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## Research Article

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# Perceptions of COVID-19 threat in Uganda and its impact on household welfare: Evidence from the High-Frequency Phone Survey on COVID-19

By  
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The novel coronavirus that emerged around late 2019 from the central province of Hubei in China in the city of Wuhan has greatly affected people who live around the world on a scale unreported before. The pandemic has affected millions of people and thousands have died ever since its discovery. Worse still besides the direct impacts of the disease such as cumulative infection and deaths reported around the world, the indirect effects such as strict containment measures of partial and full economic lockdowns have disrupted global supply chains, led to the loss of jobs due to massive layoffs and loss in government revenues (Mukiza, 2020). Despite impressive efforts towards the production of a vaccine with some being in approval stages, total control measures of COVID-19 in developing countries such as Uganda are still in their infancy phases and most likely may be unachievable. Therefore, this study aimed at examining the predictors of people's perceptions of COVID-19 in Uganda, using the first phase of the Uganda, High-Frequency Phone Survey (UHPS, 2020).

**Keywords:** *Predictors of COVID-19, Theory of Planned Behaviour and Structural Equation model, Uganda*

**JEL Classification:** *I12 I31 & I14*

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## 1. Introduction

The 2019 novel coronavirus disease (COVID-19) was first reported in China as an infectious upper respiratory disease. The virus has since spread worldwide presenting one of the most serious global health crises in history, coupled with high socio-economic costs. While the health impacts are directly through contagion, the economic impacts are largely a consequence of the preventive measures adopted by the respective governments to curtail its spread. Key measures adopted by major economies around the world to curtail the spread included initially partial to total lockdowns of their economies which among other things, have seen the temporary closure of businesses, schools, and social services (UNCTAD, 2020). This greatly affected global trade through interruptions in the global supply chains (Shin, Kim, & Koh, 2020). The mystery surrounding COVID-19 and its unpretending impacts on the global economy have affected people's perceptions of this pandemic, in return such perceptions have not only affected purchasing power but also their way of life, particularly in a developing country context where there are limited safety nets (World Bank, 2020).

In Uganda, COVID-19 is threatening to reverse the declining poverty trend from the past decade, with widespread closure of firms, permanent layoffs in industry and services, and a rapid slowdown of economic activity, particularly for the urban informal sector. At a macro level, these losses will be further aggravated by weak growth projected in FY21, which is projected at about 3 percent due to substantially reduced tourism revenues, smaller remittances, and FDI inflows that will dampen private consumption and investment (Mukiza, 2020). Besides, credit is likely to be restricted considering the deteriorating asset quality in the banking sector, marked by an almost doubling of nonperforming loans to 6 percent within three months of the COVID-19 crisis hitting Uganda. Furthermore, the impact of the pandemic appears to be deepening, with community infections accelerating in the first quarter of FY21 (July–September 2020). It is unclear how the government will respond to increasing infections due to the run-up to presidential elections (World Bank Group, 2020).

At a micro level, perceptions that people have towards the diseases greatly affect their compliance with the measures put in place. In other words, the trust that citizens have in the authorities fighting the pandemic affects how the crisis is handled. On other hand, such perceptions will greatly affect the economic status of people, for instance, the likelihood to save and invest is affected by the perception of the citizenry towards the disease and the trust that they have towards the government's commitment to fighting the pandemic. Ever since the disease was discovered in late 2019, a lot has changed economically, politically and health-wise leading to what is now known as the "new normal". Individuals have been forced to adjust and adopt new preventative measures and mitigation strategies at an unprecedented speed never witnessed before in human history.

Thus this study is aimed at analyze the determinants of people's perceptions of the COVID-19 pandemic in Uganda and to examine the effect of such perceptions on household welfare using the first round of Uganda High-Frequency Phone Survey (UHFPS) conducted by UBOS days preceding the national wide lockdown in Uganda. To test people's perceptions of COVID-19 we follow Ajzen's, (1991) Theory of Planned Behaviour to test some of the constructs collected in the UHPS dataset. To the best of our knowledge, the UHPS is a new dataset that has not been empirically analyzed. By employing the Structural Equation Method (SEM), people's

perceptions can be tested to enable decision-makers to gain insights into the possible effective policies, by showing their interdependencies, and as such, making clear which are the underlying dilemmas that have to be addressed. This knowledge can lead to more acceptable solutions, adapted to the country's current socio-economic state, and can be sustainable from a long-term perspective.

## **2. Empirical review**

Ever since the discovery of the strange novel coronavirus in late 2019 in the central province of Hubei in the city of Wuhan in China, a lot has transpired and there has been a surge in studies analyzing the issue of COVID-19. Such studies range from the Economics of the pandemics (Balduzzi, Brancati, Brianti, & Schiantarelli, 2020; Brodeur, 2020; Gershuny et al., 2020; Goff, Ifcher, Zarghamee, Reents, & Wade, 2020; Hur & Jenuwine, 2020; Lakuma, Sunday, Sserunjogi, Kahunde, & Munyambonera, 2020; Mckibbin & Fernando, 2020; Shin et al., 2020) and health impacts and behavioral response to the pandemics (Dignum et al., 2020; Fetzer, Hensel, Hermle, & Roth, 2020; Gaudecker, Holler, Janys, Sifinger, & Zimpelmann, 2020; Hager et al., 2020; Seale et al., 2020; Zegarra-Valdivia, Chino Vilca, & Ames-Guerrero, 2020)

According to (Fetzer et al., 2020), a dual problem has resulted from the spread of the pandemic around the world, i.e. health and economic crisis, on their review of the economics of pandemics around the world since the onset of the pandemic, their findings show that adequate testing coupled with selective standard disease containment procedures are somewhat effective in controlling the outbreak. However, in case of inability to adequately test, other SOPs such as social distancing are effective. In another study to analyze the impact of COVID-19 on the Chinese economy, (Mckibbin & Fernando, 2020) explored seven possible scenarios of how the pandemic could affect macroeconomic outcomes and financial markets in china using an upgraded DSGE/CGE general equilibrium model. Their results indicated that even if the pandemic was to be contained, the pandemic could significantly affect the global economy, particularly in the short run. Their results point to the need to invest more in healthcare systems mainly in developing countries where the health systems are poor and yet support massive numbers of people. However, this conclusion has been overtaken by events since COVID-19 hit the developed nations the hardest.

