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Feeling Blue Over the Economy, Will You Pull Down Your Face Mask? Economic and Psychological Well-Being and Preventive Health Behavior

Amira El-Shal and Eman Moustafa

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FEELING BLUE OVER THE ECONOMY, WILL YOU PULL DOWN YOUR FACE MASK? ECONOMIC AND PSYCHOLOGICAL WELL-BEING AND PREVENTIVE HEALTH BEHAVIOR[1]

Amira El-Shal[2] and Eman Moustafa[3]

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Send correspondence to:
Amira El-Shal
Cairo University
amira.elshal@feps.edu.eg

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[2] Assistant Professor, Faculty of Economics and Political Science, Cairo University, Egypt
[3] Research Manager, African Export-Import Bank, Egypt. Email: emoustafa@afreximbank.com

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Abstract

This study investigates what predicts the uptake of preventive health behaviour (PHB) during COVID-19, bringing to the fore economic and psychological determinants. We provide novel evidence that through affecting psychological well-being, economic well-being can affect PHB. Exploiting a panel survey dataset of four North African countries for November 2020–August 2021, we construct a psychological well-being index and develop a structural equation model that addresses endogeneity in the PHB, economic and psychological well-being, and COVID-19 risk perception relationships. Our estimates reveal vast heterogeneity in individual responses to different PHB determinants across countries and by behaviour type. Psychological well-being had the strongest positive effect on the likelihood of physical distancing in Egypt and Sudan and of wearing masks in Morocco, Sudan, and Tunisia. Psychological well-being in turn was negatively affected by decreased food consumption and higher economic anxiety in all four countries. Psychological well-being was also lower for unpaid family workers in Egypt and Sudan and the unemployed in Egypt, Morocco, and Tunisia. Handwashing, a less publicly visible practice, was directly related to the perceived risk of COVID-19 and neighbourhood compliance. Gender, age, and education effects varied across countries and by PHB type.

Keywords: Preventive health; mental health; anxiety; economic conditions; food consumption; risk perception.
JEL Classifications: D9; I12; I18.

ملخص

تبحث هذه الدراسة في تنبؤات استيعاب السلوك الصحي الوقائي (PHB) خلال جائحة فيروس كورونا (كوفيد-19)، مع تسليط الضوء على المحددات الاقتصادية والنفسية. نقدم أدلة جديدة على أنه من خلال تأثر الرفاه النفسية، قد يؤثر الرفاه الاقتصادي على السلوك الصحي الوقائي. وباستخدام مجموعة بيانات استقصائية لأربعة بلدان في شمال إفريقيا في الفترة من نوفمبر 2020 إلى أغسطس 2021، نُعِد مؤشر الرفاه النفسي. ونطور نموذج معادلة هيكلي يتناول علاقات تأثير المتغيرات الداخلية في السلوك الصحي الوقائي، والرفاه الاقتصادية والنفسية، وإدراك مخاطر فيروس كورونا (كوفيد-19). تكشف تقديراتنا عن عدم تجانس واسع النطاق في الاستجابات الفردية لمختلف محددات السلوك الصحي الوقائي عبر البلدان وبحسب نوع السلوك. كان للرفاه النفسي أقوى تأثير إيجابي على احتمالية التباعد الجسدي في مصر والسودان وارتداء الكمامات في المغرب، والسودان، وتونس. وقد تأثر الرفاه النفسي. في المقابل سلبًا بانخفاض استهلاك الغذاء وزيادة القلق الاقتصادي في البلدان الأربعة. كما كان الرفاه النفسي أقل بالنسبة للعاملين بغير أجر في الأسرة في مصر والسودان والعاطلين عن العمل في مصر والمغرب، وتونس. وكان غسل اليدين، وهي ممارسة تقل معرفة العامة بها، مرتبطًا مباشرةً بالمخاطر المتصورة لفيروس كورونا (كوفيد-19) والتزام المنطقة. واختلفت تأثيرات النوع الاجتماعي، والعمر، والتعليم عبر البلدان وبحسب نوع السلوك الصحي الوقائي.

1. Introduction

In the absence of immediate pandemic treatments, non-pharmaceutical interventions imposing social distancing are key mechanisms adopted by governments to contain disease outbreaks, epidemics, and pandemics (Anderson et al., 2020). Physical distancing, wearing a mask, and cleaning hands are the most cost-effective precautions. More than 120 countries worldwide mandated the wearing of face masks in public to contain the first wave of COVID-19. Among these countries in the Middle East and North Africa (MENA) region are Egypt, Morocco, Sudan, and Tunisia.

However, enactment of public policies does not necessarily imply compliance. This hypothesis is more evident if the public measures are health ones (Nivette et al., 2021). While governments are using various tactics, such as fines, to enforce favourable measures, individual more than government action is what counts in the battle against pandemics. There is persistent need to explain why, during a pandemic, individuals do not consistently engage in preventive health practices (also referred to as "precautionary health practices"). Not all factors affecting adherence to preventive health behaviour (PHB) are health related. Human nature is complex, and economic and psychological factors can play a significant role.

The aim of this study is to investigate what determines the uptake of PHB in the MENA region in the context of COVID-19, focusing on economic and psychological well-being. We estimate how various determinants affect compliance with three preventive health practices across 5,358 individuals in four MENA countries (Egypt, Morocco, Sudan, and Tunisia) between November 2020 and August 2021. Three research questions are explored. First, what are the estimated effects of individual psychological well-being, together with perception of COVID-19 risk and public adherence, on engaging in PHB against COVID-19 in MENA? Second, if the effect of psychological well-being is significant, how is it affected by economic anxiety, changes in food consumption, and labour market status? Third, what other significant determinants contribute to the prediction of non-compliance with COVID-19 preventive health measures in MENA?

Disease risk perception dominates research on the determinants of PHB, suggesting that higher perceived susceptibility to and severity of a disease promote adopting recommended preventive behaviours (Bish & Michie, 2010; Leppin & Aro, 2009). Yet far less is known about how the public perceives the risk associated with a disease outbreak. The levels of perceived threat, perceived severity, and perceived vulnerability for an outbreak are found to vary across countries (De Zwart et al., 2009). Beyond disease risk perception, little is known about how mental health affects engaging in PHB and the evidence is mixed. Some studies show that anxiety and depression lowered the uptake of PHB (e.g., Stickley et al., 2020), while other studies report an over practicing of PHB by individuals diagnosed with mental health problems during COVID-19 (Lee et al., 2021).

As economic anxiety has become more salient than health anxiety over the course of COVID-19 (Timing et al., 2021), it is imperative to study how different economic determinants can

promote or discourage PHB. Studies to date focused on how socio-economic status can predict general PHB (Coburn & Pope, 1974). We could identify two studies that are particular to economic determinants and both indicated that economic anxiety and insecurity lowered the likelihood of adopting preventive behaviours during COVID-19 (Etilé & Geoffard, 2022; Shin et al., 2021).

The significance of our study is twofold. First, it is the first to estimate how economic determinants can impact PHB adoption through psychological well-being. We propose a new dimension of individual determinants of PHB that considers economic issues whose effect typically grow as health anxiety fades and economic anxiety worsens. This is also the first endeavour to report a rigorous analysis of the adoption of PHB in the MENA region. To our knowledge, there is no empirical evidence to date on what affects engaging in PHB in MENA either in the COVID-19 context or before the onset of the pandemic (for example, from the Avian Influenza (H5N1) or from the acute respiratory syndrome (SARS), both of which hit some countries in the region).

Second, by holistically studying psychological, demographic, and socioeconomic factors and identifying what increases the risk of non-compliance with preventive health measures, our findings will enable policy makers to adopt effective public health measures that induce behavioural change and help contain outbreaks. Informing public health policies is important in light of the successive waves of COVID-19 and the rising frequency of disease outbreaks worldwide.

2. Background literature

The literature on PHB is dominated by a key determinant of the types of behaviour individuals adopt: *risk perception*. Risk perception is a main component of theories of behaviour change and a core feature of the health belief model (Rosenstock, 1974), the protection motivation theory (Rogers, 1975), and the precaution adaption process model (Weinstein, 1987). These theoretical models explain the role of perceived risk as a determinant of PHB (for an overview, see Van der Plight (1996)). Empirical research indicates that risk perception is a subjective psychological construct that varies by cognitive, emotional, social, cultural, and individual characteristics between populations (e.g., Leiserowitz, 2006; Joffe, 2003; Sjoberg, 2002; Loewenstein et al., 2001).

