					23	0.2
Unemployment	Yes	13,616	0.6	0.006	0	1	7,625	56
	No	13,616					5,991	44
Health status	Excellent	13,616	1.8	0.006	1	4	4,525	33
	Good	13,616					7,409	54
	Poor	13,616					1,456	11
	Very poor	13,616					226	2
Food support	Yes	13,616	0.1	0.003	0	1	11,899	87
	No	13,616					1,717	13
Education	No education	13,616	3.7	0.009	1	6	265	2
	Primaryonly	13,616					1,261	9
	Secondary incomplete	13,616					4,288	32
	Matric	13,616					4,311	32
	More	13,616					3,388	25
	Unspecified	13,616					103	1
Age	18 – 19	13,616	5.9	0.025	1	11	452	3
	20 – 24	13,616					1,416	10
	25 – 29	13,616					1,499	11
	30 – 34	13,616					1,713	13
	35 – 39	13,616					1,702	13
	40 – 44	13,616					1,378	10
	45 – 49	13,616					1,233	9
	50 – 54	13,616					999	7
	55 – 59	13,616					942	7
	60 – 64	13,616					808	6
65+	13,616					1,474	11	
Household size		13,616	3.7	0.021	1	24		
Grant application	Yes	13,616	0.5	0.004	0	1	7,069	52
	No	13,616					6,547	48
Indigency	Yes	13,616	0.4	0.004	0	1	8,743	36
	No	13,616					4,873	64
Income	Monthly	13,616	3,700	0.013	800	51,201		

**Table 5.** Summary statistics of factors affecting household food insecurity

**Source(s):** Authors contribution based GCRO QoL (2020/2021) dataset

The average age of the household heads was between 35 and 39 years old. The average household size was four members, and 52% of the household dependents depended on grant funding from either the government or other non-government organisations. In addition, 35.8% of households were registered with the municipality for rate rebates or other subsidised services such as electricity, waste and water. Finally, the average household income was 3,700 rands per month.

#### 4.3 Logistic regression analysis

The study adopted 11 explanatory variables to establish the determinants of household food insecurity in the Gauteng City-Region. The logistic regression model was conducted under the hypothesis that gender (particularly being a man), race (particularly being white), unemployment, good physical health status, availability of food support, higher levels of

education, age (particularly being young), smaller household size, availability of grant support, availability of indigence rebates and higher levels of income are significant in reducing food insecurity in the Gauteng-City-Region. Six variables were statistically significant in determining a household's food insecurity status in the Gauteng City-Region. The statistically significant variables include unemployment, health status, education, household size, indigence and income (Table 6).

Unemployment was positively associated with food insecurity, with a coefficient of 0.648. This implies that unemployment increases the chances of an individual's being food insecure. The odds ratio shows that those unemployed are 1.9 more likely to be food insecure when compared to those employed. The implication is that unemployed individuals are experiencing food insecurity in the Gauteng City-Region compared to their employed counterparts. The findings are in line with Akinboade and Adeyefa's (2017, p. 71), who argue that unemployment leads to food insecurity because people do not have the employability skills.

The health status factor (measured from 1 very good health to 5 very poor health) was positive and statistically significant at a 1% level. Poor health status increases the chances of an individual being food insecure. The odds ratio highlights that those with poor health are 1.3 more likely to be food-insecure than those who are healthier. The inference is that poor health is related to food insecurity. The results are supported by Mthethwa and Wale (2021), who argue that poor health status is linked to food insecurity as the unhealthy person is incapacitated from participating in income-generating activities.

The lower education status carries an expected positive sign and was statistically significant at a 1% level. The inference is that a lower education level increases the chances of being food-insecure. The odds ratio shows that individuals with lower education levels are 0.78 more likely to experience food insecurity than those with higher education. Mthethwa and Wale (2021) argues that better education leads to increased chances of gainful employment, an increase in income and a reduction in food insecurity.

The household size was positive and statistically significant at a 1% level (and a coefficient equivalent to 0.1). Thus, a larger household size is more susceptible to food insecurity. The estimation predicts that for every one unit increase in family size, the household would be more likely to be food insecure by 0.2 times. The odds ratio shows that individuals residing in large households are 1.1 times more likely to experience food insecurity. This is in line with Akinboade and Adeyefa (2017), who say that bigger households put more strain on available food resources, which is part of food insecurity.