Considering people's behavioral response to COVID-19, a study by (Seale et al., 2020) examined perceptions of 1420 adult Australians towards COVID-19, their capacity and willingness to cope with the disease mitigation measure, using both Univariate and multivariate logistic regression analysis. Their results showed that about half of the sampled individuals had fears for COVID-19 towards their health, while 19 percent displayed a high/very high perception of the risk of contagion to COVID-19. On the issue of behavior change, 84.9 and 93.9 percent had performed at least one of the three suggested standard operating procedures and one of the six recommended avoidance behavioral changes over the previous month under the outbreak respectively. On the other hand trust in government also greatly affected the adoption of preventive behavior among adult Australians. This, therefore, informs the role that government can play in influencing the adoption of avoidance measures under a pandemic. However, measurement of some of the study constructs such as perceived behavior was not measured.

In a Peruvian study by (Zegarra-Valdivia et al., 2020) using a web-based cross-sectional survey method of 225 self-selected respondents aged 18-29 years, the authors analyzed the impact of people's access to knowledge, attitudes, and vulnerabilities toward COVID-19 outbreak. First, the results from the logistic regression showed that socio-economic factors such as occupation, education, and one's age were highly associated with knowledge about the pandemic. Such knowledge was measured by how much one knew about symptoms and disease transmission mechanisms. Perceived susceptibility was highly significant with stigmatization behavior and fear of contraction standing at 59.1 and 70.2 percent respectively. Lastly, the study reports a lack of confidence in national health systems, unpreparedness, and inadequate measures to handle the outbreaks as the main factors contributing to negative perceptions of COVID-19. The concept of perceptions is multifaceted and thus the application of purely descriptive methods is not sufficient besides.

In a similar bi-national cross-sectional study of 1437 respondents in Nigeria and Egypt by (Hager et al., 2020). The authors found an average knowledge score of  $14.7 \pm 2.3$ , indicating sufficient knowledge about the disease (61.6 percent). Logistic results indicated that those aged (18-39) years, college/degree education level and background characteristics of the respondents significantly influenced people's knowledge levels. People's attitude towards containment measures was also satisfactory with a score mean of  $6.9 \pm 1.2$ . On the other hand, people's perception of global effort was also satisfactory with an average of  $10.9 \pm 2.7$ . The results from this study can be consumed with a grain of salt since studies based on the convenience sampling technique ignore views from a wider populace, besides the authors do not show how constructs in the KAP framework were measured clearly. A study supporting the inclusion of human behavior in former epidemiological economic models is reported by (Dignum et al., 2020). The authors apply an agent-based social simulation tool to model different policy intervention scenarios and their impact on covid-19.

Methodologically, several studies have applied the Theory of Planned Behaviour (TPB) (Ajzen, 1991; Chen & Tung, 2014; De Groot & Steg, 2007; Ukenna & Ayodele, 2019) to study people's behaviors and perceptions. In a study to predict customers' intention to visit a given green hostel in Taiwan. Chen & Tung, (2014) developed an extended TPB model that incorporated the customer's environmental concern and perceived moral obligation. Results from a sample of 559 respondents analyzed through a structural equation technique (SEM) show that environmental concern truly has a positive impact on people's attitudes, subjective norms, and perceived behavioral control towards choosing to visit a green hostel as opposed to a non-green hotel. Also, people's perceived moral duty which affects one's intention to visit a green hotel is affected. These results demonstrate the explanatory power of the TPB framework. In a similar Nigerian study of 437 street food buyers, Ukenna & Ayodele, (2019) applies an extended TPB framework to predict the impact of sustainable street food patronage. The unique feature of (e-TPB) is that it includes past behavior in the analysis, results from (SEM) indicate that past behavior may not patronage sustainable street food. However, their study validated utility for forecasting trends in customer behavior, which are similar to decisions made during a pandemic.

## **2.1.Gaps**

A critical review of the studies above indicates some glaring gaps that form a basis to probe this topic further in this study. First, most of the studies covid-19 have been on the macro-level focusing on the impact on the economy and besides most of them have been in western economies where the virus started. Research interest is yet to be drawn to behavioral and perception impacts of the pandemic on people's welfare in developing countries context. Secondly the role of behavioral intention and people's perceptions towards the fight against covid-19 in Uganda being a country that had a good initial track record in the fight against has been under-reported in the mainstream pandemics literature. Finally, most studies that have applied the TPB have been in Business and marketing, studying consumer behavior, but most of them have been in western and Asian countries. To the best of our knowledge, a few or no study in Uganda has applied the Theory of Planned Behavior (TPB) and structural equation model (SEM) to the Uganda High-Frequency Phone Survey dataset to examine the determinants of people's perception of covid-19.