The association between risk perception and PHB during pandemics is well attested for high-income countries. Bish and Michie (2010) and Leppin and Aro (2009) provided a meta-analysis of the factors influencing PHB during pandemics and concluded that perceived susceptibility to and severity of a disease and believing in the effectiveness of preventive measures increased their implementation. A low-to-moderate risk perception related to the 2009 H1N1 influenza pandemic together with a lack of concern were reported in several high-income countries based on surveys conducted in these countries. Examples include Italy (Ferrante et al., 2011), The Netherlands (Bults et al., 2011), and the United States (SteelFisher et al., 2010). In the United

Kingdom, however, perception about the risk of catching H1N1 was associated with multiple preventive behaviours (Rudisill, 2013). In the context of SARS, population with high-risk perception in The Netherlands adopted the recommended preventive behaviours against the pandemic (Brug et al., 2004).

A large strand of literature considered the *mental health* consequences of COVID-19 and social distancing. The pandemic was associated with substantial increases in anxiety and depression, substance use, loneliness, and domestic violence (Galea et al., 2020). Only mild psychological impact was reported for MENA though (Al Dhaheri et al., 2021). The opposite direction of the relationship—how mental health affects PHB—was rarely examined and the findings are mixed. Some studies show that anhedonic depression symptoms during COVID-19 had a negative indirect effect on preventive behaviour through general health behaviours (e.g., Frías-Armenta et al., 2021). Some studies indicated the negative effect of anxiety plus depression (e.g., Stickley et al., 2020). On the contrary, there is evidence that individuals with clinically significant mental health problems might practice preventive measures to COVID-19 to a greater and longer extent than those without (Lee et al., 2021).

In parallel, there is a growing body of literature on peer or neighbourhood effects or, broadly, social norms and health behaviours. Weaker evidence exists in the context of disease outbreaks and COVID-19. A review of the literature by Webster et al. (2020) concluded that social norms play an important part in adherence to quarantine protocols. Social pressure from the community and from the head of household to adhere to quarantine was, respectively, associated with a higher likelihood of quarantining during the SARS outbreak in Canada and during the Ebola outbreak in Senegal. In contrast, breaking quarantine protocols during the H1N1 outbreak in Australia became more likely as rumours that others were breaking quarantine spread. Examining human mobility behaviour, El-Shal and Moustafa (2021) show that social norms, namely risk taking, patience, and trust, can explain the heterogenous effects of containment, closure, and economic policy responses to COVID-19 on behaviour change. They reported that risk averse populations and who exhibit more patience worldwide pre acted and lowered their mobility independent of public policies, but this did not strictly hold in MENA.

Specific socio-demographic and socio-economic characteristics, such as gender (i.e., female), and age (i.e., elderly), are found to be associated with greater compliance with PHB during COVID-19 (Nivette et al., 2021; Galasso et al., 2020; Brouard et al., 2020). Evidence on some characteristics, such as education, is inconsistent. Some studies show that higher education is associated with greater compliance, but other studies reported the opposite (e.g., Nivette et al., 2021) or reported no effect (e.g., Brouard et al., 2020). Individuals from some demographic backgrounds may lack the practical capacity to comply due to their occupation or economic concerns (e.g., Webster et al., 2020), but this finding applies to quarantine rather than maintaining a physical distance, wearing a face mask, or washing hands.

Reviewing the literature on *economic determinants* of PHB, together, education, age, income, and social participation (in that order) were found to provide the most parsimonious set for predicting general PHB (Coburn & Pope, 1974). The few recent studies, focusing on economic determinants rather than socioeconomic status, indicate that psychological anxiety and the prospect of economic losses undermined the adherence of young adults to physical distancing recommendations during the first COVID-19 wave (Etilé & Geoffard, 2022) and that the economically insecure, such as the unemployed and those with low incomes and net worth, were less likely to adopt preventive behaviours (e.g., Shin et al., 2021).

3. Data and descriptive analysis

3.1 COVID-19 MENA Monitor Household survey

We exploit a unique panel dataset, recently released by the Economic Research Forum (ERF): the COVID-19 MENA Monitor Household (CMMHH) survey (ODAMI, 2021). The survey is constructed using a series of short *panel* phone surveys, which were conducted approximately every two months. Topics covered by the survey's questionnaire include but are not limited to demographic and household characteristics, education and children, labour market status, food security, income, social safety net, employment and unemployment detection, attitudes towards risks, mental health, and social distancing.

Geographically, the CMMHH survey covered a national random sample of mobile phone users aged 18-64 in five MENA countries: Egypt, Jordan, Morocco, Sudan, and Tunisia. Four out of these countries are in North Africa (Egypt, Morocco, Sudan, and Tunisia), on which we base the analysis of this paper. Specifically, we make use of the relevant *individual* data collected from these countries on PHB, psychological well-being, economic anxiety, and COVID-19 risk perception, among other demographic and socioeconomic factors, over the period from November 2020 to August 2021. The number and timing of survey waves varied by country: Egypt (two waves; February 2021, June 2021), Morocco (four waves; November 2020, February 2021, April 2021, June 2021), Sudan (two waves; April 2021, August 2021), and Tunisia (four waves; November 2020, February 2021, April 2021, June 2021). We use all available survey waves. Our sample consists of 5,358 individuals who were interviewed in at least two waves.

3.2 Outcome variables

PHB. We include three dependent variables to measure individual compliance with COVID-19 public health preventive measures. Respondents were asked whether they adopted three PHBs that reflect national and international recommendations. Each respondent indicated if s/he tried to stay at least one meter away from other people when outside the house, wore a mask when outside the house, and/or washed his/her hands with soap more often than s/he did before COVID-19.

Psychological well-being. Psychological well-being is a core feature of mental health. We use a multivariate statistical method, namely multiple correspondence analysis (MCA), to

construct a composite index that assesses psychological well-being rather than making a priori assumptions and selecting one variable as a proxy for psychological well-being or including all relevant variables additively. Using this index enables us to reduce the dimensionality of the dataset and allows the available data on psychological well-being measures to manifest itself in determining the most relevant variables and optimal weights assigned to each variable. The index is also designed to capture the complex interaction between the different measures as the variables are expected to be intercorrelated.

Following the World Health Organisation (WHO) Five Well-Being Index (WHO-5), our index is a self-reported measure of psychological well-being and, hence, can be referred to as a subjective psychological well-being index. Respondents to the CMMHH survey were asked five questions regarding their mental health: for how long over the two weeks preceding the survey they felt cheerful and in good spirits, they felt calm and relaxed, they felt active and vigorous, they woke up feeling fresh and rested, and their daily life was filled with things that interest them. Well-being is assessed on a 6-point Likert scale, ranging from 0 (at no time) to 6 (all of the time).

We use responses to these five questions to construct a *continuous* measure of psychological well-being. We obtain the index from the first dimension of inertia since it explains the highest variability in the data. Unlike the standard principal component analysis (PCA), variables used for MCA do not need to follow a normal distribution, which makes the latter the appropriate approach given the type of our variables being categorical—ordinal, not nominal. Moreover, while PCA determines the set of weights that explain the largest variation in the original variables, MCA additionally dichotomises and weighs the modalities of the original variables rather than the variables themselves (Asselin, 2009).

3.3 Explanatory variables

PHB determinants. For determinants of PHB, we include four groups of *explanatory* variables that reflect psychological well-being, individual perception of COVID-19 disease risk, neighbourhood effect, and demographic and socioeconomic factors. Psychological well-being is captured by our constructed subjective psychological well-being index. COVID-19 risk perception is captured by a self-reported measure of how worried a respondent is about being infected with COVID-19 using a 5-point Likert scale: not at all worried, a little worried, rather worried, very worried, or I had it already.

We measure social compliance with preventive health measures by constructing three *district-level* variables of the adoption of the three considered PHBs, reflecting the neighbourhood effect. We calculate the three measures as the percentages of individuals within a level-2 administrative division who reported trying to maintain a physical distance, wearing a mask, and washing hands with soap more often. Level-2 administrative division boundaries in the CMMHH survey correspond to the district level (e.g., qesm or markaz for Egypt).

Finally, we include five confounding demographic and socioeconomic factors hypothesised as relevant for compliance with PHB: gender; age (in years); educational attainment (less than basic, basic, secondary, or higher education); labour market status, specifically main job or activity [farmer, business owner/self-employed (but not a farmer), unpaid family worker on a farm, unpaid family worker (but not a farmer), wage worker for government/public sector, wage worker for a private sector/NGO, unemployed and looking for work, housewife, full-time student, retired, or other]; and geographical location.

Psychological well-being determinants. We hypothesise that psychological well-being during COVID-19 is affected by two overarching sets of determinants: economic well-being and the perceived risk of being infected with COVID-19.

