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Research Article

Perceived Effect of Knowledge Level and Socio-Demographics on COVID-19 Risk Exposure: the Africa Experience

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Abstract

COVID-19 remains a global public health emergency till date. It is eminent that the transmission of the disease is subjective to people's readiness to implement public health preventative strategies and these are often related to knowledge. Proper public knowledge about COVID-19 plus its predisposing factors is critical to effectively manage the increasing public health risks. However, socio-demographics have been implicated to COVID-19 infection risk and management outcome. Thus, this present study examined the influence of knowledge on COVID-19 risk outcome, the contribution of socio-demographics on the risk of COVID-19 and predicted synergistic effects of knowledge and socio-demographics on the risk of COVID-19. All measured was strictly perception amongst African sampled with an online Google form as the primary data source. The Correlation designed used Zr Statistics of Fisher Transformation to determine the differences between the two correlation coefficients of the prediction variables after an initial test using Pearson Product Moment Correlation between COVID-19 risk and Knowledge plus socio-demographic. The hypothesis was tested using Statistical Package for Social Science version 21 and iStat at varying significant levels of 0.05 and 0.01 respectively. Generally, a significant relationship exists between COVID-19 risk and knowledge level but not with composite socio-demographics. However, specific significant relationship ($p<0.05$) was noticed between COVID-19 risk and age ($r=0.220$) as well as marital status ($r=-0.158$). Educational level, location, and sex showed no correlation ($p>0.05$) with COVID-19 exposure. Also, the proposition of no significant difference between correlation coefficients of socio-demographics and knowledge was proven otherwise ($p<0.05$). The regression model ($R^2=0.420$ and adjusted $R^2=0.404$, df=2, 336, F-value=27.012, $p=0.00$) significantly predicted the synergic contributions of knowledge level and socio-demographics to COVID-19 exposure. 40.04% of the COVID-19 risk exposure can be explained by socio-demographics and knowledge

about COVID-19. Synergic contribution of knowledge and socio-demographics proved risk prediction to COVID-19. Traditional factor like age should be decidedly considered and attention should be drawn towards good knowledge about COVID-19 especially its signs and symptoms plus transmission.

Keywords:
Perceived; Effect; Knowledge; Level; Socio-Demographics; COVID-19; Risk; Exposure; Africa; Experience

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Introduction

A heavy devastating and death toll of the COVID-19 pandemic on Africa was severally and massively predicted by many scholars across the globe. These predictions were made from the stand point of our past experience of uncoordinated and scanty outbreak investigation pattern and several viewpoints of weakened health systems and paucity of critical health infrastructure. Remarkably, local expertise gathered from previous outbreaks and centralized public-health infrastructure with a clear action plan would help, in addition to favourable demographic structure and climate, have put many Africa countries head-on as COVID-19 is handled in right standing [1]. Reports revealed that Africa seems to be affected only moderately by COVID-19. As at early June 2020, the novel Coronavirus had spread to all 54 countries in Africa with about 156,000 confirmed cases and 4,931 estimated deaths. The first case was reported in Egypt around mid-February 2020, followed by Nigeria and others which spread sporadically throughout Africa [2]. Globally, COVID-19 is a global public health emergency. It is eminent that the transmission of the disease is subjective to people's readiness to implement public health preventative strategies, and these are often related to knowledge about COVID-19 methods of spread and it's transmission mechanism.

Nonetheless, the knowledge about COVID-19 is paramount in this period of the pandemic. General knowledge about COVID-19 and specific knowledge with regards to its risk factors, signs/symptoms, transmission and misconception amidst numerous information is of importance to everyone at this point. All guidelines are geared towards flattening the curve, combat spread of the novel Coronavirus and arrest a predicted overwhelming onslaught of cases. For Africa especially Sub Sahara countries, this was borne out of fear; seen the experience of the developed countries like Italy and the USA amidst the level of technological advancement. Noteworthy, is the public health preparedness of campaign regards knowledge, attitude and practice (KAP) because from past pandemics history has it that the effectiveness of policies to combat rapid transmission of a highly infectious disease rely partly, on the knowledge and awareness of the public. Knowledge and attitude to a large extent influences practice of an individual. Increased morbidity and mortality have made it to become progressively more imperative to appreciate public risk perception of the novel Coronavirus [3]. Knowledge of COVID-19

is paramount, particularly during the pandemic period. Risk awareness correlated significantly with reported adoption of preventative health behaviours with proven evidence from different countries [4].

