

Article

Determinants of Environmental Perceptions and Attitudes in a Socio-Demographically Diverse Urban Setup: The Case of Gauteng Province, South Africa

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Abstract: In environment-nature discourse, determinants of environmental perceptions and attitudes vary significantly making it difficult to draw generalisations on their significance for particular locales. In this paper, we explore the key socio-demographic factors affecting environmental perceptions and attitudes for a socio-economically diverse area of Gauteng province, South Africa, using a generalised ordered logit model (gologit) approach. Personal level variables like gender, education level, employment status, age, population group, migration status and external variables such as dwelling type and electricity availability, obtained through a questionnaire, were assessed as determinants of environmental perceptions and attitudes. Statistical results indicated that dwelling type, gender, education level, place of birth and employment status were strong determinants of environmental attitudes. Population group (Coloured and White), dwelling type, electricity availability, employment status and education level (from primary only up to matric) were found to be significant predictors of environmental perceptions. Education level, dwelling type and employment status were therefore the common explanatory variables from the analysis, giving prominence to material values that people attach to environmental attitudes and perceptions. Age had no influence on both environmental perceptions and attitudes. The results from this article can provide a foundation for segmentation of anthropocentric factors for environmental planning and strategy formulation within the province.

Keywords: generalised ordinal logistic regression; gologit model; environmental attitudes; environmental perceptions; human–nature relationships; GCRO; Gauteng

1. Introduction

Environmental perceptions and attitudes are multidimensional, consisting of several interrelated constructs [1]. One of the ways researchers can promote sustainable and pro-environmental behaviour is to understand the determinants of environmental perceptions and attitudes, as these have implications on human–nature relationships [2–4]. Environmental behaviour are actions emanating from beliefs, attitudes, values and perceptions towards the environment. Ajzen and Fishbein (1980) [5] in their theory of reasoned action, asserted that evaluative and normative beliefs influence attitudes and norms towards the environment, and the resultant environmental behaviour. Studies have pointed out that person's environmental perceptions and attitudes and resultant environmental behaviour can be shaped by several individual level and externally determined factors [6]. At an individual level, researchers have demonstrated that age has a strong correlation to environmental attitudes [7]. Younger people

are believed to hold less stringent views on the environment and have lower levels of environmental concern [7,8]. However, in a study of cohort group differences in environmental concern, Honnold (1984) [9] found decreased levels of environmental concern in almost all age groups since the 1970s. Gender has also been widely studied as a factor affecting environmental attitudes, with females being more inclined towards environmental protection than males are [10]. Studies on correlates between gender and its influence on environmental perceptions and attitudes have been inconsistent though, as other researchers have found no universality on differences in perceptions and attitudes based on gender [11,12]. Scholars have explained the differences in the effect of gender on human–nature relations based on gender roles and socialization [2,10]. Socialisation theory postulates that females are socialised to be more caring, expressive, nurturing and have the ethics of care. Males, on the other hand, are socialised to be less expressive and competitive, and not very nurturing in approach [10]. Other empirical studies e.g., that by Theodori and Luloff (2002) based on a national survey in the USA, were not conclusive on the influence of gender on environmental behaviour [6].

Another socio-demographic determinant of environmental perceptions and attitudes that has received attention from researchers is socio-economic status, in terms of income levels and employment status. In more developed countries, employment status has been linked to relatively higher levels of income as more people are involved in the formal economy [13]. Some studies have shown that higher-income earners tend to be more environmentally concerned than lower-income earners [14,15]. Other researchers have argued that high-income earners tend to live in more environmentally friendly areas, and are therefore more protective of the environment [14]. Additionally, Van Liere and Dunlap (1981) [16] and Kemmelmeier, Król and Kim (2002) [17] suggested that environmental matters are more of a 'luxury' for low-income earners, and can only be indulged upon after more basic livelihood needs (adequate food, shelter, and economic security) have been addressed. Theodori and Luloff (2002) also found that higher income earners are more likely to involve in more pro-environmental behaviour than lower income earners [6]. The logic ensues that higher financial status brings with it the ability to focus on aesthetic matters [18]. Economic status has also been linked to levels of education, as wealthier people, or those with higher income levels, are typically more educated than the lower earners [19,20]. In support of this assertion, Theodori and Luloff (2002) also found that education and political ideology were the most consistent predictors of engagement in a variety of pro-environmental behaviours [6]. In South Africa, economic status has been linked to the political legacy of separate development (*apartheid*), wherein the White population group was afforded superior economic opportunities to the other groups, hence perpetuating economic disparities along racial lines [21]. It is unclear, however, if economic status has implications for environmental perceptions and attitudes in the Gauteng province.

Education level has also been found to influence environmental perceptions and attitudes. Studies have found that people with higher levels of education are more expressive towards environmentalism in terms of perceptions and attitudes than those with lower levels of education [16,20]. These expressions are mainly about environmental concern, awareness, knowledge, and subsequent behaviours [22]. In support of this assertion, Van Liere and Dunlap (1981) [16] also found a positive link between education and environmental perceptions and attitudes. Scott and Willits (1994) [23] found that people with more years of formal schooling are more expressive about environmental issues, in terms of perceptions, attitudes and resultant environmental behaviour than did the less educated and lower-income respondents. During their studies, people get more exposed to a wide variety of ideas and beliefs about the environment and become more liberal-minded on the environment than people with lower levels of education [17]. In essence, therefore, increased levels of education are associated with heightened environmental concern. Environmental concern has been considered to be a determinant of people to act responsibly, and a key determinant of perceptions and attitudes [22,24,25].