	$\beta$	SE	Wald	df	Sig.	Exp(B)
Gender	-0.046	0.092	0.248	1	0.619	0.955
Race	0.028	0.1	0.081	1	0.776	1.029
Unemployment	0.648	0.11	34.765	1	0.00	1.911
Health status	0.275	0.065	17.79	1	0.00	1.316
Food support	0.035	0.113	0.098	1	0.755	0.965
Education	-0.247	0.058	18.429	1	0.00	0.781
Age	0.009	0.018	0.259	1	0.611	1.009
Household size	0.09	0.037	5.851	1	0.016	1.095
Grant application	0.016	0.114	0.02	1	0.887	1.016
Indigence rebates	-0.385	0.092	17.383	1	0.00	0.681
Income	-0.427	0.059	53.135	1	0.00	0.652
Constant	0.163	0.353	0.214	1	0.644	1.177

Source(s): Survey data (2020) computed using SPSS software (version 25)

**Table 6.**  
Determinants of the  
household food  
insecurity in the  
Gauteng City-Region

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The cities' indigent registration shows negative significance at 1% ( $p = 0.00$ ) and a coefficient of  $-0.385$ . The model indicates that an additional 1% increase in the cities' indigent registration reduces the household's likelihood of food insecurity by 0.4. Thus, a household registered as indigent decreases the chances of individuals being food-insecure. The odds ratio linked to the cities' indigent registration highlights that registered individuals are 0.7 less likely to experience food insecurity. Those findings are in line with [Mthethwa and Wale \(2021\)](#), who argue that registering the city's indigent reduces food insecurity because the subsidies that come with it make available additional income to spend on food.

The household income was negative ( $-0.427$ ) and statistically significant at a 1% level ( $p = 0.00$ ). The estimation predicts that for a 1% increase in household income, food insecurity will be reduced by at least 0.4. The interpretation is that a higher income decreases the probability of a household experiencing food insecurity. The odds ratio associated with income indicates that households are 0.7 less likely to suffer from food insecurity. The results are congruent with [Ngema et al. \(2018\)](#), who argue that households with higher-income scales are less likely to suffer from food insecurity, while their lower-income counterparts are more likely to suffer from food insecurity.

Seven statistically insignificant factors were included in the model. These factors include food support, grant application, gender, number of adults and race. All the identified insignificant factors do not have any effect on food insecurity in the Gauteng City-Region. As [Ngema et al. \(2018\)](#) assert, gender is not a significant factor because males can migrate for work and single women can provide for their families. Consequently, race is insignificant, as cases of the white minority in need in the Gauteng City-Region are on the rise. Moreover, there are a number of black in the middle class and a couple more transitioning in the high-income bracket. The number of adults was insignificant due to the prevalence of child-headed households. The grant application has broader implications in rural areas. Finally, food aid is not a common way to assist needy households in the Gauteng City-Region.

## 5. Discussion

This article sought to estimate the determinants of household food insecurity in nine municipalities in the Gauteng City-Region of South Africa. This was realised by primarily assessing the food insecurity status of households residing in metropolitan and non-metropolitan areas in Gauteng City-Region. Household food insecurity was adopted as the dependent variable, which shows that food insecurity is experienced due to unemployment and other socio-economic factors. [Akinboade and Adeyefa \(2017\)](#) argue that household food insecurity is an issue cutting across all unemployed households in the Gauteng City-Region, as determinants are not selective. [Mthethwa and Wale \(2021\)](#) argue that even if a person is working, he or she might not be able to afford food because of their income level and other factors, like the size of their household.

The descriptive findings show that households were dominated mainly by people with good health status, while poor health conditions were characterised by only a few below 2%. However, there is no consensus regarding the stimulus of health status on household food security in the Gauteng City-Region. For instance, [Akinboade and Adeyefa \(2017\)](#), [Mojela et al. \(2018\)](#) and [Ningi et al. \(2021\)](#) argue that sick people in urban areas tend to be food-insecure due to various factors limiting their participation in socio-economic activities, while other scholars, for instance, [Mthethwa and Wale \(2021\)](#), [Oduniyi and Tekana \(2020\)](#) and [Mkhatshane \(2019\)](#), are not able to identify any significant association between health status and household food security status. According to [Akinboade and Adeyefa \(2017\)](#), the bivariate estimation in this article found that health status and food insecurity were linked in nine municipalities of the Gauteng City-Region. This is not the case.

In all sampled groups, the households possess a low level of education, characterised by incomplete secondary education and matric. There are households with primary and no school status, which are more susceptible to food insecurity due to the inability to obtain high-paying jobs, which translates into the incapacity to secure nutritious food sustainably. Education is negative and statistically significant, which highlights that an additional year of schooling reduces household food insecurity. The findings are consistent with intuition as well as results from the empirical literature. For instance, [Ngema \*et al.\* \(2018\)](#) and [Oduniyi and Tekana \(2020\)](#) argue that increasing the educational level of a household would decrease the chances of food insecurity as it triggers the employment opportunities of a household, which results in the ability to acquire nutritious food. This is because households that have more educated members are more likely to be successful in business or find jobs that will allow them to support their families.