Furthermore, some studies have been able to reveal the relationship between COVID-19 and socio-demographics. Gender-based risk stratification suggests that males have a higher risk than female counterparts however, on the basis of mortality [5, 6]. Also, the Lancet Infectious Disease journal published an observational study, which was carried out by University of Oxford's Nuffield Department of Primary Care and Health Sciences for a period of four months, using routine electronic health records across England. The study acknowledged that socio-demographic indicators may possibly be associated with COVID-19 infection. Thus, variable of age, sex, living standard, occupation (employment in high-risk jobs), education, income status, and differences in access to healthcare and testing among ethnic groups [7] were all regarded as a potential risk factor to the exposure and spread of the pandemic.

The novel coronavirus risk is attributed to lots of things which are a major challenge of infectious diseases. Weighed against risks from other domains, such as environmental risks, far less is known about how the public perceives risks associated with emerging infectious diseases according to a study [8]. Nonetheless, much has not been studied with ample empirical evidence about the risk of the novel coronavirus and its relationship with knowledge level as well as socio-demographics. From earlier reviews, most of the substantiation on risk perception has come from studies during previous pandemics, mainly from the H1N1 swine flu pandemic [9, 10, 11]. Furthermore also, the Ebola outbreak [12, 13]; SARS and Avian influenza epidemics [14] respectively.

This present study examined the influence of knowledge on the COVID-19 risk, the contribution of socio-demographics on the risk of COVID-19 and predicted synergistic effects of knowledge and socio-demographics on the risk of COVID-19, even as all measured was strictly perception. The selection of a synergistic approach to evaluate the interplay between various demographics variables, and different variables constituting knowledge about COVID-19 with regards to COVID-19 risk, was based on the fact that overreliance on just one paradigm, aids mitigates concerns about the uncertain dependability of single-item constructs. As a rule of thumb, several items are best used to measure a construct than a few or even one. This has also been adopted in recent studies of disease outbreaks [15].

Researchers' framework (2020) presents the Correlation between COVID-19 Risk and variables of Demographics (socio-demographics) with Knowledge. The correlation designed study considered the COVID-19 risk as the outcome variable (Y) and Socio-demographics and Knowledge level as predictor variables (X). Socio-demographics (X) include; gender, age, education, marital status and location. While knowledge level considered cut across general knowledge, signs/symptoms, transmission, and misconceptions about the novel Coronavirus. The study investigation showed the correlation (r) and the coefficient of determination square (R^2) as presented in the result section.

Methods

The study was conducted in Africa with participants resident within the Continent as at the time of the study. It was a designed correlation study which sampled opinions of the residents in an online survey created using questionnaire as a study instrument, developed by the researchers. The sample size was determined according to Cochran (1977) formula for descriptive study design based on 94% as the percentage of knowledge of COVID-19 in Africa as reported by earlier study (Geopoll, 2020). This originally gave a minimum sample size of 87 but after calculating for 10% non-response rate, a sample size of 95 was obtained. However, since increase sample size increases the power of the study, this was made up to 347 as used in the study.