Economic well-being is captured by the level of economic anxiety, changes in consumption, and labour market status. We measure economic anxiety by a self-reported measure of how worried a respondent is about the economic situation using a 4-point Likert scale: not at all worried, a little worried, rather worried, very worried, or I had it already. We define changes in consumption as changes in food consumption. We use a dummy variable that switches on if a respondent reported that s/he was unable to buy the amount of food they usually buy in the past seven days because the price of food increased and/or because their household income dropped. Economic anxiety and changes in consumption are two exogenous variables that are believed to affect psychological well-being but not PHB. Labour market status is defined as before.

As previously discussed, we capture COVID-19 risk perception by a self-reported measure of how worried a respondent is about being infected. We include other factors that presumably affect mental health. These are gender, age, educational attainment, and geographical location.

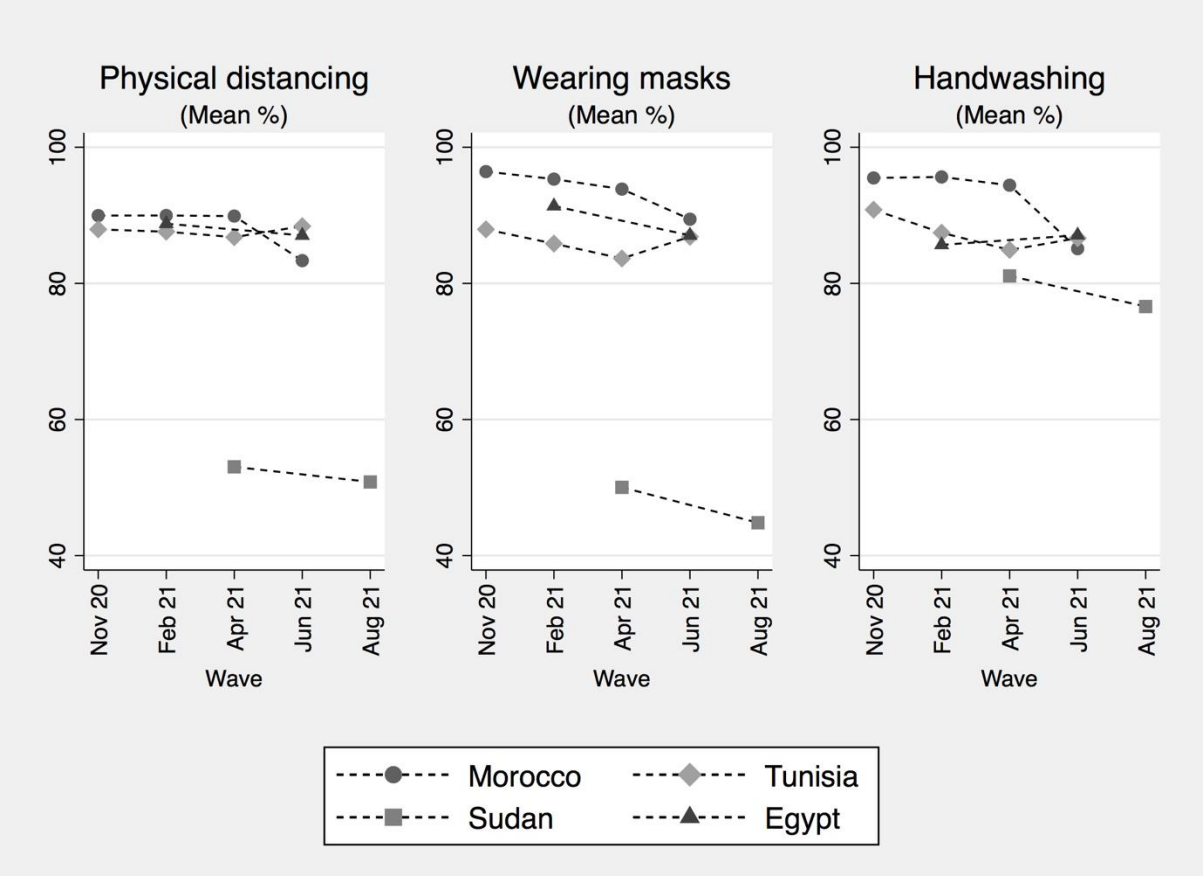
3.4 Descriptive analysis

We outline the summary statistics of the data used in the Appendix (see Table A.1). The table shows that at least 85 percent of the respondents from Egypt, Morocco, Sudan, and Tunisia reported trying to stay 1+ meter away from other people when outside the house, wearing a mask when outside the house, and washing their hands with soap more often than they did before COVID-19.

Figure 1 depicts persistence in physical distancing adherence in Egypt, Morocco, and Tunisia between November 2020 and April 2021, with at least 87 percent of respondents in all three countries maintaining physical distancing when outside the house. Post April 2021, adherence has weakened in all countries except Tunisia. Wearing masks has consistently decreased in all countries except Tunisia, with respondents from Morocco reporting the highest uptake levels throughout the five survey waves. The handwashing with soap practice has been increasingly adopted in Egypt during February–June 2021 and Tunisia during April–June 2021. Moroccan respondents, having the strictest compliance with preventive health measures overall, have

decreasingly reported washing their hands with soap more often following April 2021. Lowest compliance levels are detected in Sudan, especially for physical distancing and wearing masks.

Figure 1. Changes in PHB (November 2020 – August 2021)

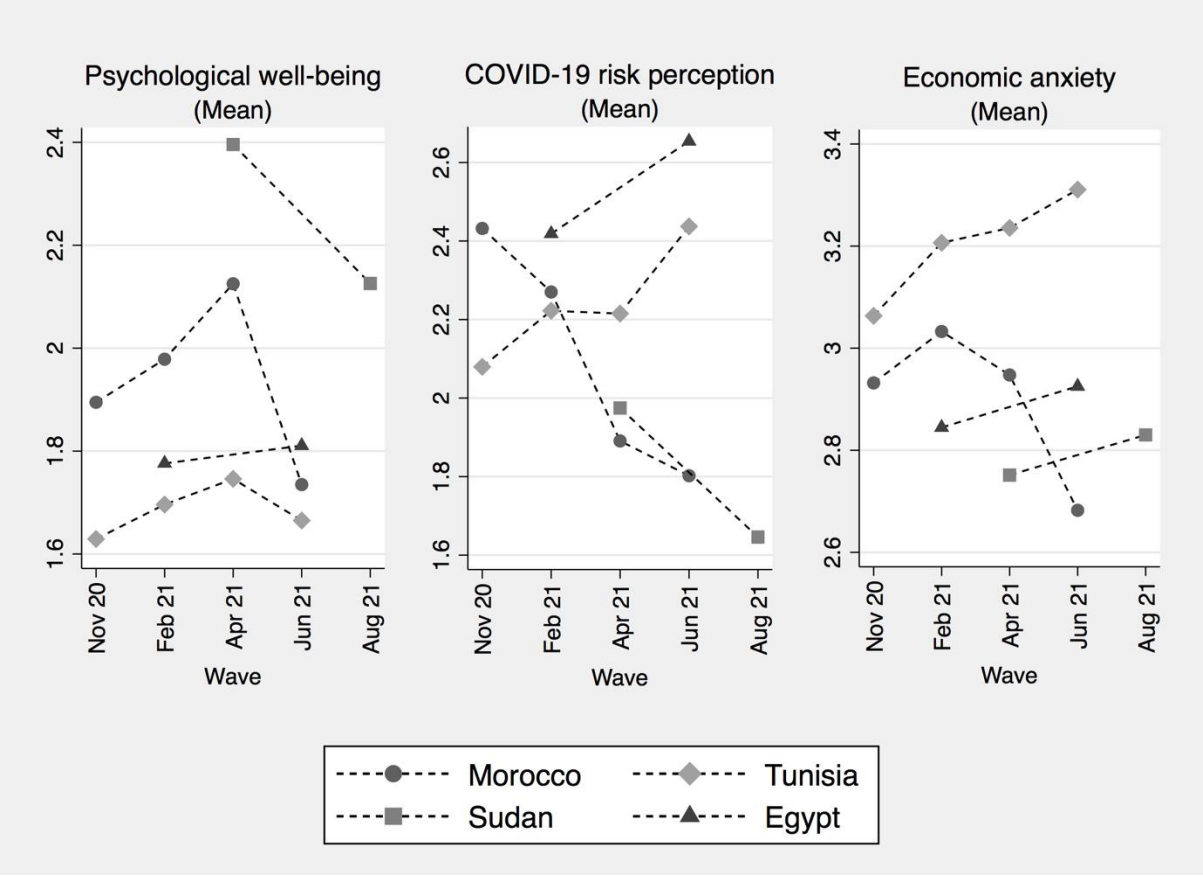


Source: Authors' calculations based on CMMHH survey data.
Note: Each marker represents a weighted average of the indicator for the specified country within the wave.

