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# The use of the Theory of Planned Behaviour as a Conceptual Framework to Understand and Promote Health Recommendations During the First Wave of COVID-19 in Mexico City

# El uso de la Teoría del Comportamiento Planeado para entender y promover recomendaciones de salud durante la primera ola de COVID-19 en la Ciudad de México

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**Abstract**

In this study, we apply the Theory of Planned Behavior to understand the factors that explained adherence to health recommendations during the first wave of Covid-19 in Mexico City. To do this, we designed and implemented an online survey on prevention measures (N=2,794). In addition, we generate an empirical model based on the Theory of Planned Behavior to hypothesize about correlations between variables in the survey. In addition, we included four simple experiments in the survey. We found that norms, attitudes and perception of control are correlated with the planning and adoption of preventive actions. In the experiments we observe (1) that corruption reduces the credibility of the government with respect to the health crisis (n=414), (2) doctors are more persuasive about prevention (n=681), and (3) masks generate feelings of security (n=700). We conclude that the Theory of Planned Behavior is useful to make sense of data from surveys like ours. We encourage governments in developing countries to use methods like ours to collect and interpret data, even if provisional, to respond to future health crises.

**Keywords:** public policy; health psychology; health crises; survey experiments; protective behaviour

**Resumen**

En este estudio aplicamos la Teoría del Comportamiento Planeado para comprender los factores que explicaron la adherencia a las recomendaciones de salud durante la primera ola de Covid-19 en la Ciudad de México. Para ello, diseñamos e implementamos una encuesta en línea sobre medidas de prevención (N=2,794). Además, generamos un modelo empírico basado en la Teoría del Comportamiento Planeado para plantear hipótesis sobre correlaciones entre variables en la encuesta. Además, incluimos en la encuesta cuatro experimentos sencillos. Encontramos que las normas, las actitudes y percepción de control se correlacionan con la planificación y adopción de acciones de prevención. En los experimentos observamos (1) que la corrupción reduce la credibilidad del gobierno con respecto a la crisis sanitaria (n=414), (2) los médicos son más persuasivos de prevención (n=681), y (3) las mascarillas generan sentimientos de seguridad (n=700). Concluimos que la Teoría del Comportamiento Planeado es útil para dar sentido a los datos de encuestas como

la nuestra. Alentamos a los gobiernos de los países en desarrollo a utilizar métodos como los nuestros para obtener e interpretar datos, incluso si son provisionales, para responder a futuras crisis de salud.
**Palabras clave:** política pública; psicología de la salud; emergencias sanitarias; experimentos en encuestas; comportamientos de prevención

## 1. Introduction

Public policy should always be built on evidence. This is no less true during emergencies. So, in March 2020, policymakers were in need of timely, science-based responses to counteract the adverse effects of the Covid-19 outbreak. By then, several problems were starting to accumulate, yet governments had barely begun to understand the magnitude of the situation (Singh et al., 2021). In addition, as treatment and vaccines were not yet available, the global responses to mitigate the virus relied on non-pharmaceutical interventions such as social distancing, face masks, hand washing, and the avoidance of public gatherings (Allam, 2020). However, the success of the majority of these actions relied on compliance rates, so the population's trust in science and the government, became a critical variable for the development of the crisis (Pavela Banai et al., 2021; Plohl & Musil, 2021).

Behavioural science was cited during the first months of the pandemic as a tool for policymakers to direct the first reaction of the population to the health crisis (Van Bavel et al., 2020). It was understood that cognitive biases could negatively affect compliance with preventive behaviours (Mohamed et al., 2021). However, behavioural science depends on theoretical models and data from surveys and experiments to provide valuable insights. Therefore it was necessary to generate data and interpret it using sound theoretical models, no matter the adverse environment of uncertainty and social isolation.

Moreover, the Covid-19 pandemic represented an even bigger challenge for developing countries such as Mexico. In Mexico, decision makers faced additional challenges because of three core reasons. First, the percentage of people in Mexico with at least one chronic comorbidity was and remains high (Kammar-García et al., 2020). Second, the weak health infrastructure meant increased vulnerability for Mexican patients (Candia-Calderon & Olivera-Villaroel, 2021). Third, the historically high levels of corruption implied a more complex, and at times suboptimal, response to the crisis (Lindor, 2021). In that context, to make the first step in the design of evidence-based policy, it was necessary to understand the factors that motivated some individuals to take more care than others as well as how to potentiate the communication of the health recommendations, based on solid theoretical models as well as data.