The study instrument was in three sections; section A- socio-demographic variables and section B, included the outcome variable- COVID-19 risk-exposure and section C comprising of the predictor variable- knowledge level. Data sourced were primary data collected from the questionnaire responses and secondary data obtained from the internet used as supportive literatures. However, cronbach Alpha was used to estimate the reliability index r=0.89. Face and content validity aided the validation process of the study instrument by experts. Africans in Diaspora were excluded from the study. Also, residents not within internet reach zone were excluded. Nevertheless, the age group as classified in this study were limited and was done at the researchers' discretion. It did not follow the standardized classification

provided by United Nations, even as it did not follow the epidemiological method of grouping, but the age groups were self-determined by the researchers.

Statistical analysis determined the association between COVID-19 risk and socio-demographics as well as knowledge level using Pearson Product Moment correlation analytical test to obtain the coefficient of correlations, while multiple regression analysis was performed with Statistical Package for Social Science version 21. Furthermore, iStat online Statistical software based on [16, 17] was used to test the significance of the difference between the correlation coefficients obtained for demographics and knowledge using Fisher Transformation for a two-tailed test at 0.05 level of significance. Consent was given by each study participants and confidentiality was high upheld.

Results

The study which observed the probable relationship between COVID-19 risk exposure as a criterion variable predicted by synergic contributions of knowledge level about COVID-19 and Socio-demographics revealed a dramatic outcome. See detail below.

Classification of study participants based on socio-demographic characteristics revealed that more females 204 (58.8%) participated compared to males 143 (41.2%). Age classes revealed 30 - 44 Years -140 (40.3%) as the highest participants whereas, Less than 15 Years- 2 (0.6%) were the lowest in number. The study participants were mainly single 187 (53.9%) and married 153 (44.1%) but Separated/ Divorced was the least 3 (0.9%). Furthermore, tertiary 309 (89.0%) and primary 2 (0.6%) education were the highest and least respectively. Based on the location where the respondents reside as at the time of the data collection, urban residents 278 (80.1%) participated more while the rural residents 23 (6.6%) were the least in number. Table 1 presents detail.

Table 1. Frequency Distribution of Socio-demographics of the Subjects

Socio-demographics	Classification	Frequency (%)
Sex	Male	143 (41.2%)
	Female	204 (58.8%)
	15 - 29 Years	137 (39.5%)
	30 - 44 Years	140 (40.3%)
	45 - 59 Years	42 (12.1%)
	60 - 74 Years	17 (4.9%)
Age	75 Years and Above	9 (2.6%)
	Less than 15 Years	2 (0.6%)
	Married	153 (44.1%)
	Separated/Divorced	3 (0.9%)
	Single	187 (53.9%)
	Widow/ered	4 (1.2%)
Education	No Formal Education	31 (8.9%)
	Primary	2 (0.6%)
	Secondary	5 (1.4%)
	Tertiary	309 (89.0%)
Location	Rural	23 (6.6%)
	Semi-Urban	46 (13.3%)
	Urban	278 (80.1%)

Table 2. Correlation between Risk Factors and Socio-demographics with Knowledge among study Subjects

Variable	Correlation	SEM	BCa 95% Confidence Interval		p-value
			Lower	Upper	
	COVID-19 Risk and Socio-demographics				
Sex	0.097	0.052	-0.004	0.194	0.07
Age	0.220**	0.049	0.121	0.314	0.00
Marital Status	-0.158**	0.050	-0.255	0.057	0.00
Education	-0.057	0.049	-0.155	0.046	0.29
Location	0.055	0.042	-0.027	0.135	0.31
	COVID-19 Risk and Knowledge				
General knowledge	0.499**	0.069	0.370	0.621	0.00
Signs/symptoms	0.285**	0.064	0.160	0.419	0.00
Transmission	0.532**	0.062	0.408	0.641	0.00
Misconceptions	0.108*	0.058	0.000	0.218	0.05

** .Correlation is significant at the 0.01 level (2-tailed);
* . Correlation is significant at the 0.05 level (2-tailed). Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

Table 3. Fisher Transformation for Correlation Significance

Predictor Variables	N	R	Z	p-value
Knowledge Level	347	*0.356*		
Socio-demographics	347	*0.0961*	3.62	0.00

Correlation of COVID-19 Risk exposure and Socio-demographics with Knowledge was measured to evaluate the relationships between the variables studied. The relationship study affirms no statistical correlation between COVID-19 risk and variables of sex, (0.097, p=0.07) education (-0.057, p=0.29) and location (0.055, p=0.31) as hypothesized. On the contrary, age (0.220, p=0.00) and marital status (-0.158, p=0.00) reported a considerable correlation with COVID-19 risk.