Changes in psychological well-being, COVID-19 risk perception, and economic anxiety are believed to be key determinants of how the uptake of PHB has developed over the course of COVID-19. We plot the changes in the three variables in Egypt, Morocco, Sudan, and Tunisia between November 2020 and August 2021 in Figure 2. Some of the steepest changes in PHB in Figure 1 may be explained in view of Figure 2. For example, the sharp decrease in physical distancing and handwashing in Morocco between April and June 2021 may be an echo of the drop in psychological well-being and perceived risk of COVID-19. In parallel, improved physical distancing, wearing masks, and handwashing practices in Tunisia between April and June 2021 may mirror the elevated COVID-19 risk perception over the same period.

These initial observations warrant a formal investigation.

Figure 2. Changes in selected determinants of PHB (November 2020 – August 2021)



Source: Authors' calculations based on CMMHH survey data.
Note: Each marker represents a weighted average of the indicator for the specified country within the wave.

4. Generalised structural equation model

An individual's decision to adopt a PHB and her/his subjective psychological well-being can jointly be affected by several factors. An explicit example is how s/he perceives their risk to catch COVID-19. Additional examples include gender, age, and educational attainment. Some factors are not observed. We develop a generalised structural equation model to integrate the *causal* link between psychological well-being and uptake of PHB in a recursive framework. This framework handles the endogeneity of the psychological well-being-PHB relationship by including common, unobserved components into two equations for psychological well-being and PHB. The framework also accommodates the selectivity of reporting psychological well-being for only a sub-sample of individuals.

Our model is formalised in two equations: (1) an individual's psychological well-being during COVID-19 is determined by her/his economic well-being, perceived risk of COVID-19, and demographic and socioeconomic factors (psychological well-being equation 2); and (2) an individual decides to adopt PHB as a result of her/his psychological well-being along with other determinants, importantly COVID-19 risk perception and neighbourhood compliance with PHB (PHB equation 1).

We specify the following model to estimate the relationship between PHB and psychological well-being.

$$PHB_{it} = (\beta_0 + PWB_{it}\beta_1 + R_{it}\beta_2 + Z_{it}\beta_3 + \eta_i + \epsilon_{it}) > 0 \quad (1)$$

$$PWB_{it} = \alpha_0 + ECON_{it}\alpha_1 + R_{it}\alpha_2 + Z_{it}\alpha_3 + \eta_i\alpha_4 + \xi_{it} \quad (2)$$

where

$$\eta_i \sim N(0,1)$$
$$\epsilon_{it} \sim \text{Logistic}(0, \pi^2/3)$$
$$\xi_{it} \sim N(0, \sigma^2)$$
$$(\eta_i, \epsilon_{it}, \xi_{it}) \text{ are mutually independent.}$$

PHB_{it} is a binary variable for individual i (in country c) reporting adopting a PHB at wave t. We consider three preventive care practices, namely physical distancing, wearing masks, and handwashing. PWB_{it} is the continuous "subjective" psychological well-being index obtained from MCA. R_{it} is an ordinal variable for individual perception of COVID-19 risk. Z_{it} is a vector that captures the neighbourhood effect (only in equation 1), the effect of confounding factors (gender, age, educational attainment, and geographical location) (in equations 1 and 2), and time effect (in equations 1 and 2). $ECON_{it}$ is a vector of three economic determinants, namely economic anxiety, (food) consumption change, and labour market status.

η_i is the common, unobserved component that gives rise to endogeneity. We introduce η_i as a "latent" variable in our system of equations to attenuate omitted-variable bias. It can be thought of as the individual-level effect. ϵ_{it} and ξ_{it} are the error terms.

If we separately consider equation (1), one can argue that PWB_{it} is endogenous as it may be related to the unobserved, individual-level component η_i. But within the system of equations, we can make use of an instrument. We believe that, in $ECON_{it}$, the level of economic anxiety and changes in food consumption affect PWB_{it} but not PHB_{it}. In a sense, $ECON_{it}$ can be regarded as an instrument and Z_{it} as exogenous covariates. Besides Z_{it}, our system of equations shares unobserved components that can model random effects and endogeneity.

Estimation methodology. Within the generalised structural equation modelling framework, we estimate our model as a recursive system of equations (1–2) by the full-information maximum likelihood (FIML) method. Following Drukker (2014), we use Stata's generalised structural equation model *(gsem)* command since it allows us to incorporate generalised (non-continuous) responses and latent variables in the model. Cross-equation residual correlation, or contemporaneous correlations, are accounted for as the model is *jointly* estimated, diverging from previous studies following a two-step estimation routine.

We estimate the model three times, each for one type of PHB. The obtained standard errors are clustered at the individual level to make them robust to heteroscedasticity and serial correlation (Abadie et al., 2017).

Robustness checks. We consider and report the results of estimating the parsimonious model below together with the main estimation results in all results tables. Time (month) effects are included in all estimations.

$$PHB_{it} = (\beta_0 + PWB_{it}\beta_1 + R_{it}\beta_2 + \eta_i + \epsilon_{it}) > 0 \quad (3)$$

$$PWB_{it} = \alpha_0 + ECON_{it}\alpha_1 + R_{it}\alpha_2 + \eta_i\alpha_3 + \xi_{it} \quad (4)$$

$ECON_{it}$ here is a vector of economic anxiety and (food) consumption change.

To confirm the reliability of the psychological well-being index constructed using multiple correspondence analysis, we re-run the generalised structural equation model using the ordinal variables used to construct the psychological well-being index (feeling cheerful and in good spirits, feeling calm and relaxed, feeling active and vigorous, etc.) rather than the index itself and compare between the obtained estimates.

5. Results

5.1 GSEM estimates of psychological well-being

In Table 2, we present the results of estimating the psychological well-being equation (2) in the system of equations of physical distancing. The estimates of the psychological well-being equation in the two systems of equations of wearing masks and handwashing have close values and are reported in the Appendix (see Tables A.2 and A.3). Columns (2), (4), (6), and (8) show the results of the full model and columns (1), (3), (5), and (7) the parsimonious model.

We find that changes in food consumption had the highest effect on psychological well-being in the context of COVID-19, whereas decreases in food consumption significantly lowered psychological well-being in all countries except Sudan. Worrying about the economic situation came second, where higher levels of economic anxiety lowered psychological well-being in all four countries. The magnitude of the reported coefficients indicate that economic anxiety is particularly—if not the most—relevant in Sudan, the only low-income country included in this analysis.

The effect of labour market status varied by country. Our estimates show that unpaid family workers on farms and being unemployed and looking for work decreased psychological well-being in Egypt. The effect was notably higher in magnitude and more significant for the former. Contrarily in Sudan, being an unpaid family worker (but not a farmer) increased psychological well-being. Being retired similarly increased psychological well-being. Full-time students in Sudan had lower psychological well-being though. In line with evidence from Egypt, being

unemployed and looking for work in Morocco decreased psychological well-being, but this was only observed from the handwashing estimations. In Tunisia, again being unemployed and looking for work or a business owner/self-employed (but not a farmer) decreased psychological well-being.

COVID-19 risk perception, a variable that is perfectly comparable to economic anxiety as they have the same unit of measurement, came third. In Egypt, Morocco, and Tunisia, the higher an individual was worried about being infected with COVID-19, the lower her/his psychological well-being was.