Another socio-demographic variable that is a determinant of environmental perceptions and attitudes is population group or ethnicity. Different environmental perceptions amongst population groups may help account for variances in behaviour related to environmental resource availability,

and resource governance and management, especially in areas where segregation by ethnicity and cultural orientation still exists. Variations in perceptions about environmental matters between ethnic groups have been found to persist even when demographic factors such as age, education, gender, residence, and family size were held constant [10]. Lazri and Konisky (2019) [10] in their Gallup study of population groups spanning over 15 years, found that people of colour in the USA are more concerned than Whites about matters about environmental justice, and just as concerned about problems related to sustainable behaviours like pollution prevention and resource protection. This finding is pitted against traditional findings that people of colour and those of Hispanic origin in the USA are concerned more by basic survival and view environmentalism as a luxury issue. Therefore, socio-demographic factors have not always been consistent in predicting environmental concern [26].

Besides the above socio-demographic variables, other factors that have been noted to be strong determinants of environmental perceptions and attitudes include knowledge about the environment [27,28], length of stay in an area [4], immigration status [29], access to amenities [30], place of residence (rural/urban) [31] dwelling type [32–34] and religion [35]. For example, knowledge about the environment may affect environmental perceptions and attitudes, as knowledge about environmental topics leads to pro-environmental behaviour [5,36]. Studies have also indicated that longer residence in an urban area is generally associated with greater environmentalism and that rural dwellers who rely more on the land tend to be more protective towards the environment [32]. Length of stay and immigration status have been linked to environmental perceptions and attitudes, as place bonding leads to certain environmental behaviours, which are driven by environmental perceptions and attitudes [29]. In urban areas, access to amenities like water and access to waste disposal facilities may lead to people developing certain perceptions and attitudes of the environment, as behaviours and awareness of water pollution and waste disposal results in certain levels of environmental awareness, especially in less developed countries [31]. All of these factors influence how people view their role in that environment, and hence their perceptions and attitudes towards their surroundings [10,37].

Although there have been many studies done on environmental perceptions and attitudes, few have been carried out in less economically developed and diverse societies. Even then, researchers have concurred that the relationship between these dimensions remains poorly understood [28,38]. Additionally, most studies of environmental perceptions and attitudes have relied on relatively small samples that were geographically limited [10]. Even for those studies conducted in less developed countries, they have been on environmentally homogenous locales like tourist areas and botanical gardens [38] rural settings [39], outdoor recreation [1,40] and few have been on culturally and socio-economically diverse urban environments like Gauteng which is dominated by racial groups that have a long history of being systematically discriminated against [11]. Gauteng, like the rest of the urban setups in the country, has settlement patterns that are largely shaped by past governance structures that created and implemented race-based discriminatory settlements patterns [21]. Therefore, it is unclear if such social engineering has influenced people's perceptions and attitudes towards the environment. By carrying out this study, we aim to determine which of the socio-demographic variables are strong determinants of environmental perceptions and attitudes. We envisage that this knowledge may help in understanding environmental behaviours like protecting pooled resources, recycling and pollution reduction and control, which can then assist in achieving environmental sustainability within the province.

The study was conducted in all the metropolitan and district municipalities of Gauteng. The province consists of metropolitan cities of Johannesburg, Ekurhuleni and Tshwane, and the district municipalities of the West Rand and Sedibeng (Figure 1). Although the province only covers 1.5% of the total land area of South Africa, it is the most populated province and is viewed as the economic heartland of the country and a gateway to Africa, generating a third of the country's gross domestic product [41,42].