In addition, the relationship between COVID-19 Risk and Knowledge level with respect to general knowledge (r=0.499**, p=0.00), signs/symptoms (r=0.285**, p=0.00), transmission (r=0.532**, p=0.00), and misconceptions (r=0.108*, p=0.05) showed significant correlation at varying alpha levels (0.01 and 0.05). See table 2.

The study separately investigated the relationship between COVID-19 risk and knowledge level about novel Coronavirus with a correlation (r) estimate of 0.356 showing a direct moderate relationship between the exposure to COVID – 19 associated risks and the knowledge level of the public. Further estimation revealed a direct non-significant weak correlation (r=0.0961) between socio-demographics and COVID-19 risk. Fisher Transformation was used to test the statistical significant difference of the two correlations obtained, a Z-value of 0.362 proved a statistically significant (p=0.00) difference between the correlation of knowledge and socio-demographics with respect to COVID-19 risk exposure. Table 3 presents the detail.

Table 4. Multiple Regression Model of the Study

R	R^2	Adjusted R^2	S.E of the Estimate	Change Statistics					
				R^2 Change	F Change	F-value	df1	df2	p-value
0.648	0.420	0.404	0.258	0.420	27.012	27.012	9	336	0.00

Table 5. Coefficients of Regression for COVID-19 Risk

Predictors	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	.532	.201		2.648	.008
General Knowledge	.287	.044	.325	6.535	.000
Signs/Symptoms	.043	.031	.062	1.359	.175
Transmission	.378	.051	.357	7.347	.000
Misconception	.053	.025	.096	2.125	.034
Sex	.052	.029	.077	1.806	.072
Age	.033	.019	.096	1.710	.088
Education	.000	.018	-.001	-.022	.982
Location	.005	.025	.009	.204	.838
Marital Status	-.022	.017	-.065	-1.289	.198

The regression model significantly predicted the synergic contributions of knowledge level and demographics to COVID-19 risk exposure. A comparable significant regression equation was found indicating a strong correlation from the output of the coefficient of determination (R=0.648). Result showed; R^2=0.420 and adjusted R^2 =0.404, df=2, 336, F-value=27.012, p=0.00.

Using the adjusted R^2, the result reads that about 40% of the variance in the outcome variable, in essence, the probability of COVID-19 risk exposure can be explained by knowledge about COVID-19 and demographics. 40% is a marked significance. Since R^2 cannot be used to ascertain a biased model because R^2 increases per time a predictor is added to the model. R^2 never decreases even when it is just a chance correlation, based on this the adjusted R^2 was used for interpretation, to compare the goodness-of-fit for the multiple predictor variables. The adjusted R increases only when the new term improves the model fit more than expected by chance alone and decreases when the term does not improve the model fit by a sufficient amount. See table 4.

Predictor variables of the knowledge used here included knowledge about COVID general issue, signs/symptoms, transmission, and misconceptions about COVID-19. Also, the second predictor variable-socio-demographic variables constituted; sex, age, education, marital status and location. Coefficients of Regression for COVID-19 Risk result obtained in this study showed the predictor variables of knowledge and socio-demographics were regressed on COVID-19 risk outcome.