Age did not seem to affect psychological well-being except in Tunisia, where elder people were significantly worse off. Education also appears to be relevant in Tunisia, where the higher the educational attainment the higher the psychological well-being. This was observed from the estimations of all three preventive behaviours. Education appears to be relevant in Sudan as well, this was observed especially from the handwashing estimations (see Table A.3)

Table 2. GSEM estimates of psychological well-being equation (2) (November 2020 – August 2021)
Dependent variable: Psychological well-being index
System of equations: Physical distancing

Psychological well-being	Egypt		Morocco		Sudan		Tunisia	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Economic anxiety	-0.101***	-0.079***	-0.165***	-0.110***	-0.145***	-0.149***	-0.065**	-0.065**
	(0.024)	(0.023)	(0.027)	(0.025)	(0.050)	(0.046)	(0.032)	(0.025)
Consumption change		-0.271***		-0.540***		0.000		-0.291***
		(0.051)		(0.073)		(0.168)		(0.058)
COVID-19 risk perception	-0.036*	-0.035*	-0.056**	-0.069***	0.028	0.039	-0.042***	-0.044***
	(0.020)	(0.020)	(0.025)	(0.023)	(0.048)	(0.045)	(0.016)	(0.016)
Gender (Ref: Male)		0.035		-0.118		-0.117		0.008
		(0.071)		(0.072)		(0.131)		(0.045)
Age		-0.003		0.004		0.003		-0.008***
		(0.003)		(0.002)		(0.004)		(0.002)
Education (Ref: Less than basic)								
Basic		0.048		-0.054		0.257*		0.101*
		(0.083)		(0.069)		(0.145)		(0.052)
Secondary		0.090		0.101		0.155		0.110**
		(0.065)		(0.072)		(0.133)		(0.044)
Higher education		-0.003		-0.054		0.170		0.194***
		(0.081)		(0.095)		(0.151)		(0.056)
Latent variable *L*	-0.611	-1.106*	-0.210**	0.178***	-0.239***	-0.203***	1.662	0.589
	(0.893)	(0.571)	(0.091)	(0.044)	(0.070)	(0.057)	(2.915)	(0.458)
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Location effect	No	Yes	No	Yes	No	Yes	No	Yes
Job/activity effect	No	Yes	No	Yes	No	Yes	No	Yes
N	1,766	1,766	4,886	4,886	904	904	6,766	6,766

Notes: Each column represents a separate regression. Robust standard errors clustered at the individual level are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. The reported GSEM estimates are for physical distancing; wearing masks and handwashing have very close values (see the Appendix).

The coefficients of the latent variable (L) are highly significant, confirming that the effect of unobserved factors is significant in the context of this study and should be accounted for.

5.2 GSEM estimates of PHB

The GSEM estimates of physical distancing, wearing masks, and handwashing from equation (1) are listed in Tables 3, 4, and 5. Columns (2), (4), (6), and (8) display the results of the full model and columns (1), (3), (5), and (7) the parsimonious model.

Table 3 shows that psychological well-being was the main determinant of *physical distancing* in Egypt and Sudan (and in Morocco based on the parsimonious model). Higher psychological well-being significantly increased the likelihood of trying to maintain a physical distance when outside the house. In these three countries, COVID-19 risk perception came second. The higher an individual perceived the risk of being infected with COVID-19, the higher the likelihood that s/he maintained physical distancing. But in Tunisia, COVID-19 risk perception was the key determinant of physical distancing, and psychological well-being appears to have no effect. Neighbourhood compliance significantly increased the likelihood of individual compliance in all four countries. Females were more likely to try to maintain a physical distance in Morocco and Tunisia. Elder people were more likely to maintain a physical distance in all countries except Sudan. We surprisingly found that higher educational attainment significantly lowered the likelihood to comply in Morocco (Table 3).

For *wearing masks,* Table 4 provides evidence that psychological well-being had the strongest effect on the likelihood of adoption, where higher psychological well-being increased adoption significantly in all four countries. COVID-19 risk perception also had a strong, direct effect on the likelihood of wearing masks when outside the house. This effect is consistent across the four countries. Echoing the physical distancing results, we find that neighbourhood compliance increased the likelihood of individual compliance in all four countries and that females and elder people were more likely to wear masks in Morocco and Tunisia (Table 4).

The results of *handwashing* in Table 5 diverge from that of physical distancing and wearing masks. The likelihood of washing hands with soap more often than before COVID-19 was mainly affected by how the risk of being infected with COVID-19 was perceived in Egypt, Morocco, and Tunisia. The higher the perceived risk, the higher the likelihood of engaging in washing hands with soap. Higher psychological well-being promoted the handwashing practice only in Morocco. The effect of neighbourhood compliance on individual compliance was significant in all countries and the only significant effect in Sudan. Females were significantly less likely to wash their hands in Egypt but more likely to do so in Morocco. Elder people were significantly more likely to wash their hands in both Egypt and Tunisia. Education had a strong, consistent effect on the handwashing practice in Egypt, where higher educational attainment increased the likelihood of engaging more often in washing hands with soap (Table 5).

Job or activity effects are included in all estimations. Our results indicate that the retired were less likely to maintain physical distancing in Egypt while the unemployed whether looking for

work or not looking for work (e.g., taking care of family members) and full-time students were more likely to wear masks and to practice handwashing. In Morocco, the retired were more likely to wear masks but unpaid family workers on farms were less likely to do so. In Sudan, full-time students were more likely to wear masks and to practice handwashing, and unpaid family workers on farms also were more likely to practice handwashing. The unemployed looking for work were more likely to wear masks in Tunisia. Wage workers for government or public sector or for the private sector or NGOs, housewives, and full-time students were more likely to practice handwashing.

Table 3. GSEM estimates of PHB equation (1) (November 2020 – August 2021)

Dependent variable: PHB – Physical distancing

PHB – Physical distancing	Egypt		Morocco		Sudan		Tunisia	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Psychological well-being	0.985	0.614***	1.059***	-0.174	1.617***	1.526***	-0.432	-0.776
	(1.017)	(0.204)	(0.130)	(0.157)	(0.367)	(0.307)	(0.454)	(0.476)
COVID-19 risk perception	0.361***	0.483***	0.497***	0.172	0.507**	0.480**	0.559***	0.532***
	(0.128)	(0.105)	(0.106)	(0.107)	(0.209)	(0.206)	(0.117)	(0.105)
Neighbourhood effect	0.086***	0.100***	0.131***	0.133***	0.101***	0.126***	0.084***	0.094***
	(0.016)	(0.007)	(0.020)	(0.019)	(0.016)	(0.020)	(0.008)	(0.011)
Gender (Ref: Male)		-0.227		1.685***		0.035		0.760**
		(0.396)		(0.432)		(0.641)		(0.297)
Age		0.042**		0.025*		-0.027		0.041***
		(0.017)		(0.013)		(0.023)		(0.011)
Education (Ref: Less than basic)								
Basic		-0.136		-0.633**		0.029		0.187
		(0.437)		(0.318)		(0.795)		(0.287)
Secondary		0.293		-0.569*		0.020		0.036
		(0.353)		(0.329)		(0.642)		(0.248)
Higher education		0.567		-1.549***		0.121		-0.027
		(0.408)		(0.447)		(0.687)		(0.309)
Latent variable *L*	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Location effect	No	Yes	No	Yes	No	Yes	No	Yes
Job/activity effect	No	Yes	No	Yes	No	Yes	No	Yes
N	1,766	1,766	4,886	4,886	904	904	6,766	6,766

Notes: Each column represents a separate regression. Robust standard errors clustered at the individual level are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 4. GSEM estimates of PHB equation (1) (November 2020 – August 2021)

Dependent variable: PHB – Wearing masks

PHB – Wearing masks	Egypt		Morocco		Sudan		Tunisia	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Psychological well-being	1.684**	1.294	1.063***	0.956***	1.776***	1.684***	1.075***	1.010**
	(0.841)	(1.029)	(0.165)	(0.144)	(0.303)	(0.357)	(0.336)	(0.408)
COVID-19 risk perception	0.680***	0.683***	0.707***	0.726***	0.412*	0.391*	0.781***	0.643***
	(0.174)	(0.175)	(0.145)	(0.161)	(0.240)	(0.205)	(0.101)	(0.096)
Neighbourhood effect	0.100***	0.110***	0.192***	0.198***	0.090***	0.093***	0.095***	0.097***
	(0.029)	(0.034)	(0.040)	(0.040)	(0.018)	(0.018)	(0.013)	(0.015)
Gender (Ref: Male)		-0.214		0.932*		0.270		1.637***
		(0.593)		(0.481)		(0.614)		(0.414)
Age		0.038		0.025*		-0.012		0.049***
		(0.027)		(0.015)		(0.021)		(0.015)
Education (Ref: Less than basic)								
Basic		0.336		-0.161		-1.088		0.095
		(0.516)		(0.455)		(0.749)		(0.306)
Secondary		0.714*		-0.759**		0.278		0.042
		(0.415)		(0.350)		(0.587)		(0.264)
Higher education		0.594		-0.426		0.700		-0.067
		(0.541)		(0.459)		(0.681)		(0.367)
Latent variable *L*	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Location effect	No	Yes	No	Yes	No	Yes	No	Yes
Job/activity effect	No	Yes	No	Yes	No	Yes	No	Yes
N	1,766	1,766	4,886	4,886	904	904	6,766	6,766

Notes: Each column represents a separate regression. Robust standard errors clustered at the individual level are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 5. GSEM estimates of PHB equation (1) (November 2020 – August 2021)