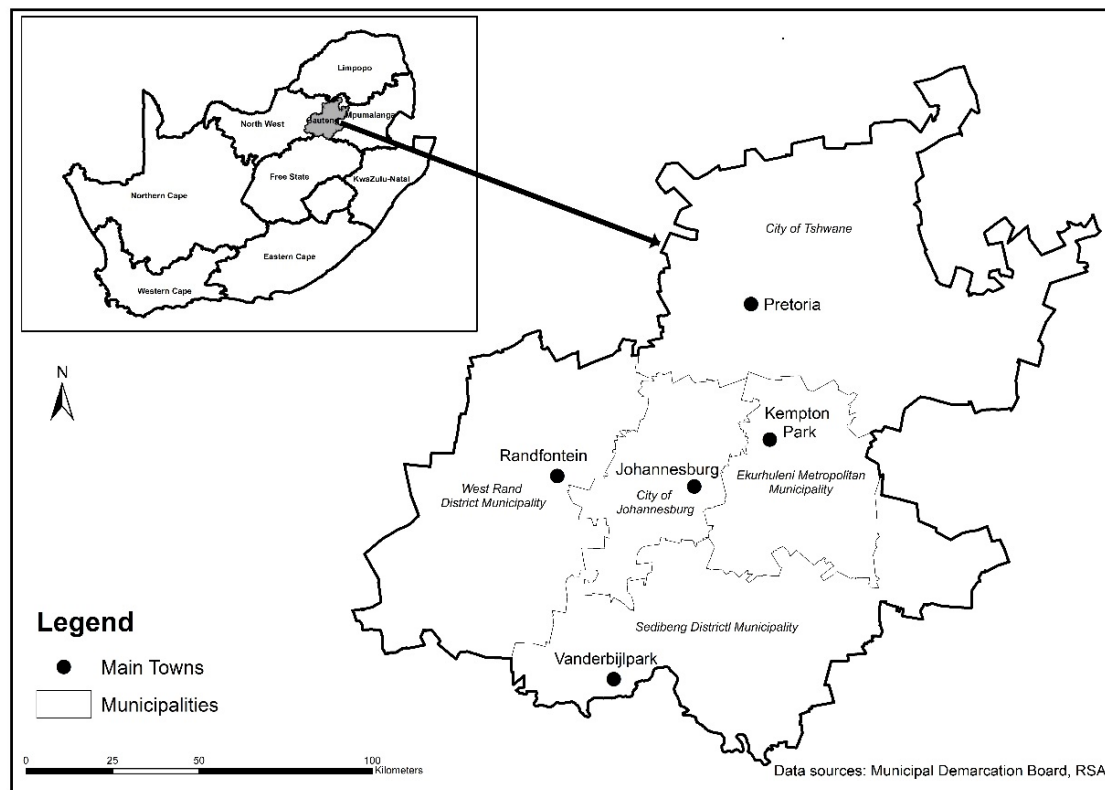


Figure 1. Gauteng province: metropolitan municipalities, district municipalities and major cities.

Gauteng's population is made up of approximately 80% Black Africans, 2.9% Asians/Indians, 3.4% Coloureds and 13.7% Whites [41]. In terms of gender, the province is made up of 50.6% males and 49.4% females. The province consists of 64.8% of people that were born in the province and is comprised mainly of youth (18–35 year age group), who make up 42.8% of the population. The population is also made up of by people who have had secondary education (62.2%) followed by those with tertiary education (24%), and those with only primary education (10.3%). Even though the province is dominated by formal dwellings, a large percentage of the population lives in informal settlements (12%), where the provision of basic amenities is limited [42]. The population of Gauteng was estimated to have exceeded 14 million in 2017, using projections from Statistics South Africa [42].

2. Materials and Methods

2.1. Data

Data from the 2015 Quality of Life Survey conducted by the Gauteng City-Region Observatory (GCRO) was used [42]. The survey consisted of questions on, amongst others, satisfaction with basic services, livelihoods, local community and neighbourhood dynamics, as well as political, environmental, social values and attitudes. The questionnaire was administered in the eleven official languages in the country. A total of 30,002 respondents, 18 years and older, selected through a stratified sampling technique, participated in the interviews. The interviews were conducted using a Computer-Assisted Personal Interview (CAPI) tool, which is a face-to-face data collection method in which the interviewer used tablets to record answers given during the interview [42]. In this article, socio-demographic variables were assessed for their predictive power on environmental perception and attitudes variables. Two dependent variables were selected as proxies for environmental perceptions and attitudes. To measure environmental perceptions, a dependent (response) variable on whether people perceived of any improvement or deterioration in their environment over the past year was selected (*Perceive of improvement/deterioration*). The variable was measured on a Likert scale with three responses:

improvement, deterioration and no change. To assess environmental attitudes respondents were asked whether they thought it is important to look after the environment or not (*It is important to look after the environment*). Notably, questions were framed in such a way that respondents' answers reflected how the environment contributes to their overall 'quality of life'. A five-point Likert scale was used to record peoples' responses to this specific statement, ranging from strongly agree to strongly disagree. Both the dependent variables, therefore, have ranked responses, making them an ordinal type of data (Table 1). A set of independent (predictor) variables was selected as socio-demographic determinants of the above two dependent environmental responses; these variables include population group, gender, age, education level, dwelling type, employment status, whether or not respondents were born in Gauteng and access to electricity (Table 1). All the explanatory variables were nominal in scale. Similar measures of human–nature relations have also been used by researchers examining the influence of socio-demographic variables in environmental concern and pro-environmental behaviour [13,28,33]. Other socio-demographic variables that have been used in almost similar studies (e.g., religion and political affiliation as used in the study by Theodori and Luloff, 2002) were not included in the Quality of Life survey data that was used for this paper.

Table 1. Independent (explanatory) and dependent (outcome) variables used in the study.