In this study, we aimed to understand the factors that explained the adherence to health recommendations during the first wave of Covid-19 in Mexico City. In addition, we aimed to contribute to the discussion on how to promote such behaviours. We answer two research questions. The first is exploratory, while the second identifies causality using randomised experiments. The first is: What factors explain the adherence to protective behaviours? To answer this question, we examined both the factors that explained following the recommendations at the time of the questionnaire and the factors that explained the decision to continue taking care after the first wave of the pandemic. The second research question asked if simple interventions, based on the factors examined in question one, could help promote adherence to preventive behaviours. We answered both questions using an online self-administered survey distributed to inhabitants of Mexico City in June 2020.

We applied the Theory of Planned Behaviour (TPB) as a conceptual framework throughout our study. The TPB is one of the most influential models in behavioural psychology, and it has been widely used to explain health-related behaviours (Ajzen & Manstead, 2007). Nonetheless, in this article, we did not intend to test the adequacy of the TPB to explain adherence to protective behaviours, nor did we aim to generate measurements of the elements in the TPB and then test the relations between them to ascertain if the theory adjusts to reality. We applied the TPB to generate an empirical construct of it, and thereafter understand the observed correlations and the design of simple behavioural interventions. In that sense, our study assumed a pragmatic

stance. Instead of testing if the TPB approximated exact psychometric variables that are readily available for policymakers, we used the theory to interpret data derived from a simple online survey.

The relevance of our research questions surpasses the timeframe of the peak of the Covid-19 pandemic. Other health-related crises have posed unexpected challenges for which little evidence has been made available. In this context, to design and evaluate their interventions, policymakers may find it helpful to have theories of behaviour tested during other similar moments at their disposal. This study contributes to the literature that uses the TPB, presenting it as an alternative in public policy design. We argue that online surveys and simple vignette experiments may provide insights into the population's first reactions to a health-related crisis. Additionally, we highlight the limitations of instruments such as these and stress their use only as a benchmark for designing evidence-based public policy.

The rest of this article goes as follows. In Section 2 we review the extant literature and place this study in the context of similar efforts worldwide and in Mexico. In Section 3 we present the conceptual framework and an empirical model based on the theory, which led to our testable hypotheses. In Section 4 we describe the methodology used to collect the data using the online survey. Section 5 contains a detailed explanation of the variables related to the elements in the TPB used in our analysis. Section 6 presents the tests of our exploratory hypotheses to answer our first research question. In Section 7 we answer our second research question by presenting the designs, methods, and results of the four survey experiments. Finally, in Section 8, we outline the limitations of our study, present conclusions in the form of a summary of results, and discuss the research implications.

***Literature review***

The onset of the pandemic created the need for solid academic research that could inform policymakers. In addition, the increased use of web-based solutions and social media made it natural for researchers to imagine online surveys as an instrument to gather data in those adverse circumstances. As these online tools are not restricted to a particular location and the pandemic was a global problem, some researchers designed and implemented online questionnaires on a large scale, attempting to obtain information from a worldwide sample of respondents. The majority of these early studies were not as preoccupied with probabilistic sample selection and representativeness as they were on obtaining information about the first reactions of the population to the pandemic.

Most international surveys concentrated on compliance with recommendations (Kim & Ryu, 2021) and risk perceptions among the population (Anaki & Sergay, 2021). Other studies focused on more specific topics. For example, Van Bavel et al. (2022) analysed the effect of national identity on protective behaviours. Bicchieri et al. (2021) used simple survey experiments to explore the role of social norms in protective behaviours. During the design of our survey, we were particularly inspired by the study of Hensel et al. (2022). Using an online questionnaire distributed in 58 countries, with more than 100,000 respondents, these authors studied the role of social norms in explaining adherence to protective actions.

The distribution strategies of the worldwide surveys meant some countries would ultimately be under-represented. Thus, these surveys would be less helpful in informing public policy in those under-represented countries. That was often the case of Mexico. As a response, some research teams focused on studying the response of the population in specific places. Many of these studies analysed the effects of the pandemic on depression and anxiety. For example, Campos et al. (2020) analysed the impact of social isolation due to Covid-19 on depression and anxiety in Brazil. Using a similar methodology, Nagasu et al. (2021) observed the same variables in a non-probabilistic sample of Japanese residents. A noteworthy study was implemented in Poland, where Debowska et al. (2020) undertook a panel study on the student population. With repeated measurements, they showed that the effect of the pandemic on depression was progressing alongside the virus.