The unstandardized beta (B) which represent the slope between predictors (knowledge and socio-demographics) and outcome variable being COVID-19 risk indicates that; a unit increase in the predictor variables results to an increase in the outcome of COVID-19 risk exposure by .287, .043, .378, .053, .052, .033, .000 and .005 for General Knowledge, Signs/Symptoms, Transmission, Misconception, sex, age, education and location respectively. Also, a unit increase in the predictor variables will cause a concomitant decrease in the outcome variable by -.022 for marital status. Furthermore, the t-test demonstrated statistical significant in just three areas namely general knowledge (t=6.535, p=0.00), transmission (t=7.347, p=0.00) and misconception (t=2.125, p=0.03). Table 5.

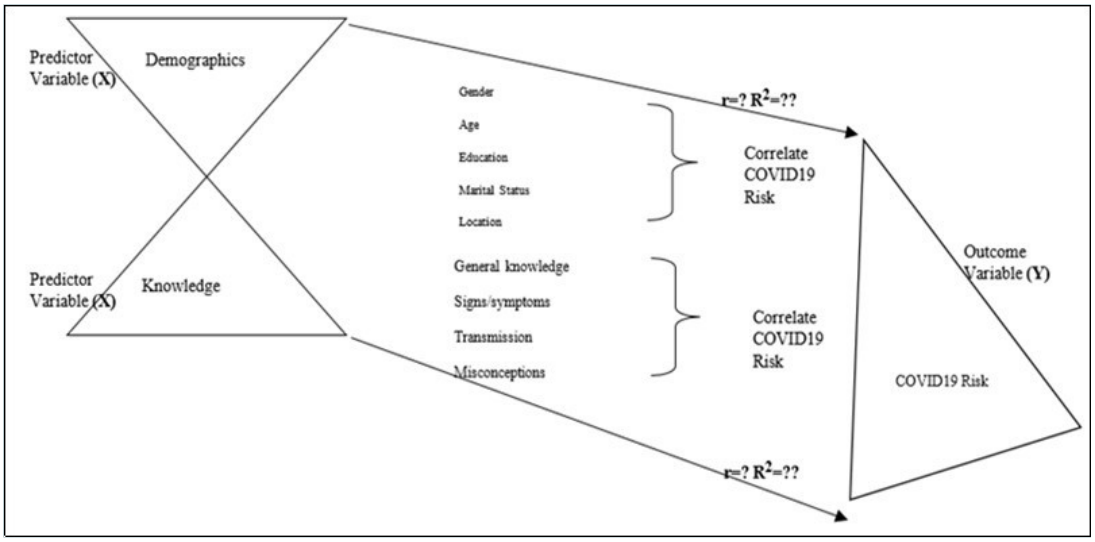

Figure 1. Demographic Characteristic of the Research Design Outcome (Researcher's Framework)

Discussion

This study examined the perception of the public about COVID-19 risk exposure and its relationship with other factors like socio-demographics and COVID-19 knowledge as previous studies tried to highlight some of these issues, but it has remained ambiguous to appreciate the prevailing interplay. Based on knowledge level about COVID-19, this study is consistent with a review on risk perceptions of COVID-19 around the world confirming that knowledge was significantly associated with COVID risk perception, in addition to a gender effect. It showed that the determinants of knowledge predicted the influence of COVID-19 risk exposure. Similarly, knowledge level which correlated with COVID-19 risk was observed by Dryhurst and colleagues (2020) [18].

However, behavioural patterns of individuals can basically influence and alter the exposure including a spread in pandemic [19-22]; this is applicable in this COVID-19 pandemic. Risk awareness is a determinant of the populace's enthusiasm to oblige and adopt public health precautionary behavioural pattern during pandemics. Practices such as hand hygiene, use of face mask, social distancing and avoidance of crowd depend on prior knowledge especially about the risks [23-28]. General knowledge about COVID-19 as well as its transmission can be attributed to the risk of exposure directly. Moderate to strong correlation found in this study suggested that. From the study knowledge about COVID-19 on the transmission which deals with the spread of the virus is directly related to the perceived exposure risk.