	Variable of Interest	Variable Description
Independent (explanatory) variables	Age	Age (1 = 18–19, 2 = 20–24, 3 = 25–29, 4 = 30–34, 5 = 35–39, 6 = 40–44, 7 = 45–49, 8 = 50–54, 9 = 55–59, 10 = 60–64, 11 = 65+)
	Gender	Gender (1 = male, 2 = female)
	Education level	Education level (1 = No education, 2 = Primary only, 3 = Secondary incomplete, 4 = Matric, 5 = More, 6 = Unspecified)
	Dwelling type	Dwelling type (1 = Formal, 2 = Informal, 3 = other)
	Employment	Employment status (1 = Employed, 2 = unemployed, 3 = other)
	Place of birth	Place of birth (Born) (1 = born in Gauteng, and 2 = migrated to Gauteng)
	Electricity	Electricity (1 = Yes, 2 = No)
Dependent (outcome) variables	Population group	Population Group (1 = African, 2 = Coloured, 3 = Indian/Asian, 4 = White, 5 = Other)
	Perceptions	<i>There has been improvement/deterioration in my neighbourhood in the last 12 months</i> (1 = Improvement, 2 = Deterioration, 3 = No Change)
	Attitudes	<i>It is important to look after the environment</i> (1 = Strongly agree, 2 = Agree, 3 = Neither agree nor disagree, 4 = Disagree, 5 = Strongly disagree)

It should be noted, moreover, that population group was restricted to the dominant ethnic groups in Gauteng, and the less represented groups were covered in the 'Other' category. Similarly, other less dominant dwelling types (like people living in caravans, tents, etc.) were also included in the 'Other' category. A similar approach was used for employment status, where people who were not exactly employed or unemployed (e.g., being involved in some form of income-generating activity, though not classified as employment per se) were classed under the 'Other' category. For education level, respondents with an education higher than matric, i.e., postgraduate studies/certificates/diplomas, were classified as 'more'. Some respondents did not indicate their level of education and have been classified as 'Unspecified'. Age group was classified as 18–19, then grouped at five-year intervals from 20–25 through to 60–65, and those over 65. Dwelling type and electricity availability were selected as variables of interest since they have an economic bearing in the South African context where stark inequalities exist in the provision of such amenities at a spatial level.

2.2. Bivariate Analysis: Association between Dependent and Independent Variables

The analysis was conducted to determine if environmental perceptions and attitudes were associated with socio-demographic factors. Initial assessment on the nature of the data showed that the data were not normally distributed indicating the non-suitability of parametric statistical tests: therefore non-parametric tests of association were used. Specifically, two tests were considered: Kruskal-Wallis and Chi-squared (χ^2) tests. Each test was run to determine, for example, if perceived improvement/deterioration in an area depends on population group type; or if attitudes on whether it is important to look after the environment were dependent on dwelling type. Such assessment was replicated to all dependent and independent variables.

The Kruskal-Wallis test is the non-parametric (distribution-free) alternative to the one-way analysis of variance (ANOVA) when the assumptions of the one-way ANOVA are not met. It is a rank-based test that is used to determine if there are statistically significant differences between two or more groups of an independent variable on a continuous or ordinal dependent variable. The Kruskal-Wallis test is calculated as where n is the sum of sample sizes for all samples, k is the number of samples, R_i is the sum of ranks for the i th group and n_i is the size of the i th sample.

$$H = \frac{12}{n(n+1)} \sum_{i=1}^k \frac{R_i^2}{n_i} - 3(n+1), \quad (1)$$

Similar to the Kruskal Wallis test, the χ^2 test statistic is a non-parametric (distribution-free) tool designed to examine the association between two qualitative variables (e.g., environmental perceptions and population groups). The χ^2 test can be calculated as where k is the number of groups or classes, O_i is the observed frequency (the actual count of cases) and E_i is the expected frequency.

$$\chi^2 = \sum_{i=1}^k \frac{(O_i - E_i)^2}{E_i} \quad (2)$$

2.3. A Generalised Ordered Logistic Regression Model

Since the dependent variables (i.e., environmental perceptions and attitudes) had more than two categories, the ordered logit model, also known as the proportional odds (PO) model can be used to do the analysis. One of the most important assumptions of the PO model is that the relationship with the explanatory variables must be the same for each level of the dependent variables. In our analysis, a Generalized Ordered Logit, also known as a gologit model (Williams 2006) was fitted to estimate the association between environmental perceptions and attitudes to socio-demographic factors. The gologit model is one of the most popular methods for analysing ordinal outcome variables [43]. It is a preferred alternative to a PO model since its results are usually much better-fitting, and no variables need to meet the parallel lines assumption. For an ordinal dependent variable with M categories, the gologit model can be written as follows:

$$p(Y_i > j) = \frac{\exp(a_j + X_i \beta_j)}{1 + [\exp(a_j + X_i \beta_j)]}, \quad j = 1, 2, \dots, M-1 \quad (3)$$

where j is the cumulative logit, β_j is a vector of regression coefficients, X_i is a $p \times 1$ vector containing the full set of explanatory variables [44]. A gologit model gives results that are similar to those from a series of binary logistic regressions/ cumulative logit models and can be interpreted the same way. We use maximum likelihood estimation techniques to estimate the model parameters.

3. Results

Initial tests of association between the explanatory variables (socio-demographic factors) and outcome variables (variables related to environmental perceptions and attitudes) were conducted using the Kruskal-Wallis and χ^2 tests. Table 2 presents the results for the Kruskal-Wallis and χ^2 tests. The results indicated that dwelling type, electricity availability, born in Gauteng or migrated, education level and population group were significantly associated with environmental attitudes and perceptions using both the χ^2 and Kruskal-Wallis tests. Age was only significantly associated with environmental perceptions, whilst gender showed no association with both environmental attitudes and perceptions. Therefore, except for gender and age, the Kruskal-Wallis test, together with the χ^2 independence test point to a strong association between the dependent and independent variables.