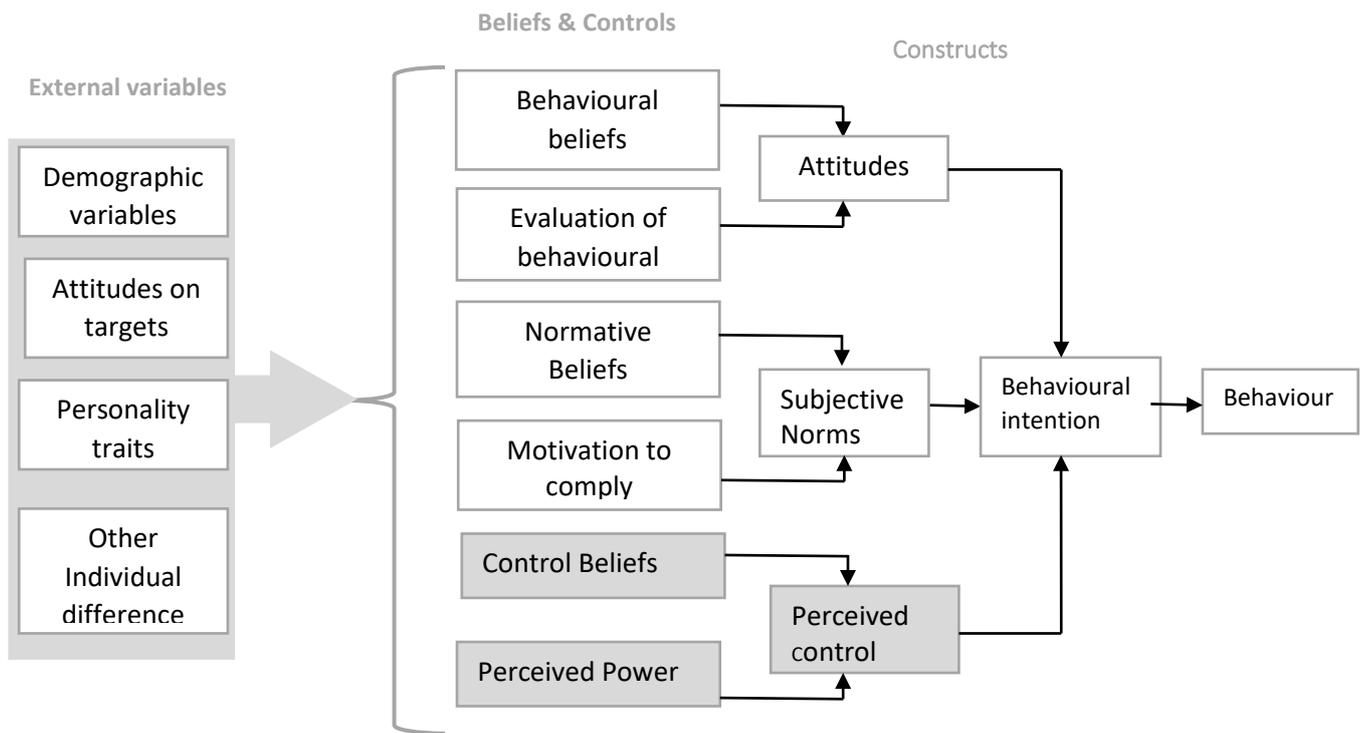
## **2.2.Conceptual Framework**

### **2.2.1. The theory of planned action**

From the traditional microeconomic consumer theory, individuals are assumed to be rational decision-makers. Thus the Theory of Reasoned Action (TRA) borrows from this view and assumes that people are "rational beings" that who analyze available information on options and their inner reason motivates the performance of chosen behavior (Ajzen, 1991) (Montaño & Kasprzyk, 2002). The main preoccupation in many of the behavioral sciences has been understanding people's decision-making conditions under stressful situations such as pandemics like COVID-19 and also examining predictors of such behaviors or perceptions (Ferdous, 2010).

To conceptualize study variables (constructs), we adopt the theory of planned behavior (TPB) which is one of the most widely studied and famous theories in behavioral economics. The TPB is an extension of the theory of Reasoned Action (TRA) which also attests to it that behavioral intention is the major determinant of individual behavior. The TPB was formulated by Ajzen (Ajzen, 1991) as one of the robust models for analyzing human behavior. The theory is premised on the fact that individuals are motivated by factors that influence their likelihood of performing a certain behavior, these factors are known as the five constructs of the model (Ukenna & Ayodele, 2019). In addition to attitudes and subjective norms cited by TRA as the main determinants of behavioral intention, the TPB incorporates perceived control on top of behavior (*see gray area in fig.1*), this inclusion enables the model to account for situations in

which decision-makers may not have total volitional control over the situation. In this model, one's behavior intention affects his/her behavior and in return predicts one's attitudes towards a given behavior, subjective norms and social normative perceptions towards a change in the stimuli (Ajzen, 1991). The TPB explain most of the variations observed in the people's behavioral intention and therefore can forecast to large extend various behaviors which includes response to health behavior such as pandemics (Hager et al., 2020).



**Figure 1.** Theory of Planned Behavior. **Source:** Modified from (Montaño & Kasprzyk, 2002)

In this framework, people's attitudes are affected by their beliefs about the expected outcomes of exhibiting a given behavior, and these behavioral beliefs are weighted by evaluation of the results of the behavior (Chen & Tung, 2014). In this regard, people who believe positive payoffs may result from a given behavior will have positive attitudes toward that behavior (Ajzen 1991) the reverse is true for persons who hold negative beliefs towards a certain behavior. On the other hand, one's subjective norm is determined by his/her normative beliefs, which assume the role played by important third parties (referents). If one thinks that referent people think he/she should perform the behavior then he/she will have positive normative beliefs. Conversely one will have negative normative beliefs if one thinks otherwise and these norms are weighted by one's motivation to comply.

The power of TRA theory in explaining human behavior depends on the extent to which people can exercise control over their behavior otherwise known as volitional control. Such power

was limited for the TRA model which later led to the modification by the addition of the perceived control construct that led to the creation of the Theory of Planned Behavior by Ajzen (1991). This addition enabled the control of factors outside one's realm that could affect both behaviors and intentions (Montaño & Kasprzyk, 2002). From the TPB the perceived control is influenced by control beliefs and weighted by perceived power (the *grey part of figure 1*). The performance of behavior can be facilitated or inhibited by barriers under control beliefs. TPB treats perceived control, attitudes, and subjective norms as independent factors influencing behavioral control (Montaño & Kasprzyk, 2002). Taking an individual's perceptions into account, the ease or difficulty of performing a certain behavior affects one's behavioral intention if other constructs are considered constant, and the variability of attached weights on these constructs depends on the nature of behavior and populations under study (Ukenna & Ayodele, 2019). Clearly from the above framework, there is a causal link between three kinds of beliefs (behavioral, normative, and control) to the behavioral intentions and behavior through perceived control, attitudes, and subjective norms. According to (Montaño & Kasprzyk, 2002), One of the strengths of the TPB framework is that many of the relationships and measurements of the constructs have been delineated in earlier studies (Chen & Tung, 2014; Montaño & Kasprzyk, 2002; Ukenna & Ayodele, 2019). In this framework, external factors work via model constructs to explain the performance of behavior but not independently.

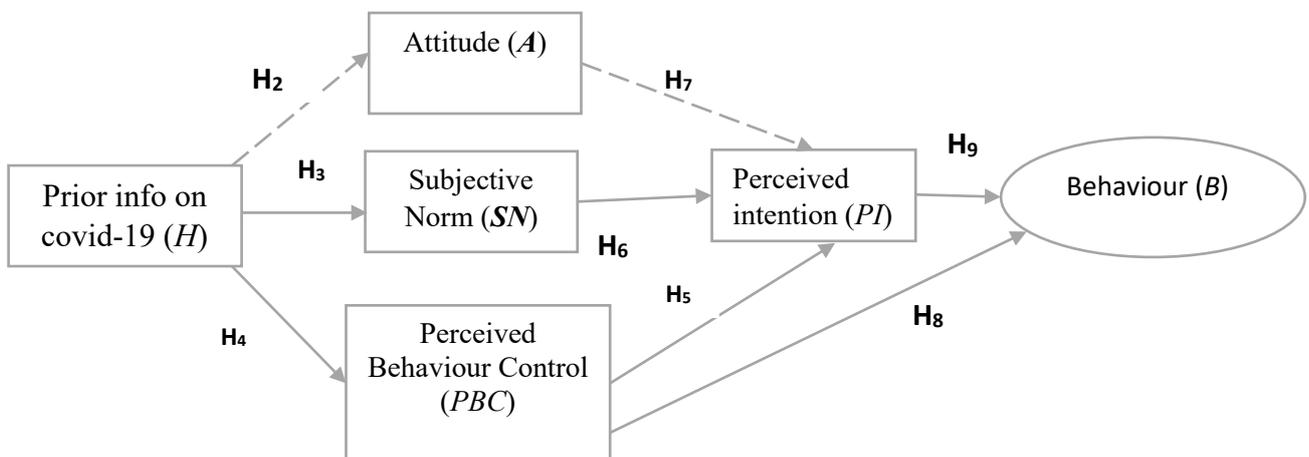
To operationalize the model constructs and unravel predictors of perception towards COVID-19, we estimate a multinomial regression model to determine the predictors of people's perceptions of the pandemic. Secondly, we fit a structural equation model to analyze determinants of people's perception of COVID-19 at the onset of the pandemic, given the fact that the dataset used is collected in the first months of the lockdown. Similar approaches have been undertaken by (Chen & Tung, 2014; Ferdous, 2010). In this study, we examined the knowledge, behavior change, and concerns towards COVID-19.