Dependent variable: PHB – Handwashing

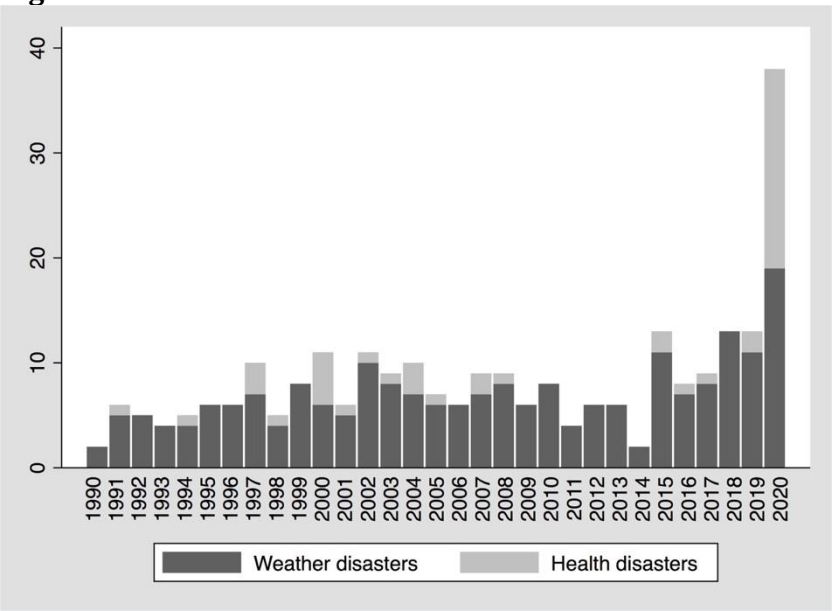
PHB – Handwashing	Egypt		Morocco		Sudan		Tunisia	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Psychological well-being	0.818	-0.036	0.703	0.335***	-0.248	-0.916	0.266	0.103
	(1.054)	(0.160)	(0.550)	(0.080)	(1.114)	(0.800)	(0.295)	(0.238)
COVID-19 risk perception	0.536***	0.581***	0.647***	0.540***	0.272	0.243	0.771***	0.734***
	(0.152)	(0.102)	(0.145)	(0.108)	(0.196)	(0.213)	(0.093)	(0.086)
Neighbourhood effect	0.083***	0.089***	0.112***	0.112***	0.073***	0.104**	0.078***	0.080***
	(0.017)	(0.006)	(0.020)	(0.013)	(0.017)	(0.043)	(0.006)	(0.006)
Gender (Ref: Male)		-0.731**		0.597*		-0.252		0.382
		(0.359)		(0.342)		(0.647)		(0.243)
Age		0.027*		0.020		0.024		0.029***
		(0.014)		(0.013)		(0.021)		(0.010)
Education (Ref: Less than basic)								
Basic		0.924**		-0.419		0.158		-0.293
		(0.464)		(0.315)		(0.798)		(0.242)
Secondary		0.696*		-0.668**		0.876		-0.287
		(0.362)		(0.326)		(0.832)		(0.226)
Higher education		0.753*		-0.641		1.004		-0.503*
		(0.401)		(0.422)		(0.922)		(0.257)
Latent variable *L*	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Location effect	No	Yes	No	Yes	No	Yes	No	Yes
Job/activity effect	No	Yes	No	Yes	No	Yes	No	Yes
N	1,766	1,766	4,886	4,886	904	904	6,766	6,766

Notes: Each column represents a separate regression. Robust standard errors clustered at the individual level are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

6. Discussion and conclusions

The COVID-19 pandemic has underscored the importance of PHB, such as physical distancing, wearing masks, and washing hands, in controlling pandemics. Understanding what can predict engaging in PHB is not only needed in the context of COVID-19 but also to be prepared for future disasters which occurrence is on the rise. Part of these health disasters will be driven by weather-related ones. Figure 3 illustrates how health and weather disasters evolved over time in MENA, denoting an upward trend since the year 2016. In 2020 alone, the number of health and weather disasters combined amounted to 38 incidents, with health and weather contributing equally.

Figure 3. Occurrence of weather and health disasters in MENA (1990–2020)



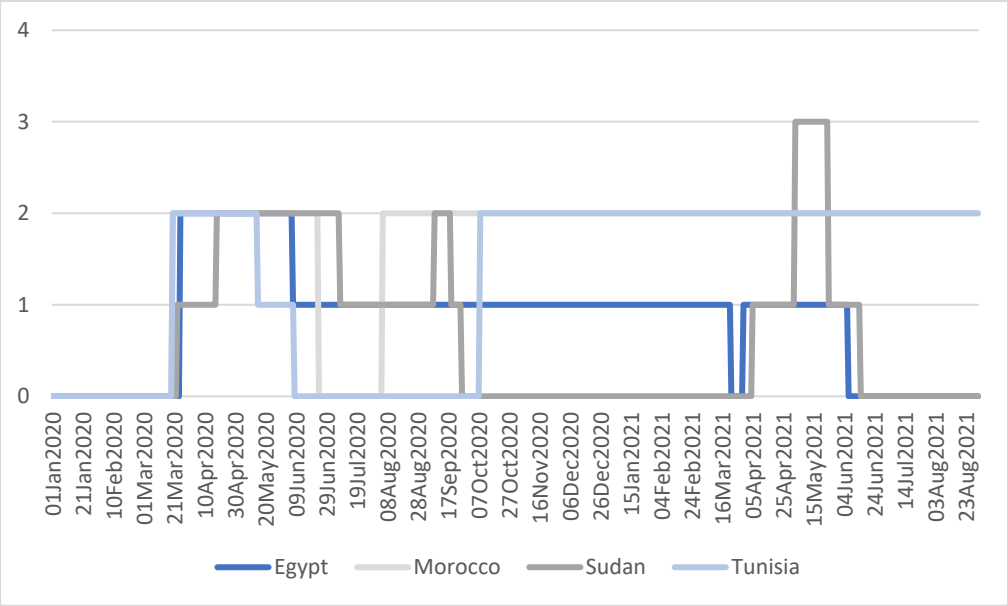
Source: Authors' calculations based on EM-DAT data.

The results of this study provide evidence that through affecting psychological well-being, economic well-being can significantly contribute to the adaptation of the aforementioned PHB. This contribution appears to be stronger than that of COVID-19 risk perception, a determinant of PHB that has dominated the literature to date. We measure economic well-being by three determinants: economic anxiety, changes in food consumption, and labour market status. The latter is especially relevant for unpaid family workers in Egypt and Sudan and the unemployed looking for work in Egypt, Morocco, and Tunisia. In addition, we document that individual's perception about the disease risk, and not psychological well-being, contributed the most to the adaptation of handwashing, a less publicly visible practice. This result was observed in Egypt, Morocco, and Tunisia, but not in Sudan. Neighbourhood compliance significantly promoted individual compliance in all four countries and played a key role in Sudan.

Below, we discuss why the estimated results varied across countries and by PHB type in the light of alternative but non-exhaustive explanations. First, we argue that variation in national mandates set and the length they were implemented does not typically justify the adoption or non-adoption of PHB. Take, for example, stay-at-home requirements (see Figure 4) and let's see if they explain how physical distancing compliance evolved across countries (Figure 1).

For Morocco and Tunisia, the two countries with the longest time series, between November 2020 and April 2021, the likelihood of maintaining physical distancing almost remained the same (Figure 1). This stagnation cannot be explained by stay-at-home requirements. Over this period, Morocco kept requiring not leaving house with some exceptions, but Tunisia lifted this requirement on May 15th and only recommended not leaving house until June 7th, which should have led to lower compliance in Tunisia.