In Mexico, an effort was made to understand the early development of the pandemic, with a representative sample obtained using a version of the National Health and Nutrition Survey (ENSANUT) adapted to the context of Covid-19 (Rivera-Domarco, 2021). Later, the same instrument was used to study the

acceptance of the vaccine in Mexican residents (Carnalla et al., 2021). Despite the usefulness of that survey, its content fell short of identifying other effects of the pandemic and how the Mexican population's attitudes, perceptions, and beliefs relate to compliance with the health recommendations. In a similar exercise, the firm Buendía & Laredo (2020) implemented a series of opinion polls with representative samples using the probabilistic method of calling mobile phones. Their questionnaires found that the majority of people were pessimistic at the beginning of the health crisis and felt that more governmental support was needed, while they simultaneously endorsed the health recommendations and attempted to follow them. However, the questionnaires by Buendia & Laredo were not designed for academic research nor to derive actionable public policy recommendations.

To fill these gaps, researchers in Mexico designed simple online questionnaires to understand the first response of specific population groups. For example, Gutiérrez García et al. (2021) implemented a survey to estimate the emotional impact of the pandemic on students in Guanajuato. Additionally, Hermosillo-de-la-Torre et al. (2021) studied suicidal behaviour in adolescents in Aguascalientes. Moreover, Sánchez-Arenas et al. (2021) implemented an online questionnaire with similar questions and samples to those in this current study. Their work was valuable in helping us to confirm some of our observations, although their approach differentiated from ours. First, their geographical scope was more extensive given it comprised the State of Mexico. Second, they did not position their results within a theoretical framework using variables related to psychological constructs. Third, we added causal tests using experimentation to our purely descriptive observations. To the best of our knowledge, only the studies conducted by Martinez et al. (2021a, 2021b) also tested hypotheses based on behavioural science using vignette experiments in online surveys in Mexico. We direct interested readers to those papers focused on the role of social norms and framed messages in the adoption of protective behaviours and tracing applications.

This study has several similarities to the previous literature on motivation, design, and distribution methods. It shares the advantages of collecting information quickly in the adverse environment of the pandemic with previous studies. However, our study also shares some shortcomings, including the non-representative nature of the sample and the inevitable biases of measurements made in self-administered online surveys. We describe these limitations further in Section 8 of this article.

Nevertheless, our study contributes to the literature in three ways. First, we limited our sample and research questions to the inhabitants of just one city. This allowed us to direct our time resources to distribute the questionnaire in non-traditional venues, such as neighborhood groups on social media. These groups helped us ensure that we had participants from all municipalities in Mexico City. Therefore, although our sample was not representative of all socioeconomic variables, it ensured comprehensive coverage of social groups in the City. Second, in contrast with previous studies that presented their results purely descriptively, we interpreted our data within a solid theoretical framework: the TPB. We used this theory to make sense of the data, suggest testable hypotheses and offer public policy advice using information easily accessible to public officials. Finally, this study combined tests of exploratory and causal hypotheses by incorporating simple behavioural experiments. Therefore, we offer a sound first step in evidence-based public policy to respond to Covid-19 and similar crises in the future.

## *Theroretical framework and hypotheses*

### *The Theory of Planned Behaviour*

In its original formulation, the TPB explains a behaviour from its proximal determinants: intention—wanting to do something, and perceived behavioural control (PBC)—feeling the capacity to do as intended. Intention is explained by the combination of PBC, attitudes—our position concerning the behaviour after an evaluation based on our beliefs about it, and social norms—beliefs about the acceptability of the behaviour (Ajzen, 1991). Researchers have used the TPB to explain behaviours in diverse fields including health, business, and environmental sciences (Bosnjak et al., 2020; McEachan et al., 2011). Such applications have required adaptations and have included other factors such as beliefs, past experiences or habits, and self-identity (Conner

& Armitage, 1998). However, the essential elements of the theory have remained consistent and are recognised as robust concerning empirical scrutiny (Ajzen, 2020).

We adapted and used the TPB as a conceptual framework to derive hypotheses about the determinants of planning to adopt and sustain protective behaviours against the spread of the Covid-19 pandemic in Mexico City. Moreover, we used the theory to motivate causal claims regarding how to promote adherence to health recommendations. Figure 1 presents our adapted version of the TPB. Following similar applications of the theory, we included the role of perceived risk as a determinant of the social norms, attitudes, and PBC constructs (Schmiege et al., 2009). Further, like other modern presentations of the TPB, we included the role of beliefs. However, to simplify the explanation of the mechanisms from which we derived our hypotheses, we understood beliefs as part of the contextual factors with other socioeconomic controls; that is, we assumed beliefs affect all the elements in the model. This allowed us to show how to affect the determinants of intention and behaviour through reminders or specific framings of information about the government, the pandemic, or recommendations.