### **2.3. Development of hypothesis**

From the empirical studies and conceptual frameworks reviewed above, and given the restrictive nature of the dataset available, the following study hypothesis is developed to estimate first a multinomial regression model of predictors of the perception of covid-19 in hypothesis one and second to estimate a partial TPB framework following hypothesizes (2-8). Both direct and indirect effects are estimated. The variable behavior ( $B$ ) is captured as binary i.e. whether one performed at least one of the preventive measures directed to covid-19. And

prior information (H) is whether an individual had heard about covid-19 before the survey and whether he/she had been observing sanitation measures before the covid-19 breakout.

- H<sub>1</sub>:** There exists a significant relationship between individual socioeconomic and demographic factors and perceived Covid-19 threat (*Regression analysis*)
- H<sub>2</sub>:** Prior information on covid-19 significantly affects one’s Attitude towards covid-19.
- H<sub>3</sub>:** There exists a significant association between prior information (H) on covid-19 and one’s subjective Norms (SN) (*what others think about the person*)
- H<sub>4</sub>:** There exists a significant relationship between historical knowledge of Covid-19 and perceived behavior control (PBC) on the covid-19 threat.
- H<sub>5</sub>:** There is a significant association between one’s perceived behavior control (PBC) and his perceived intention (PI) to perform the required behavior
- H<sub>6</sub>:** There is a significant relationship between an individual’s subjective Norm (SN) toward Coid-19 and his/her perceived intention (PI) to perform the required activity
- H<sub>7</sub>:** There is a significant association between people’s Attitude (A) toward covid-19 and their perceived Intention (PI) to perform a behavior of avoiding covid-19.
- H<sub>8</sub>:** There exists a significant relationship between a person’s perceived behavior control (PBC) on covid-19 and the behavior (B) under question
- H<sub>9</sub>:** There exists a significant relationship between one’s perceived intention (PI) (the desire to perform the activity) and the behavior (B) observed.



**Figure 2:** research schema, Partial TPB framework of shows the association among variables

**Table1: Measurement of constructs**

| <b>Construct</b>                   | <b>Question</b>  | <b>Measurement</b>  |
|------------------------------------|--|---|
| Covid-19 threat (Outcome variable) | How much of a threat would you say the coronavirus outbreak is to your household's finances?               | <i>(No threat, Moderate threat, and High threat)</i>  |
| Attitude (A)                       | Captured as true or false statements on covid-19, computed on the scale of (1-7) Questions                 | Africans are immune to covid-19<br>Children are affected by covid-19<br>Coronavirus can't survive warm weather<br>Covid-19 is just a common flu<br>Alcohol increases immunity<br>local herbs can treat covid-19<br>Alcohol & lemon can be used as a sanitizer |
| Subjective Norm (SN)               | What steps have the government/local authorities taken to curb the spread of the coronavirus in your area? | Captured as the frequency of correctly stated measure   |
| Perceived behavior control (PBC)   | To your knowledge, what measures can you adopt to reduce the risk of contracting coronavirus?              | <i>(HW=hand washing, SU=sanitizer use, MU=mask use, GU=gloves use, SD=social distancing)</i>  |
| Intention (I)                      | Captured as one's desire to perform the behavior.  | Captured as either a yes/No either an individual had an intention to protect him/herself from COvid-19.   |

### 3. Methods and materials

#### 3.1. Data sources

Data used in this study is from the Uganda High-frequency Phone Survey on COVID-19 (UHFS) conducted by the government of Uganda through the Uganda Bureau of Statistics (UBOS). The data collected through phone interviews follow the normal Uganda National Panel Survey (UNPS) sampling framework, conducted in June 2020 one month affect the lockdown of the economy. The purpose of this survey was to track the impact of covid-19 as the pandemic evolved in the country. The survey is part of the World Bank's Living Standards Measurement Study (LSMS) program funded by USAID with aim of enabling poor countries to monitor pandemics as it evolved (UBOS, 2020). A total of 2257 households were trucked through their phone numbers and were interviewed for two weeks. Information collected included household demographics, knowledge, perceptions, and behavioral change toward covid-19, adoption of SOPs, access to social services, agriculture, employment, income loss,

food security, shocks, coping strategies, and concerns about covid-19 (UBOS 2020). The interest of this study is particularly on the perceptions and concerns towards the pandemic.

### 3.2 Description of the outcome variable

To answer hypothesis one ( $H_1$ ), a multinomial logistic regression (MLR) is estimated with the covid-19 threat as the main outcome variable which is categorical with three levels (running from 1 = no threat to a major threat =3). It's important to put a caveat here, although an ordinal logistic regression would have been ideal, given that our dependent variable may be considered ordered categorical, we find that the assumption of proportional odds is violated, and as such multinomial logistic is found to be a model of choice, considering *Covid-threat* as nominal. Predictors included in the model are age (15-24, 25-29, 30-34, 35-39, 40-59 & 60+), gender (0=male, 1=female), and education level (No education, primary & post-primary), prior knowledge (yes, no), region, residence status (urban, rural), presence of children, employment (yes, no), food security (measured by the number of meals), and ability to buy medicine (yes, no). The study population comprised a sample of persons aged (15-65+).