Table 2. Test of association between explanatory variables and dependent variables using Chi-squared and Kruskal-Wallis tests.

Variable	Measurement Scale	It Is Important to Look after Environment (Attitudes)		Perceived Improvement/Deterioration (Perceptions)	
		Kruskal-Wallis (H)	Chi Square (χ^2)	Kruskal-Wallis (H)	Chi square (χ^2)
Gender	Nominal	2.60	2.60	6.20 *	6.20
Dwelling type	Nominal	37.30 ***	43.30 ***	647.8 ***	685.3 ***
Electricity Y/N	Ordinal	20.50 **	20.40 ***	512.2 ***	512.2 ***
Place of birth	Nominal	31.70 **	31.70 ***	26.7 ***	26.6 ***
Employment status	Ordinal	36.40 **	75.30 ***	79.1 ***	377.1 ***
Education level	Ordinal	162.50 **	241.40 ***	490.6 ***	550.2 ***
Age	Nominal	5.50	41.00	16.4 ***	37.9 **
Population group	Nominal	187.20 ***	237.10 ***	250.6 ***	283.6 ***

* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$, $n = 30002$.

Having tested the significance of the association between dependent and independent variables, modelling was then necessary to establish the relationships between the two sets of variables. In order to achieve this, the proportional odds assumption was performed using the likelihood-ratio test (LRT). The results of the proportionality assumption of the fitted model using gologit are given in Table 3. The LRTs for both perceptions and attitudes were significant (p -values = 0.000), hence indicating that the proportional odds assumption of the response variables were violated. Consequently, an alternative to the PO model would be desirable to establish the relationship between the dependent and independent variables.

Table 3. Likelihood-ratio test (LRT) of proportional odds assumption.

Response Variable	LRT	p -Value
It is important to look after the environment	17,110.7	0.000
Perceived improvement/deterioration	12525.0	0.000

When a violation of proportional odds has occurred, gologit models are a superior alternative since they can be less restrictive and are more parsimonious than PO models. Table 4 represents the results of the fitted gologit model for the two dependent variables. The odds ratios (OR) reflected as the $Exp(\hat{\beta})$ column in Table 4, shows the change in the odds of being in a higher category on the dependent variable for every one-unit increase on the independent variable, holding the remaining independent variables constant. An OR >1 suggests an increased probability of being in a higher level on the dependent variable as values on an independent variable increase, where a ratio <1 suggests a decreasing probability with increasing values on an independent variable. An OR =1 suggests no

predicted change in the likelihood of being in a higher category as values on an independent variable increase. The beta coefficients ($\hat{\beta}$) indicate whether the movement is in the positive or negative, and the magnitude of the movement.

Table 4. Generalised ordered logit (gologit) results indicating beta values ($\hat{\beta}$) significance levels and OR.

It Is Important to Look after the Environment			Perceived Improvement/Deterioration		
	$\hat{\beta}$	$Exp(\hat{\beta})$ (OR)		$\hat{\beta}$	$Exp(\hat{\beta})$ (OR)
Population group			Population group		
African	0.076	1.079	African	-0.125	0.882
Coloured	0.07	1.073	Coloured	-0.234 **	0.792
Indian/Asian	-0.14	0.869	Indian/Asian	-0.125	0.883
White	-0.134	0.874	White	-0.215 **	0.807
Other (reference)	0 ^a	1	Other (reference)	0 ^a	1
Gender			Gender		
Male	0.028 **	1.029	Male	-0.004	0.996
Female (reference)	0 ^a	1	Female (reference)	0 ^a	1
Dwelling type			Dwelling type		
Formal	-0.172 ***	0.842	Formal	-0.134 **	0.875
Informal	-0.139 **	0.87	Informal	0.187 **	1.206
Other (reference)	0 ^a	1	Other (reference)	0 ^a	1
Electricity availability			Electricity availability		
Yes	-0.008	0.992	Yes	-0.343 ***	0.709
No (reference)	0 ^a	1	No (reference)	0 ^a	1
Place of birth			Place of birth		
Born in Gauteng	0.087 ***	1.091	Born in Gauteng	0.021	1.021
Migrated to Gauteng (reference)	0 ^a	1	Migrated to Gauteng (reference)	0 ^a	1
Employment status			Employment status		
Employed	-0.042 **	0.959	Employed	-0.039 **	0.962
Unemployed	0.027	1.028	Unemployed	0.164 ***	1.179
Other (reference)	0 ^a	1	Other (reference)	0 ^a	1
Education level			Education level		
No education	0.149 **	1.161	No education	0.380 ***	1.463
Primary only	0.106 **	1.112	Primary only	0.285 ***	1.33
Secondary incomplete	0.038	1.039	Secondary incomplete	0.285 ***	1.33
Matric	0.027	1.027	Matric	0.209 ***	1.232
More	-0.057	0.945	More	0.042	1.043
Unspecified (reference)	0 ^a	1	Unspecified (reference)	0 ^a	1
Age			Age		
18–19	-0.049	0.953	18–19	-0.022	0.979
20–24	-0.037	0.964	20–24	0.019	1.019
25–29	-0.027	0.973	25–29	-0.001	0.999
30–34	0.009	1.009	30–34	-0.009	0.991
35–39	0.015	1.016	35–39	0.038	1.038
40–44	0.044	1.045	40–44	0.018	1.018
45–49	-0.002	0.998	45–49	0.048	1.049
50–54	0.03	1.031	50–54	0.069	1.072
55–59	0.057	1.058	55–59	-0.028	0.973
60–64	-0.063	0.939	60–64	0.013	1.013
65+ (reference)	0 ^a	1	65+ (reference)	0 ^a	1

* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$, $n = 30002$.