Figure 4. Stay-at-home requirements in MENA (1 January 2020 – 31 August 2021)



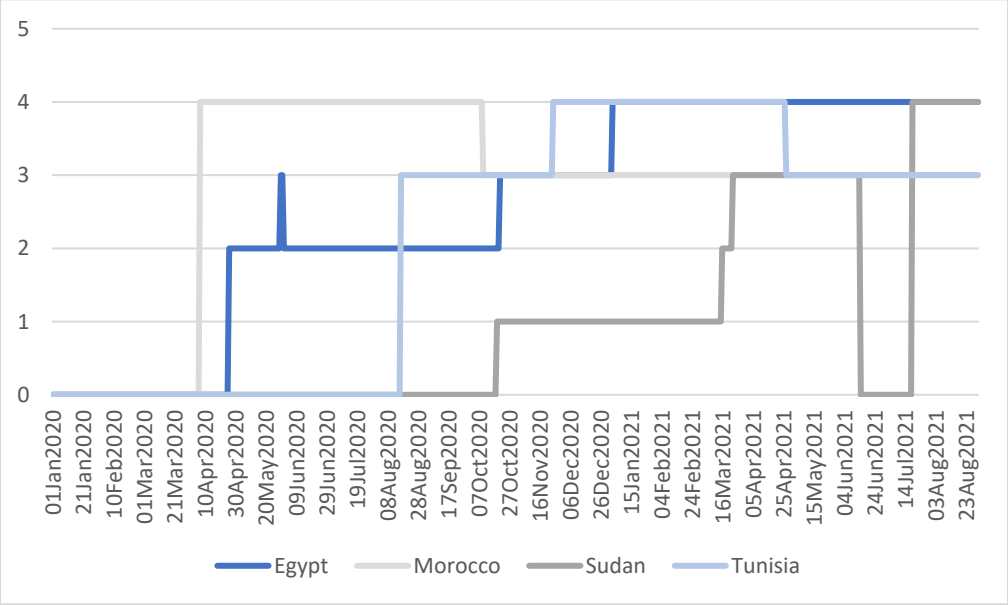
Source: Oxford Covid-19 Government Response Tracker.
Note: 0 - no measures. 1 - recommend not leaving house. 2 - require not leaving house with exceptions for daily exercise, grocery shopping, and 'essential' trips. 3 - require not leaving house with minimal exceptions (e.g., allowed to leave once a week, or only one person can leave at a time, etc.).

Another key observation: during April–June 2021, physical distancing compliance weakened in Morocco but improved in Tunisia. Again, we cannot explain this trend by stay-at-home requirements, which even appear to be inversely related to physical distancing compliance. During this period, Morocco was still requiring not leaving house with some exceptions, while Tunisia loosened this requirement on May 15th and only recommended not leaving house. We would have expected compliance to persist in Morocco and to decrease in Tunisia.

The second PHB we studied is wearing masks. This is a behaviour that is expected to directly reflect changes in facial coverings requirements. In Morocco and Tunisia, the two countries with the longest time series, wearing masks decreased gradually between November 2020 and April 2021 (Figure 1). Over this period, Morocco required face coverings in all shared/public spaces outside the home with other people present or all situations when social distancing not possible. Tunisia went a step further and required face coverings outside home at all times regardless of location or presence of other people between 25 November 2020 and 26 April 2021 (Figure 5). However, wearing masks have been less adopted in Tunisia than in Morocco in all data points. During April–June 2021, facial coverings were still required in both countries at least in all shared/public spaces outside the home with other people present or all situations

when social distancing not possible. Despite this policy resemblance, compliance weakened in Morocco but improved in Tunisia.

Figure 5. Facial coverings requirements in MENA (1 January 2020 – 31 August 2021)



Source: Oxford Covid-19 Government Response Tracker.
Note: 0 - No policy. 1 - Recommended. 2 - Required in some specified shared/public spaces outside the home with other people present, or some situations when social distancing not possible. 3 - Required in all shared/public spaces outside the home with other people present or all situations when social distancing not possible. 4 - Required outside the home at all times regardless of location or presence of other people.

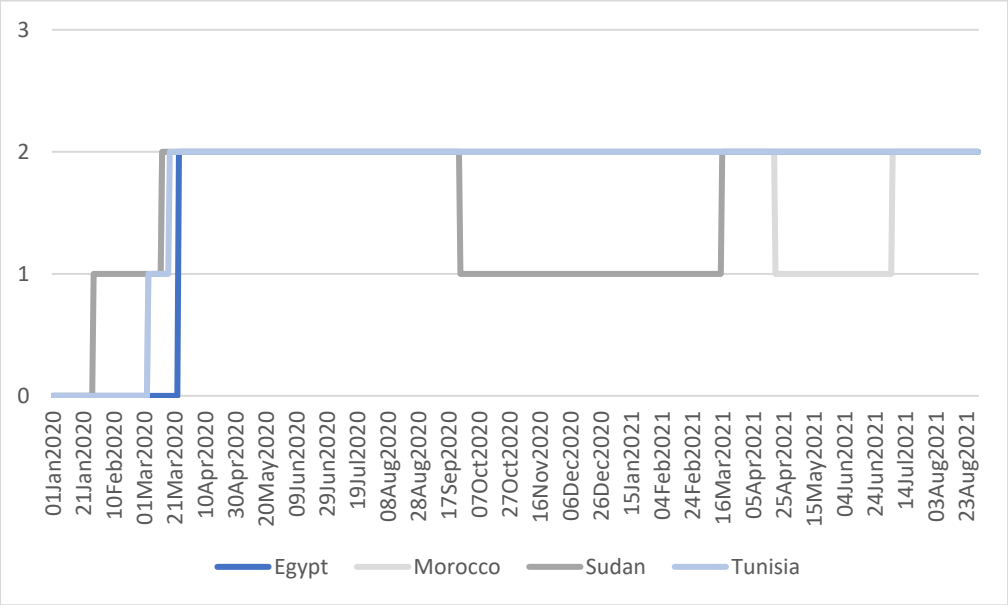
So, it could be that the stringency of relevant national mandates was intended to counter the behaviours of MENA populations rather than the other way around. This explanation seems to be valid considering the findings of El-Shal and Moustafa (2021), who found that the level of strictness of containment and closure policies in MENA was associated with reductions in the frequency of visits to places classified as retail and recreation, transit stations, and workplaces, but had no effect on the frequency of visits to grocery places, pharmacies, and parks. The latter category reflects non-essential places that mobility to should have decreased. The study further reports that recommending not leaving house or requiring not leaving house but for 'essentials' were even associated with increases in the frequency of visits to parks among risk-neutral individuals in the region. There is also evidence from 58 countries worldwide that in settings with risk-averse attitudes, individuals were more likely to adjust their mobility behaviour in response to the WHO declaration of COVID-19 to be a pandemic before official government lockdowns (Chan et al., 2020).

For the handwashing practice, we found that it was affected mainly by the perceived risk of being infected with COVID-19. This is an expected result since handwashing is a preventive practice for which no national mandate exists and is almost not visible to one's community. In this context, neighbourhood compliance which was found to notably affect individual adoption of handwashing, may be understood as how the community collectively perceive the COVID-19 risk. While we do not expect containment and closure policies to affect handwashing, health

system policies, specifically public information campaigns, may raise adoption through risk communication. We plot the presence of public information campaigns in the four countries in Figure 6. Compliance in the two countries in which campaigns lasted the longest, Tunisia and Egypt, evolved differently, improving in the former for all three behaviours but in the latter for handwashing only (Figure 1).

Exploring vaccination policies in MENA (Figure 7) does not indicate a relationship between vaccines availability and the uptake of PHB. Over the April–June 2021 period, compliance weakened in Morocco but improved in Tunisia with respect to all three preventive behaviours (Figure 1). For both countries, vaccines were available for key workers, clinically vulnerable groups (non-elderly), and elderly groups between April 1st and May 31st. This continued to be the case in Tunisia. In Morocco, however, vaccines were delivered to only two of these groups from June 1st. The number of people vaccinated varied considerable across countries, with Morocco achieving a higher progress on administering more people with the vaccine. The share of people with at least one dose of COVID-19 vaccine stood at about 67 percent, 60 percent, 43 percent, and 13 percent, respectively, in Morocco, Tunisia, Egypt, and Sudan by end of March – early April (COVID-19 Data Explorer, 2022).

Figure 6. Public information campaigns in MENA (1 January 2020 – 31 August 2021)



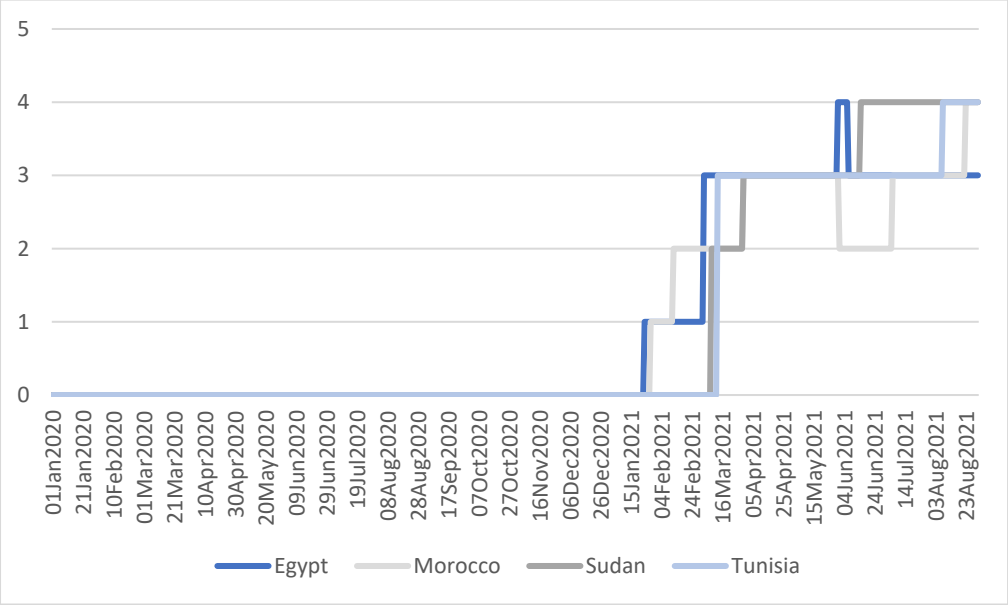
Source: Oxford Covid-19 Government Response Tracker.
Note: 0 - no Covid-19 public information campaign. 1 - public officials urging caution about Covid-19.
2- coordinated public information campaign (e.g., across traditional and social media).