### 3.3 Estimation strategy

Assuming an individual  $i$  has perception  $j$  on the scale (1-3) about the covid-19 threat to his/her household finances and health status. Then the outcome variable is

$$y_j = \begin{cases} 1 & \text{if } y = j \\ 0 & \text{if } y \neq j \end{cases} \quad (1)$$

Therefore, covid-threat  $y = 1$  if option  $j$  is mentioned by the respondent and other remaining options  $y_r = 0$  for each of the other alternatives only one of  $y_1, y_2, \dots \dots y_r$  will be non-zero. Using the maximum likelihood estimation technique given that the disturbance term in the multinomial logistic regression model follows a logistic distribution function, the density function in the multinomial case for one observation is given below.

$$f(y) = p_1^{y_1}, \dots \dots \dots, p_m^{y_m} = \prod_{j=1}^m p_j^{y_j} \quad (2)$$

The probability that individual  $i$  says covid-19 is *no threat* given his/her socio-economic and demographic factors ( $X$ ) is given as;

$$p_{ij} = pr[y = 1/x] = F_j(x_i, \beta)$$

In this case, the density function above follows a logistic distribution which leads to a multinomial regression model, here the probability that individual  $i$  says covid-19 is no threat is given as;

$$p_{ij} = pr(y_i = j/x) = \frac{\exp(x_i\beta_j)}{\sum_{r=1}^m \exp(x_i\beta_r)} \quad (4)$$

From the above formulation, a multinomial regression model below is estimated. Where alternatives  $j$  range from 1-3 namely; ( $1=high\ threat, 2=moderate\ threat \& 3=Not\ a\ threat$ )

$$Covid - threat_i = \beta_0 + \beta_1age + \beta_2educ + \beta_3sex + \beta_4res + \beta_5reg + \beta_6child + \beta_7empl + \beta_8foodse + \beta_9med + \varepsilon \quad (5)$$

#### 4 Results and interpretations

**Table 2: Multinomial logistic regression on predictors of Covid-19 perceptions**

| Dependent variable                | Perception of COVID-threat      | Moderate threat      | Not a threat     |
|-----------------------------------|---------------------------------|----------------------|------------------|
| <b>High-threat (base outcome)</b> |                                 |                      |                  |
| <b>Predictors</b>                 | <b>Measurement</b>              | <b>RRR(SE)</b>       | <b>RRR(SE)</b>   |
| Residence status                  | Rural                           | 1.531** (0.286)      | 1.723** (0.384)  |
| Sex                               | Female                          | 1.037 (0.157)        | 1.360* (0.234)   |
| Employment status                 | Not Employed                    | 0.535*** (0.095)     | 0.381*** (0.079) |
| Treatment                         | Able to buy medicine            | 1.108 (0.132)        | 1.377** (0.183)  |
| Children                          | Children present                | 1.717*** (0.339)     | 1.836*** (0.414) |
| <b>Region</b>                     | <b>Central (base category)</b>  |                      |                  |
|                                   | Eastern                         | 2.743*** (0.603)     | 5.912*** (1.853) |
|                                   | Kampala                         | 0.255** (0.160)      | 1.287 (0.773)    |
|                                   | Northern                        | 1.172 (0.279)        | 5.866*** (1.786) |
|                                   | Western                         | 0.700 (0.161)        | 1.898** (0.589)  |
| Age                               | <b>15-24 (base category)</b>    |                      |                  |
|                                   | 25-29                           | 0.832 (0.225)        | 0.984 (0.279)    |
|                                   | 30-34                           | 0.877 (0.266)        | 0.864 (0.296)    |
|                                   | 35-39                           | 0.909 (0.283)        | 1.031 (0.353)    |
|                                   | 40-59                           | 1.091 (0.217)        | 0.795 (0.184)    |
|                                   | 60+                             | 1.322 (0.301)        | 1.047 (0.268)    |
| Education-level                   | <b>No educ (base category)</b>  |                      |                  |
|                                   | Primary                         | 0.687 (0.188)        | 0.615* (0.169)   |
|                                   | Secondary                       | 0.764 (0.233)        | 0.464** (0.15)   |
|                                   | Degree & higher                 | 0.952 (0.321)        | 0.544* (0.199)   |
| Food security                     | <b>One meal (base category)</b> |                      |                  |
|                                   | Two meals                       | 1.436 (0.412)        | 1.045 (0.312)    |
|                                   | Three meals                     | 2.414*** (0.749)     | 2.135** (0.699)  |
| Pseudo r-squared                  | 0.097                           | Number of obs        | 1328             |
| Chi-square                        | 223.365                         | Prob > chi2          | 0.000            |
| Akaike crit. (AIC)                | 2164.484                        | Bayesian crit. (BIC) | 2372.141         |

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

To examine the major predictors of people's perception of the threat posed by Covid-19 to personal health and finances, we generate relative risk ratios (RRR). The RRR involves the comparison of two groups in terms of their respective risks or likelihood of the outcome of interest. In the case of the above model, we compared the relative risk as a ratio of the probability of the individual falling into a comparison group to the probability of the person belonging to the reference or base category controlling for all predictors in the model (see Osborne, 2015). But first considering the model fit, the likelihood ratio test [LR Chi2 (38) = 223,  $p < 0.01$ ], shows that our model containing a full set of predictors significantly improves the fit of the model compared to a null/no model, thus at least one population slope, in this case, is non-zero, similarly a 9.7% model fit improvement is reported by McFadden's PseudoR<sup>2</sup>.

The relative risk ratios (RRR) reported above, represent a predicted multiplicative change in the relative risk, i.e. that is the risk of falling into a comparison group relative to the risk of falling into the baseline category per unit raise in the explanatory variables. Generally (if  $\beta = 0$ , then  $RRR = 1$ , if  $\beta > 0$ , then  $RRR > 1$  and finally if  $\beta < 0$ , then  $RRR < 1$ ).

The relative risk ratio (RRR) for persons living in the rural areas shows that rural residents are 1.531 and 1.723 times more likely to view covid-19 as being a moderate threat and no threat respectively compared to reporting covid19 situation as being a high threat. This effectively means that individuals residing in rural areas are more at risk of falling into both moderate threat and no threat categories respectively compared to their urban counterparts. This is a fact because most of the covid-19 cases were mostly reported in the urban places and those in the rural residents appeared to be cautioned from disease infections. Besides this data was collected around June 8<sup>th</sup> barely weeks after the pandemic hit our shores. Considering one's gender as a predictor of his/her perception of covid-19, we find that women are 1.037 and 1.360 times more likely than men to have a moderate and no threat perception about covid-19 towards their health and finances as opposed to those reporting high threat perception about covid-19. This is a surprising finding for women to undervalue the effect of covid-19 on their health and household finances, however, this could be explained by the uncertainty that surrounded this mystery disease in its early days.