Table 4 indicates that explanatory variables such as gender, dwelling type, place of birth, employment status and education level were strong determinants of environmental attitudes. Of these variables, gender and place of birth have positive $\hat{\beta}$ coefficients or ORs > 1. This means that there is a higher probability of these values to be in a higher category of the dependent variable, which, in this

case, is the environmental attitudes variable [44]. For instance, the coefficient for the male gender is positive indicating that higher values of this variable increase the probability that a respondent is in the higher category of a dependent variable (i.e., it is important to look after the environment) than the current one, i.e., it has a higher probability of being ranked in a higher category. Meanwhile, explanatory variables such as dwelling type and employment status had ORs < 1, imply that rating in lower categories is more [44]. In interpreting the results of each panel in Table 4, the $\hat{\beta}$ coefficients and the level of significance for each category are considered. The $\hat{\beta}$ coefficient is the degree of change in the outcome variable for every 1 unit of change in the predictor variable. For example, gender, place of birth and education (no primary and primary only) were found to be significantly associated with 'it is important to look after the environment', with positive $\hat{\beta}$ coefficients. Dwelling type (formal), on the other hand, had a negative $\hat{\beta}$ value ($\hat{\beta} = -0.172$; OR = 0.842) meaning for every 1 unit increase in dwelling type 'formal' the outcome variable will decrease by the $\hat{\beta}$ coefficient value (i.e., -0.172). An OR of less than 1 (i.e., 0.842) suggests a decreasing probability with increasing values on the independent variable (dwelling type). Even though other variables like age (30–64 years) had ORs > 1 and mainly positive $\hat{\beta}$ values they had no significant influence on environmental attitudes. Notably, population group, electricity availability and education level had no influence on attitudes.

Using the same interpretation, population group (Coloured and White), dwelling type, electricity availability, employment status and education level (from primary only up to matric) were found to be significantly associated with environmental perceptions (perceived improvement/deterioration). The findings of this study also indicate that gender, place of birth and age had no influence on perceptions. Dwelling type (informal), employment status (unemployed) and education level (except 'more') all had ORs > 1 for explaining perceptions. This implies that higher values of these explanatory variables increase the probability that a respondent is in a higher category than the current one of a dependent variable (i.e., perceived environmental improvement/deterioration) [44]. Meanwhile, explanatory variables such as population group, dwelling type (formal), electricity availability and employment status (formal) had negative $\hat{\beta}$ values and ORs < 1, implying that higher values of these variables increase the probability of being in the current category of environmental perceptions [44].

4. Discussion

This study sought to explore the key factors determining environmental perceptions and attitudes for a socio-economically diverse area of Gauteng province, South Africa. Statistical results indicated that explanatory variables such as dwelling type, gender, place of birth, education level and employment status were strong determinants of environmental attitudes. Dwelling type, population group (Coloured and White), electricity availability, employment status and education level (from primary only up to matric) were significantly associated with environmental perceptions. The common determinants for both environmental perceptions and attitudes are therefore dwelling type and employment status, both materialistic values in nature. In South Africa, material values have been linked to geographical location and ethnicity because of past policies of separate development [21]. These results should be interpreted with some caution because the response variables were single item indices used as proxies for perceptions and attitudes. In addition, the responses could have been influenced by other latent factors not related to respondents' views on how they relate to the social and natural environment per se. The direct questions and how they are framed (as 'quality of life questions') may also fail to capture other sentimental and emotional responses and behaviour that may also influence levels of environmental concern [35]. However, they do shed light on some of the socio-demographic factors that determine human–nature relations for a socio-demographically diverse area such as Gauteng in South Africa. The results are discussed in light of relevant literature.

Dwelling type was a strong common determinant of both environmental perceptions and attitudes. In the South African context, and indeed in other parts of the world, dwelling type is linked to socio-economic status [33]. Gauteng is made up of formal urban settlements (low-density settlements) with standard formal (medium and high density) and informal dwellings (normally overcrowded) [42].