The absence of an explicit relationship between closure and containment, health system, and vaccination policies and uptake of PHB in MENA could also partly be due to the difficulty to enforce public health measures in the region, especially in large, densely populated cities (e.g., Cairo).

From the discussion above, engaging in PHB against COVID-19 in MENA appears to be less shaped by government mandates or risk perception of COVID-19 than it is by psychological

and economic well-being. This applies specially to wearing masks which has proven to be the most cost-effective in containing the pandemic. The effect of individual well-being may even be more pronounced in settings where government mandates are not tightly enforced. Through affecting psychological well-being, economic hardship can move people away from abiding by preventive measures as they become less concerned about being infected with COVID-19, perceiving that they have little to lose given their already precarious existence. This may be the case of informal-sector workers, for example.

Figure 7. Vaccination policy in MENA (1 January 2020 – 31 August 2021)



Source: Oxford Covid-19 Government Response Tracker.
Note: 0 - No availability. 1 - Availability for ONE of following: key workers/ clinically vulnerable groups (non-elderly) / elderly groups. 2 - Availability for TWO of following: key workers/ clinically vulnerable groups (non-elderly) / elderly groups. 3 - Availability for ALL of following: key workers/ clinically vulnerable groups (non-elderly) / elderly groups. 4 - Availability for all three plus partial additional availability (select broad groups/ages). 5 - Universal availability.

The findings of this study suggest that addressing mental distress and economic anxiety during public health crises can increase the likelihood of engagement in PHB. Mitigating the negative effects of these crises on consumption changes together with considering labour market status can further promote PHB. In parallel, it is important to identify which determinants increased the risk of non-compliance with PHB in MENA during COVID-19. Our findings indicate that non-complying groups generally include men in Morocco and Tunisia, the younger population in all countries except Sudan, the more educated in Morocco, the less educated in Egypt, the retired in Egypt, and unpaid family workers on farms in Morocco.

The study has some limitations. The most notable arises from the fact that the CMMHH survey is constructed using a series of panel phone surveys, which could have affected the reachability of some respondents. We trust this disturbance to be very small or inexistent as the survey is nationally representative, covering a random sample of mobile phone users aged 18-64. We used individual weights for all analyses in this study. Being a survey, some of our calculations rely on self-reported information (uptake of PHB, psychological well-being, etc.), which may

introduce some noise. Further, the CMMHH survey does not include a module on vaccination availability and uptake. Despite this information being omitted, we are confident that the resulting bias is minimal if any because individual vaccine uptake is captured by the latent variable and by time (wave) effects at the country level.

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Appendix A

Table A.1. Summary statistics

	Observations	Mean	Standard deviation	Minimum	Maximum
PHB					
Physical distancing	14,322	0.851	0.356	0	1
Wearing masks	14,322	0.862	0.345	0	1
Handwashing	14,322	0.866	0.340	0	1
Psychological well-being index	14,322	1.834	1.012	0	3.788
COVID-19 risk perception	14,322	2.193	1.235	1	5
Neighbourhood effect					
Physical distancing	18,708	85.635	15.721	0	100
Wearing masks	18,708	87.132	15.845	0	100
Handwashing	18,708	87.233	14.136	0	100
Economic anxiety	14,322	3.055	1.136	1	4
Consumption change (food)	14,322	0.745	0.436	0	1
Labour market status	26,790	6.053	2.582	1	11
Confounding factors					
Gender	26,790	0.371	0.483	0	1
Age	26,790	37.979	12.269	18	64
Educational attainment	26,790	2.454	1.142	1	4
Geographical location	26,790	68715.480	13762.410	50401	81834

Table A.2. GSEM estimates of psychological well-being equation (2) (November 2020 – August 2021)
Dependent variable: Psychological well-being index
System of equations: Wearing masks

Psychological well-being	Egypt		Morocco		Sudan		Tunisia	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Economic anxiety	-0.094***	-0.072***	-0.153***	-0.108***	-0.145***	-0.135***	-0.042**	-0.033*
	(0.023)	(0.023)	(0.027)	(0.026)	(0.044)	(0.045)	(0.018)	(0.018)
Consumption change		-0.279***		-0.512***		-0.090		-0.240***
		(0.051)		(0.064)		(0.155)		(0.058)
COVID-19 risk perception	-0.036*	-0.036*	-0.074***	-0.068***	0.038	0.037	-0.029*	-0.033**
	(0.020)	(0.020)	(0.026)	(0.025)	(0.047)	(0.046)	(0.015)	(0.015)
Gender (Ref: Male)		0.043		-0.124*		-0.080		-0.026
		(0.072)		(0.073)		(0.129)		(0.045)
Age		-0.003		0.002		0.004		-0.008***
		(0.003)		(0.002)		(0.004)		(0.002)
Education (Ref: Less than basic)								
Basic		0.055		-0.027		0.240		0.128**
		(0.083)		(0.069)		(0.152)		(0.055)
Secondary		0.093		0.033		0.167		0.130***
		(0.066)		(0.069)		(0.123)		(0.046)
Higher education		0.007		-0.126		0.138		0.195***
		(0.081)		(0.083)		(0.138)		(0.058)
Latent variable *L*	-0.302	-0.362	-0.289**	-0.258**	-0.238***	-0.263***	-0.391**	-0.377*
	(0.216)	(0.402)	(0.119)	(0.104)	(0.058)	(0.078)	(0.169)	(0.213)
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Location effect	No	Yes	No	Yes	No	Yes	No	Yes
Job/activity effect	No	Yes	No	Yes	No	Yes	No	Yes
N	1,766	1,766	4,886	4,886	904	904	6,766	6,766

Notes: Each column represents a separate regression. Robust standard errors clustered at the individual level are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table A.3. GSEM estimates of psychological well-being equation (2) (November 2020 – August 2021)
Dependent variable: Psychological well-being index
System of equations: Handwashing

Psychological well-being	Egypt		Morocco		Sudan		Tunisia	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Economic anxiety	-0.092***	-0.077***	-0.146***	-0.110***	-0.163***	-0.153***	-0.043**	-0.040**
	(0.024)	(0.023)	(0.026)	(0.026)	(0.058)	(0.050)	(0.020)	(0.019)
Consumption change		-0.274***		-0.522***		-0.049		-0.253***
		(0.051)		(0.066)		(0.194)		(0.059)
COVID-19 risk perception	-0.036*	-0.037*	-0.079***	-0.084***	0.022	0.027	-0.037**	-0.037**
	(0.020)	(0.020)	(0.029)	(0.023)	(0.047)	(0.047)	(0.015)	(0.015)
Gender (Ref: Male)		0.037		-0.104		-0.092		-0.010
		(0.071)		(0.067)		(0.120)		(0.043)
Age		-0.003		0.003		0.003		-0.008***
		(0.003)		(0.002)		(0.004)		(0.002)
Education (Ref: Less than basic)								
Basic		0.045		-0.046		0.296**		0.104**
		(0.083)		(0.060)		(0.146)		(0.051)
Secondary		0.089		0.051		0.232*		0.114***
		(0.065)		(0.065)		(0.126)		(0.044)
Higher education		-0.002		-0.083		0.250*		0.191***
		(0.081)		(0.075)		(0.138)		(0.055)
Latent variable *L*	-0.559	-43.691	-0.801	-29.608	1.271	0.398	-1.233	-2.226
	(0.764)	(32.599)	(1.255)	(24.493)	(3.537)	(0.410)	(1.103)	(2.958)
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Location effect	No	Yes	No	Yes	No	Yes	No	Yes
Job/activity effect	No	Yes	No	Yes	No	Yes	No	Yes
N	1,766	1,766	4,886	4,886	904	904	6,766	6,766

Notes: Each column represents a separate regression. Robust standard errors clustered at the individual level are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.