Unemployed individuals were 0.535 and 0.381 times less likely than employed persons to perceive the covid-19 threat as being moderate or no threat at all compared to persons perceiving covid-19 to be of high threat. This meritoriously means that employment status plays a big role in people's perceptions about the disease and is more pandemic, since jobs

symbolize security in terms of earnings, even though covid-19 led to unprecedented job losses, layoffs, and disrupted global supply chains affecting local business in the process. Closely related to one's work status is purchasing power, individuals who reported that they could purchase medication in case of illness were 1.108 and 1.377 times more likely to perceive covid-19 as posing a moderate and not being a threat at all as compared to those who reported high threat perception towards. This points to the that individual's welfare (incomes) greatly affect one's perception of pandemics.

Considering family dynamics, households with no children had a high relative risk of perceiving covid-19 as being a moderate and not a threat at all compared to families that had children, for instance, those who believed that covid-19 posed a moderate threat to threat had a risk of 1.717 and 1.836 times than those who though covid-19 posed a high threat. This result corroborates earlier findings on pandemics (see, Zegarra-Valdivia et al., 2020). Households with children are at a greater risk of transmission among household members and children in particular, given the fact children usually have a weak immunity system, and covid-19 prides on this.

Geographical location also emerged as a significant predictor of people's perceptions of covid-19 for instance individuals from the Eastern and Northern regions were (2.743, 5.912) times and (1.172, 5.866) times at greater risk of perceiving covid-19 threat as being moderate or no threat at all respectively compared to those from the central region. While persons from regions of Kampala and Western were (0.255) and (0.700) less likely to perceive covid-19 as being a moderate threat and (1.287, 1.898) times more likely to perceive covid-19 as not a threat as opposed to those from the central region. People from Kampala and the western region were less likely to perceive covid-19 as not being a major threat because these regions are urban regions where individuals can afford medication and besides access to health facilities is easier in Kampala and some peri-urban areas in the western region.

The RRR for age categories (25-29), (20-34), and (35-39) indicate that the risk of an individual reporting that covid-19 is a moderate threat (relative to the risk of being in the high threat category) is 0.832, 0.877 and 0.909 times than that of persons aged (15-24). On the other hand, the RRR for ages (25-29) and (30-34) indicates that the risk of falling in the not a threat category is 0.984 0.864 times less likely than those aged (15-24). Lastly, since the RRR>1 for ages 40-59 and 60+, this signals that individuals in the older age categories are more likely to perceive the covid-19 threat as being either a moderate threat or not a threat at all category and less likely to view covid-19 as a major threat. This finding is in line with earlier studies (Hager et al., 2020; Seale et al., 2020), which found that older persons perceive covid-19 to pose a

high threat not only to their health but also to personal finances. Turning to education, the  $RRR < 1$  for all education levels, signaling that for each additional level of education the RRR for perceiving covid-19 as being mild (relative to the risk of viewing covid-19 as a major threat) changes by 0.687, 0.764, and 0.952 times for primary, Secondary and Degree & higher compared to no education category. On the other hand, the RRR for individuals holding the perception that covid-19 is not a threat is 0.615, 0.464, and 0.544 times less for Primary, Secondary, and Degree & higher compared to no education category. This implies that individuals with higher levels of education are at lower risk of regarding covid-19 as a minor threat and those with no education are at higher risk of referring to covid-19 as either posing a moderate or no threat at all to their lives. This finding is not surprising given the fact the novel coronavirus pandemic took the world by storm and cause havoc around the globe with the end effects being uncertain (Mckibbin & Fernando, 2020).

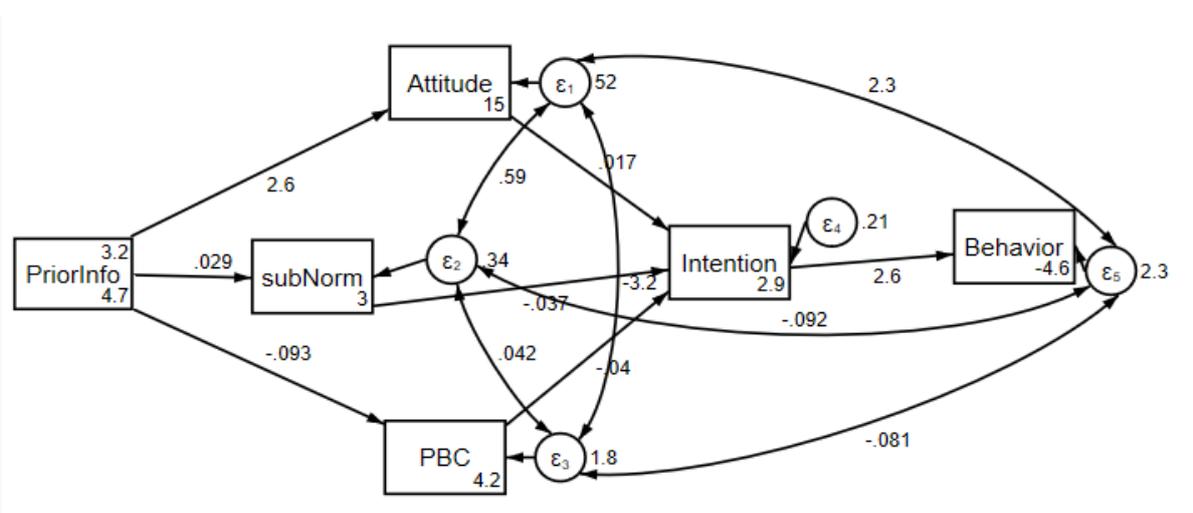
Lastly, we consider the effect of food security as a predictor of people's perceptions, this factor is measured by the number of meals that the household a week before the survey. Here three meals are ideal and indicate that the house is food secure and one meal indicates food insecurity. Since the  $RRR > 1$  for all food security categories, this implies that an increase in the number of meals by one extra meal the RRR of perceiving covid-19 threat as being minor or not a threat at all (relative to the risk of covid-19 being a high threat) changes by a factor of 1.436 and 2.414 times for two and three meals respectively as opposed to having one meal. While the RRR for the perception that covid-19 is not a threat at all changes by a factor of 1.045 and 2.135 times for two and three meals as opposed to households having one meal. These results point to the fact that households that are food secure are at a very high risk of regarding covid-19 as not being a threat, while households that are food insecure are at lower risk of treating covid-19 as a moderate threat or not a threat at all. This points to the role that food security plays in the fight against the pandemic, this explains the food stocking and panic buying witnessed not only in Uganda but also across the globe which contributed to stock-outs and the rise in prices (Mukiza, 2020).