There are also semi-rural dwellings and farm plots, especially on the outskirts of the study area [42]. These are normally made up of formal dwellings and informal dwellings mainly for farmworkers. Dwelling type, therefore, can be linked to the place of residence, and affordability of formal housing. Past research, [45] investigated the constancy of place of residence as a predictor of environmental concern using longitudinal data throughout the 1980s in the USA. Not only had environmental attitudes of urban residents become more distinct from those of rural residents over this particular decade, but the place of residence seemed to take on increasing importance as a predictor of environmental concern [45]. Environmental concern has been linked to environmental attitudes and has also been found to be an important indirect determinant of specific environmental behaviour [23]. Willers (1996) [30], in their study of more heterogeneous cities in South Africa, noted that dwelling type and place of residence are predictors of environmental concern because of (1) size of residential community, which can affect population densities and resultant environmental degradation (2) cultural diversity and pollution associated with urban areas, which may influence human–nature relations, and (3) socialisation in urban areas, which may result in certain environmental behaviours brought about by political ideologies on environmental issues. Evans and Jacobs (1981), also in their study of South African communities, reported that people living in high density, polluted areas showed less concern for the environment, and those living in more formal and wealthier dwellings showed higher levels of concern. Dixon and Durrheim (2004) [21], in their study of desegregation in South Africa, established a link between environmental attitudes and materialism, with the White community being more privileged and wealthier than other population groups, and hence affording to live in more well off dwellings. Grieve and Van Staden (1985) [11] and Willers (1994) [30] in their studies of communities in selected suburbs in South Africa, however, found no significant differences in environmental perceptions, attitudes, and concerns between different residential groupings. However, this is an angle that needs further research as international literature on dwelling type as a predictor of environmental perceptions and attitudes is scant.

Employment status was another common significant predictor of both perceptions and attitudes. Employment status is an aspect of economic conditions. Studies on economic conditions and the environment have not looked at employment status *per se*, but on how economic conditions may affect environmental attitudes [28,37]. Shen and Saijo (2007) [14] in their study of 1200 individuals in Shanghai, China, found that high income and high education level was positively related to environmental concern as expected. Other researchers have argued that high-income earners tend to live in more environmentally friendly areas, and are, therefore, prone to be more protective towards the environment [20,46]. Additionally, Van Liere and Dunlap (1981) [16] used the hierarchy of needs approach and suggested that environmental matters are more of a 'luxury' for low-income earners, and can only be indulged upon after more basic material issues (adequate food, shelter, and economic security) have been addressed. Brechin and Kempton (1995) [25] argued that the high levels of environmental concern among poor countries demonstrate that low-income earners also have high levels of environmental concern. Such studies, therefore, have raised doubts about the relationship between post-materialism and environmental concern and have inspired additional research to expand exploration of environmental concern in a variety of settings. In more heterogeneous 'impoverished' communities in South Africa, Hunter et al (2010), also found that perceptions and attitudes evolve around livelihoods, socioeconomics and the individual experience, indicating that employment or economic status alone intertwines with other factors in a complex way to determine one's outlook towards the environment.

In our study, we used the place of birth (born in Gauteng or migrated) as a proxy for migration status. This variable has been found to be a determinant of attitudes in other studies [28], but was only a moderate determinant of attitudes and a much weaker determinant of perception. Other studies, e.g., Brehm et al. (2006) [35] found migration status to be a more complex factor in determining community attachment. They found that new migrants actually form much stronger bonds with the natural environment than social networks and local relationships that longer term residents have

relating to their environment. In our study, the influence of migration on human–nature relations is also complex. Gauteng is the economic hub of South Africa and has been the largest recipient of local and international migrants [42]. Population growth resulting from rapid urbanisation as a result of in-migration has meant the involvement of communities in environmental decision-making processes. However, this has seemingly not translated into heightened place attachment amongst the residents.

Availability or non-availability of electricity in households has received scant attention on the discourse on socio-economic and demographic factors affecting environmental perceptions and attitudes. Studies that have considered electricity availability as a factor have been on environmental concern in general [30]. Other studies have touched on the availability of amenities related to service delivery and how these affect environmental behaviour [30]. In our study, electricity availability came out as one of the significant determinants of environmental perceptions. This is not surprising in the South African context, as availability of electricity in households is largely linked to socio-economic status (SES) and dwelling type. Earlier studies on SES and environmental perceptions pointed to a positive relationship between care for the environment and higher SES. For example, White and Hunter (2005) found a positive relationship between higher SES and environmental perceptions among residents of 6 coastal districts in the Central region of Ghana. This view has, however, been contradicted by other studies that have found that people of low SES hold similar, if not more solemn, views about the environment than the more affluent [10].

Level of education came out as one of the highest predictors of environmental attitudes (lower levels of education) and perceptions (low to higher levels of education). This is in slight contrast to other research that has found a positive correlation between higher educational attainment and increased environmental awareness [30]. Willers (1996) [30], however, postulated that ‘level of education’ should not be equated with the concept ‘environmental knowledge/awareness’. Being well-informed about environmental issues need not necessarily accompany high levels of education, and *vice-versa*, albeit that the causes of environmental problems are often very complex and are more easily comprehended by the better educated [47]. Interestingly, research in America [31] and in South Africa [46] pointed to generally low levels of knowledge about environmental issues and degradation in target populations even when the level of education is positively related to environmental concern. Other studies, for example, Van Liere and Dunlap (1981) [16] and White, Virden and van Riper [48] reviewed numerous studies on environmental concern conducted in the USA in the period from the late 1960s to 1990 and found positive correlations between education levels and environmental perceptions and attitudes. Similar conclusions were reached by Theodori and Luloff (2002), who, in their study in America found that education was a positive and significant predictor of pro-environmental behaviours [6].