On average, the household size in the Gauteng City-Region consists of three members, while the maximum household size is 24. The findings show that household size is positive and statistically significant, implying that additional members of a household would result in food insecurity. The results are consistent with studies conducted by [Ningi \*et al.\* \(2021\)](#), [Mazenda and Mushayanyama \(2021\)](#), and [Azwardi \*et al.\* \(2019\)](#), which highlight that a rise in household size leads to food insecurity as many household members increase consumption, which raises the overall food insecurity status. [Mojela \*et al.\* \(2018\)](#) and [Oduniyi and Tekana \(2020\)](#) argue that there is no evidence that household size and food insecurity are linked.

The results suggest that the indigence rebates are negatively related to household food in the Gauteng City-Region and statistically significant at 1% level. The results from this article confirm the assertions of [Oduniyi and Tekana \(2020\)](#) and [Mthethwa and Wale \(2021\)](#), which reveal that indigence rebates reduce the chances of food insecurity since grants relieve pressure on households regarding the affordability of food items. The indigence rebates let families use their money to buy more food, which reduces their food insecurity status.

In all sampled groups, households had access to lower-income rates, which is between R800 and R3,200 per month. The findings reveal that income is negative and statistically significant at a 1% level. This may suggest that households with continuous access to income can procure food items for their homes. The results are compatible with those of [Mthethwa and Wale \(2021\)](#) and [Oduniyi and Tekana \(2020\)](#), which show that income reduces food insecurity in the Gauteng City-Region. Higher income allows households to fund a healthy living and eating lifestyle.

The findings from the study show that gender, race, food support, age and grant support do not have any association with household food security in the Gauteng City-Region and are statistically insignificant. However, the findings support [Azwardi \*et al.\* \(2019\)](#), [Mojela \*et al.\* \(2018\)](#), [Mthethwa and Wale \(2021\)](#) and [Ningi \*et al.\* \(2021\)](#), who found that variables such as gender, race, food support and provision of a grant do matter for household food insecurity in the Gauteng City-Region. Therefore, highlighting that households of different age groups are experiencing food insecurity, particularly the black African race. On the other hand, gender is not a determinant of food insecurity; both male- and female-headed households are susceptible to hunger. Finally, being a recipient of the food and support grants is not a determinant of food insecurity in the Gauteng City-Region. [Mthethwa and Wale \(2021\)](#) argue that the grants do not cover a month's consumer basket, as shown by the South African Consumer Price Index.

## 6. Policy recommendations

There are many factors that make people in the Gauteng City-Region less likely to have food. Because of this, the provincial department of education should spend more money on the learning infrastructure to help people learn and improve their skills. Income is identified as a

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determinant of household food insecurity; therefore, it is recommended that municipalities use any innovative mechanisms to spark investments that will result in employment and income opportunities. Household indigence rebates and grants should be maintained to support households below the food poverty line. Community leaders need to work with municipalities to plan and implement programmes to decrease the Gauteng City-Region's food insecurity. Consequently, urban municipalities should foster public–private partnership synergies in food production and supply chain systems to enhance income from urban food projects.

The findings from this study have fundamental implications for the government and other development institutes for reducing household food security levels in the Gauteng City-Region. This could be realised by promoting sustainable urban agriculture through investments in education and food production infrastructure, prioritising irrigation infrastructure, offering support for households that depend on grants and implementing state food security policy programmes.

## 7. Conclusions

The study aimed at estimating the determinants of household food security in nine municipalities of the Gauteng City-Region. Descriptive statistics were adopted to provide summary statistics of identified household food security factors. Also, the binary logistic regression analytical technique was applied to estimate the statistical relationship between the determinants of household food security in the Gauteng City-Region. The findings paint a clear picture that households residing in the Gauteng City-Region are experiencing food insecurity. The article revealed factors contributing to food insecurity in the Gauteng City-Region. The descriptive statistics show that most of the households that took part in the study and were in need of food were in the three metropolitan municipalities of Johannesburg, Tshwane and Ekurhuleni.

The results reveal that even though six factors significantly defined a household's food insecurity, few were statistically significant, with their signs of effects differing, as others were affected positively (unemployment, health status, household size) and others negatively (education, grant application, indigence rebates, income). Furthermore, the findings highlight that food insecurity is more prevalent in larger households than in those with few members. The determining factors, such as education level, show that those with lower education levels are more likely to experience poverty. By contrast, those with a higher level of education are less likely to experience poverty. The good fit for the adopted logistic regression model was supported by the findings from the likelihood ratio test, the omnibus test and the Hosmer and Lemeshow Test. Household coping mechanisms and how household income (especially government social grants and access to credit) affect food security status in the Gauteng City-Region should be looked at in more detail in future studies. This will help us better understand how food insecurity changes in urban municipalities.

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