#### **4.1 Structural equation results for (H<sub>2</sub>-H<sub>9</sub>).**

The theory of planned behavior is based on three fundamental factors Attitude, normative norms, and perceived control (Ajzen, 2002). Under attitude, we ask the question "*what does the individual think about the threat posed by the novel coronavirus*" (we test this using people's knowledge of the symptoms of the disease on a scale of 1 to 7), generated from the list of symptoms, each correct symptom mention is assigned a number depending on the first mentioned. Under subjective Norms; we answer the question, "*what do others think*" about the

individual's knowledge about Covid-19. (Captured by the knowledge of government steps on fighting covid-19). We rate one's knowledge of the government steps to fight covid-19 on a scale of (1-7), depending on the correctly stated steps. Under perceived control we answer the question "can the citizens do it?" and protect themselves against the pandemic? These three factors are assumed to stimulate one's intention; one's desire to perform a given behavior, in this case, the desire to prevent one's self from covid-19. We answer the question "what preventive measures does an individual wish to perform". This finally leads to the behavior performed itself (perform a covid-19 preventive measure or not, yes=1, No=0).

Using path analysis, results from the SEM regression are displayed in the path diagram below. Results from the overall Goodness of fit tests are reported in Appendix table A1, results in the likelihood ratio test, the  $X^2(2) = 2.977, p = 0.226$ , test of population error, results from the root mean square error of approximation ( $RMSEA = 0.015 < .05$ ) and Probability  $RMSEA (Pclose = 0.967 > .001)$ . Considering the baseline comparison test, both the Comparative fit index ( $CFI = 1 > 0.95$ ) and Tucker-Lewis index ( $TLI = 0.998 > 0.95$ ). And lastly, on the Size of residuals, the Standardized root mean squared residual ( $SRMR = 0.009$ ). All these indices are indicative or display evidence for a good fit of the model to the data (see; Pituch & Stevens, 2016).



**Figure 3:** Output from Path Analysis of SEM with unstandardized path coefficients

Results from the path analysis model above indicate that prior information/knowledge is a significant predictor of one's Attitude towards Covid-19 ( $b=2.639, s.e=.0687, p<0.000; \beta = 0.621$ ). So basically individuals who had ever heard of Covid-19 are predicted to have an improved attitude towards covid-19. This means human beings incorporate historical information in decision-making concerning reactions to pandemics. Again prior information on covid-19 was a significant predictor to one's subjective norm ( $b=-0.093, s.e=.0057,$

$p < 0.000; \beta = .107$ ), and perceived behavior control PBC ( $b = 2.639, s.e = .013, p < 0.000; \beta = -0.148$ ). This implies that individuals with prior information significantly affect how one thinks about other people's views on him/her towards covid-19. However, the path coefficients from prior information to PBC are negative and significant, implying possession of prior information on the covid-19 reduced an individual's likelihood to do the activity; i.e. it affects the "can I do it question", this result collaborates with finding on street food patronage in Nigeria by (Ukenna & Ayodele, 2019).

The path coefficients from attitude to Intention (intent to perform a behavior of covid-19 protection) were significant ( $b = .0168, s.e = .001, p < 0.000; \beta = .316$ ), this means individuals having a good attitude towards prevention and coping cover-19 are predicted to also have higher intention to perform a given covid-19 preventive behavior such as adopting the SOPs. On the other hand, one's subjective norm or what others think about a person significantly and negatively affects one's intention to perform the said behavior. Lastly what an individual can do towards adopting a given behavior as captured by PBC is negative and significantly associated with his/her intention to perform the said behavior ( $b = -.0397, s.e = .008, p < 0.000; \beta = -.110$ ). Finally, the intention to perform a given behavior towards covid-19 is positive and significantly associated with the behavior exhibited. ( $b = .2647, s.e = .008, p < 0.000; \beta = .067$ ). This implies that one's overall intention to perform the behavior under consideration greatly affects the likelihood of the actual behavior being performed (Hager et al., 2020). In conclusion, indeed the constructs in the theory of planned behavior collectively affect one's behavior changed particularly under stressful conditions such as covid-19. And this theory still holds some truths in the study of people's perceptions towards pandemics and generally can be applied in healthcare planning programs, such as changing people's behaviors like adopting a healthy diet and healthy living.

## **5. Conclusions and policy implications.**

The study aimed at analyzing the determinants of people's perceptions of the COVID-19 pandemic in Uganda and to examine the effect of such perceptions on household welfare using the first round of Uganda High-Frequency Phone Survey (UHFPS) conducted by UBOS days preceding the nation-wide lockdown in Uganda. We estimated a multinomial regression model to determine the predictors of people's perceptions of the pandemic. Secondly, we fitted a structural equation model to analyze determinants of people's perception of COVID-19 at the onset of the pandemic, given the fact that the dataset used was collected in the first months of the lockdown. The main findings are summarized as: We find that rural residents are more at risk of falling into moderate and no threat compared to their urban counterparts who are at high

risk of falling into the high threat. Furthermore, our results show that Unemployed individuals were less likely than employed persons to perceive the COVID-19 threat as being moderate or no threat at all. The results reveal that households with no children had a high relative risk of perceiving COVID-19 as being a moderate and not a threat at all compared to families that had children. Geographical location also emerged as a significant predictor of people's perceptions of COVID-19 (for instance individuals from the Eastern and Northern regions were at greater risk of perceiving COVID-19 threat as being moderate or no threat at all respectively compared to those from the central region). The results confirm that individuals between the ages of 40- and 59 and 60+ perceive a high threat not only to their health but also to finances. Results from the path analysis model indicate that prior information/knowledge is a significant predictor of one's Attitude towards COVID-19, subjective norm, and perceived behavior control. Our results further indicate that attitude to intention (intent to perform a behavior of COVID-19 protection) was significant, implying that individuals with a good attitude towards prevention are predicted to also have higher intention to perform a given COVID-19 preventive behavior such as adopting the SOPs. The results also indicate that the intention to perform a given behavior towards COVID-19 is positive and significantly associated with the behavior exhibited

The findings of the present study carry important policy implications for Uganda. First, rural residents are more at risk of falling into moderate and no threat compared to their urban counterparts who are at high risk of falling into a high threat. This implies that any lapse that causes an increase in infections will leave urban areas badly affected. To achieve low infection rates, there is a need to increase surveillance to enhance adherence to SOPs. Furthermore, we observed that unemployed individuals were less likely than employed persons to perceive the COVID-19 threat as being moderate or no threat at all. This implies that jobs symbolize security in terms of earnings. As such, the government should devise all means possible to support investment projects facing financial difficulties occasioned by the pandemic such that they maintain their capacity to continue employing workers they had before. Second, to prevent a rapid increase in mortality, the government of Uganda must take health as a serious issue by investing in medical infrastructure to support the elderly, who are at high risk of death once they contract the disease. Third, it is also suggested that the policymakers may emphasize health education to educate the population so that they may become fully aware of the health-related issues regarding the COVID-19 pandemic. To this end, political leaders should also be made to take full responsibility for their actions so that the public does not compromise adherence to SOPs.