The role of socio-demographic variables in COVID-19 infection risk and management still has some grey spots awaiting scientific clarification. Age, sex, and chronic diseases have been implicated as high risk to COVID-19 infection including difficult management insights. Nevertheless, de Lusignan and colleague (2020) in a report [29] remarked a disparity that, most underlying health conditions insignificantly increased vulnerability to infection and the investigation established a relationship between smoking and lower probability of positivity. Surprisingly, the study supposed it to be as a result of confounders, than the perceived protective effect of smoking against COVID-19 that can be assumed; as there are alternative explanations like smoking could obstruct the sensitivity of COVID-19 test and other alternative explanations [30].

The outcome of this study showed no indication of a relationship between sex and COVID-19 risk, but sex-related risk perception has been reported previously. Maleness was uniformly associated with lower risk perceptions in several nations [31]. In the same way, another study on risk perception posited the same [32]. Specific risk stratification showed that males are at objectively higher risk from COVID-19 [33]. Furthermore, this study which reports considerable relationship with just two socio-demographic variables namely age and marital status is in opposition with a review study which made known that the only significant socio-demographic was gender [34]. Equally, this current study is in contrary to

the prior study by Dryhurst and colleagues (2020) in that, the study revealed sex demonstrated null significant with COVID-19 risk [35].

In addition, finding from this study is backed up by similar observations seen in preceding works. de Lusignan and colleagues (2020) established a relationship between COVID-19 and socio-demographic determinants [36]. In a study, it was reported that younger people and females have a lower risk of COVID-19. Further investigation revealed other socio-demographic variables and health determinants such as deprivation, living in a high population density; ethnicity, obesity, and chronic disease are associated with a positive test for COVID-19 [37]. Notably, this study observed evidence of a significant correlation between COVID-19 risk and marital status plus age as the only socio-demographic variables that can be implicated. On the other hand, the rationale behind the relationship between COVID-19 risk and marital status has remained unclear thus, requires more investigation. The extremes of age have been the most challenged age groups health-wise. This is due to many factors like low immunity, challenges of the ageing process and more. But the case of COVID-19 is peculiar to the geriatric population with a low impact on the younger age group. The significant relationship between COVID-19 and age reported in this study is in consonance with other studies [38-40]. This has been explained with various mechanisms such as immunity, physiologic process and more [41].

In a nutshell, the findings from this study suggest marked association between COVID-19 and knowledge with respect to general knowledge about COVID-19 pandemic, signs/symptoms, transmission and misconception. Age and marital status were the only socio-demographics which proved evidence of relationship with COVID-19 risk exposure. More so, synergistic approach revealed a combined prediction of COVID-19 risk when modelled with multiple regression, as predicted by COVID-19 knowledge indicators and socio-demographic variables. These findings share similarity and discrepancy with others. This variation may perhaps be due to some extraneous factors, geographic variability, cultural as well as traditional plus religious perceptions which make up an individuals' view.

Conclusion/Recommendation

On a daily basis, knowledge of COVID- 19 improves, due to the influx of findings. Despite the massive research about COVID-19, community transmission has remained an aspect with a grey line. It is vital to understand the effect of the perceived risk of COVID-19 based on Knowledge and socio-demographics, as it could serve as a useful tool in prevention strategy toolkits.

This study has provided an important input which has broadened the understanding of how COVID-19 risk exposure is perceived by the public based on knowledge level and demographic indicators. Knowledge level has an effect on risk likewise age and marital status. Traditional factor like age should be decidedly considered and attention should be drawn towards good knowledge about COVID-19, especially in its signs and symptoms plus transmission pattern.

"What is fundamentally clear is that whatever the specific risk factors may be, the COVID-19 pandemic exacerbates existing socioeconomic inequalities, and this needs both exploration and mitigation in the coming months and years". Rachel Jordan

Limitation of the study design.

This study should be generalized with caution as the representative sample is small compared to the population of the study area; hence a bigger survey is recommended. More to the point, the study is not completely free from bias.

Competing Interests

None was expressed among authors.

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