Our study indicated that population group was an insignificant predictor of attitudes and only the Coloured and White population groups predicted perceptions. Other research, e.g., Whittaker, Segura and Shaun (2005) [49] subscribed racial and ethnic differences in environmental attitudes to Maslow’s hierarchy of needs theory suggesting that poor or minority populations, mainly Black people and other minorities had more pressing survival issues than concerns over the environment. White people, on the other hand, were predicted to take up more environmental issues. By contrast, environmental deprivation theory posited that environmental concern is related primarily to exposure, that the more polluted the neighbourhood, the more concerned the residents of that neighbourhood [50]. Given that poorer communities occupy the most environmentally impacted neighbourhoods, they would have higher levels of concern (perceptions and attitudes). In a study on environmental attitudes in South Africa, Willers (1996) [30] found that population group was an inconsistent predictor of perceptions and attitudes, and pointed to the paucity of such studies in South Africa. Willers (1996) [30] reported that population group had a significant effect on people’s views on environmental degradation. The researchers found that 93% of the White population, 70% of the Coloured, 67.2% of the Asian and 55.4% of the Black sample regarded environmental degradation as a priority. Dixon and Durrheim (2004) [21] asserted that in South Africa ethnicity/population group is one of the strongest determinants of environmental concern due to the legacy of apartheid and that the White population group holds

strong protectionist bonds about their environments. However, studies on whether such social engineering in South Africa has directly affected people's perceptions and attitudes towards the environment have been scant. More recently, Lazri and Konisky (2019) [10] found that people of colour in the USA are more concerned than Whites about matters pertaining to environmental justice, and just as concerned about problems related to traditional environmentalism. This points to the complexity of race/ethnicity/population group as a determinant of environmental perceptions and attitudes.

Our study also found that age was not associated with environmental perceptions and attitudes. These findings are consistent with other studies that have found no association between age and environmental perceptions or attitudes. For example, Van Liere and Dunlap (1981) [16] reviewed a wide range of American studies on environmental concern and reported a negative association between environmental perceptions, attitudes with age. Even though these studies have indicated a negative relationship between age and environmental attitudes, it is more common to find a positive relationship between age and pro-environmental behaviour [9]. Wiernik et al (2013) [7], in their study of USA communities using data collected between 1970 and 2010 found that older individuals appear to be more likely to engage with nature, avoid environmental harm, and conserve raw materials and natural resources. In South Africa, Grieve and Van Staden (1985) [11] investigated environmental concern among English and Afrikaans-speaking adolescents (14 to 17 years) and adults (age 18 years +) using the Environmental Concern Scale (ECS) developed by Weigel and Weigel (1978) [50]. They found significant differences between adolescents and adults, with the former showing less environmental concern than the latter. Therefore, it appears that the relationship between age and environmental concern is a complex one and that other factors are involved in the development of environmental perceptions and attitudes.

Gender has also been widely studied as a factor affecting environmental attitudes, with females being more inclined towards environmental protection than males [2,12]. Our study revealed that gender was an average predictor of environmental attitudes, but not of perceptions. In any case, other studies have found that females have higher levels of environmental attitudes than males [2,16]. This is consistent with the socialization theory that posits that there is strong empirical evidence that females tend to be more positive in their environmental attitudes than males [51]. However, Whittaker et al. (2005) [49], in their analysis of data from a random sample of U.S. residents revealed significant differences in environmental attitudes particularly within White males, who showed variable and less concern for environmental issues than females and males from other race groups. One of the few South African studies that included gender as a predictor of environmental concern Grieve and Van Staden (1985) [11] found that gender alone is not a strong predictor of perceptions and attitudes and that it interplays with other factors like language and ethnicity as a predictor of environmental concern.

5. Conclusions

This study has explored socio-demographic variables that may significantly determine environmental perceptions and attitudes. The results demonstrate support for some variables being more important than others as predictors of environmental perceptions and attitudes. Dwelling type, migration status, employment status, and education level were the strongest predictors of environmental attitudes, whilst education level, employment status, dwelling type, and electricity availability were the most significant predictors of environmental perceptions. Notably, age had no influence on both environmental perceptions and attitudes.

Despite useful insights on the potential contributions of socio-demographic factors on environmental perceptions and attitudes observed in this study, it is important to highlight the limitations of the study. Environmental perceptions and attitudes were measured from single item variables that were only used as proxies for these concepts. Therefore, even though these items might have different interpretations, the present study only sought to quantify and analyse the results from a generic perspective. Additionally, environmental concern and behaviour were used as terms to embrace environmental perceptions and attitudes, even though these terms might be interpreted

differently based on the context in which they are used. Moreover, some of the socio-demographic variables like religion and political affiliation that have been found to be significant determinants of environmental behaviour in other studies [6] were not included in this research due to limitations of the survey data. These variables could be latent in some of the responses received from the survey. Nevertheless, this research has been one amongst a few that have explored environmental perceptions and attitudes for a socio-economically diverse and developing area like the Gauteng province. As such, within the context of the diverse South African geopolitical environment, this research has the potential to provide a foundation for the understanding of some of the socio-demographic factors that may affect environmental behaviours like participating in environmental initiatives such as recycling, health-supportive environments and managing environmental pollution and degradation, which is important for environmental planning and strategy formulation. Additionally, understanding environmental perceptions and attitudes towards the environment is essential for a sustainable future, especially in emerging economies.

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