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7. **Authors' contributions:** MJ is the main author of this article; he bootstrapped the idea of the topic to be researched, and he also carried out a rigorous literature review to establish gaps in case of perceptions towards pandemics regarding Uganda. Thirdly he collected data from different sources and analyzed it based on the developed theoretical framework. BF co-authored this manuscript, he provided invaluable advice and approved the research idea, proofread the work, and also ensured quality assurance. Finally, JBO is a Ph.D. holder in Development economics and was the main advisor on this paper, he approved the research idea, provided supervisory and advisory support towards the paper production, proofread the work, and produced feedback on the corrections where necessary which the paper to be completed.

8. **Authors' information:** MJ is an Assistant lecturer at the school of statistics at Makerere University, and he is also currently a Ph.D. student at the School of Economics (SoE) at the same University. BF is also a Ph.D. student at the School of Economics at Makerere University and also works at Kabale University as an Assistant Lecturer of Economics. Finally, JBO is a senior lecturer at the School of Economics (SoE) at Makerere University, he also doubles as a Consultant on various development issues at the school of economics (SoE) at the College of Business and Management Sciences (CoBAMS)

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APPENDIX

**Table A2: SEM output**

|                                | Coef.     | OIM<br>Std. Err. | z      | P> z  | [95% Conf. Interval] |           |
|--------------------------------|-----------|------------------|--------|-------|----------------------|-----------|
| <b>Attitude</b>                |           |                  |        |       |                      |           |
| Prior Info                     | 2.639593  | .0687437         | 38.40  | 0.000 | 2.504858             | 2.774328  |
| cons                           | 14.85242  | .2661241         | 55.81  | 0.000 | 14.33082             | 15.37401  |
| <b>Sub Norm</b>                |           |                  |        |       |                      |           |
| Prior Info                     | .0291987  | .0056925         | 5.13   | 0.000 | .0180415             | .0403558  |
| cons                           | 2.963703  | .0219152         | 135.24 | 0.000 | 2.92075              | 3.006656  |
| <b>PBC</b>                     |           |                  |        |       |                      |           |
| Prior Info                     | -.0926432 | .0130877         | -7.08  | 0.000 | -.1182947            | -.0669918 |
| cons                           | 4.238512  | .0503165         | 84.24  | 0.000 | 4.139893             | 4.33713   |
| <b>Intention</b>               |           |                  |        |       |                      |           |
| Attitude                       | .0168399  | .0011417         | 14.75  | 0.000 | .0146022             | .0190776  |
| sub Norm                       | -.0370205 | .0166462         | -2.22  | 0.026 | -.0696464            | -.0043946 |
| PBC                            | -.0397352 | .007588          | -5.24  | 0.000 | -.0546074            | -.0248629 |
| cons                           | 2.915233  | .0630861         | 46.21  | 0.000 | 2.791586             | 3.038879  |
| <b>Behavior</b>                |           |                  |        |       |                      |           |
| Intention                      | 2.646729  | .0668852         | 39.57  | 0.000 | 2.515637             | 2.777822  |
| cons                           | -4.621846 | .2056524         | -22.47 | 0.000 | -5.024918            | -4.218775 |
| var(e.Attitude)                | 51.85485  | 1.545739         |        |       | 48.91206             | 54.97469  |
| var(e.subNorm)                 | .3435101  | .0102393         |        |       | .3240164             | .3641767  |
| var(e.PBC)                     | 1.800144  | .0536581         |        |       | 1.697989             | 1.908445  |
| var(e.Intention)               | .2076988  | .006191          |        |       | .1959123             | .2201944  |
| var(e.Behavior)                | 2.331184  | .0697697         |        |       | 2.198372             | 2.472021  |
| cov(e.Attitude,<br>e.subNorm)  | .5928287  | .0898318         | 6.60   | 0.000 | .4167616             | .7688957  |
| cov(e.Attitude,<br>e.PBC)      | -3.162728 | .2142773         | -14.76 | 0.000 | -3.582704            | -2.742752 |
| cov(e.Attitude,<br>e.Behavior) | 2.328459  | .2462276         | 9.46   | 0.000 | 1.845862             | 2.811056  |
| cov(e.subNorm,<br>e.PBC)       | .0416323  | .0165976         | 2.51   | 0.012 | .0091015             | .0741631  |
| cov(e.subNorm,<br>e.Behavior)  | -.0919485 | .0189718         | -4.85  | 0.000 | -.1291326            | -.0547644 |
| cov(e.PBC,<br>e.Behavior)      | -.0809229 | .0440625         | -1.84  | 0.066 | -.1672839            | .0054381  |

**APPENDIX TABLE A3**

| Fit statistic        | Value     | Description                              |
|----------------------|-----------|--|
| Likelihood ratio     |           |  |
| chi2_ms(2)           | 2.977     | model vs. saturated                      |
| p > chi2             | 0.226     |  |
| chi2_bs(15)          | 3311.982  | baseline vs. saturated                   |
| p > chi2             | 0.000     |  |
| Population error     |           |  |
| RMSEA                | 0.015     | Root mean squared error of approximation |
| 90% CI, lower bound  | 0.000     |  |
| upper bound          | 0.047     |  |
| pclose               | 0.967     | Probability RMSEA <= 0.05                |
| Information criteria |           |  |
| AIC                  | 47538.854 | Akaike's information criterion           |
| BIC                  | 47670.394 | Bayesian information criterion           |
| Baseline comparison  |           |  |
| CFI                  | 1.000     | Comparative fit index                    |
| TLI                  | 0.998     | Tucker-Lewis index                       |
| Size of residuals    |           |  |
| SRMR                 | 0.009     | Standardized root mean squared residual  |
| CD                   | 0.402     | Coefficient of determination             |