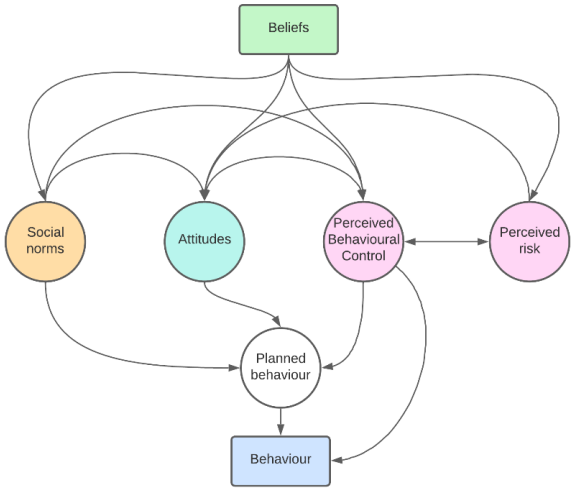


**Figure 1.** *Theory of Planned Behaviour (Adapted for Covid-19/CDMX).*
*Source:* own elaboration based on Ajzen (1991) and Bosnjak et al. (2020).

The effect of beliefs on social norms derives from observations about the behaviour of others and the acceptance of specific protective actions. Likewise, beliefs affect attitudes in terms of understanding information about the virus. Attitudes affect planned behaviour in terms of perception of the importance of the pandemic as a dangerous problem and thereby protection as a necessity. Further, behavioural control is affected by beliefs regarding the knowledge of what is recommended and expectations of how long it is necessary to do it. PBC directly affects the adoption of protective action through actual behavioural control given the assumption that the individual cannot act if they have no direct control over the situation, no matter their intentions. Finally, perceived risk affects attitudes and PBC, whereby we assume that the greater the perceived risk of getting the virus, the more positive the attitude of an individual and the lower the PBC.

For example, we can explain the behaviour of planning to use a face mask when going to the supermarket. Planning to do it and finally doing so are affected by intention, however, doing so is critically dependent on whether the person has a face mask to begin with (i.e., PBC). The intention is affected by social norms; that is, if the person perceives that using a face mask is acceptable and expected by others in the supermarket. Similarly, a person's intention is determined by their attitude towards face masks. If they receive information that Covid-19 could affect their health—that the virus spreads through the air and that face masks effectively prevent infection—the person may evaluate usage as convenient. Likewise, their intention to use a face mask is determined by their perceived capacity to do so (i.e., PBC). If the person thinks they know how to

use one and has confidence that face masks are temporal and thus bearable, they might have an increased willingness to comply with the recommendation. Finally, a person's PBC and attitudes are additionally affected by their experiences with the virus and the risk of infection they perceive.

***Empirical model based on the TPB***

The elements of the TPB are not readily observable but always latent in other variables. Likewise, it is necessary to consider the influence of relevant external variables such as the socioeconomic context of the individual and the protective behaviours of the person. Previous literature has shown how the TPB adjusts to explain protective actions assumed in the pandemic (Trifiletti et al., 2022). Further, numerous articles have concentrated on the application of TPB in the context of specific actions during the pandemic, such as social isolation (Frounfelker et al., 2021; Gibson et al., 2021), vaccination (Shmueli, 2021; Wolff, 2021), or face mask use (Irfan et al., 2021; Pan & Liu, 2022). In all these studies, the researchers used precise measurements for social norms, attitudes, intentions, and risk to predict behaviour. The majority of these studies concluded that the TPB assumptions correctly approximate an individual's decision-making process regarding the prevention of contagion.

For this study, we assumed those results as given and applied the intuition of the TPB to make sense of our observations in an online survey implemented during the first wave of the pandemic in Mexico City. Consequently, we interpreted variables in our survey, as related to the elements in the TPB to produce hypotheses regarding our observations and experiments. We aimed to offer public policy designers an example of how using an existent theory is possible in the design timely instruments to understand behaviour and simple interventions to change it.

Figure 2 presents the empirical model based on the TPB that we constructed to explain actions taken to prevent the spread of the virus. We offer a detailed explanation of each of the variables and statistics in Section 5. We reiterate that, for this empirical model, we did not assume that our variables were psychometric measurements of the elements in the theory; rather, we related the variables available in our survey to the constructs in the theory. Therefore, we were able to order the variables in our survey to develop testable hypotheses. Further, we recognize that public officials do not always have precise psychometric measurements at hand, therefore, instead of attempting to show, as other studies have, that the TPB adjusts to the observations, we applied the theory to understand our observations and design simple interventions. Section 7 of this article tests those interventions to derive actionable policy recommendations.

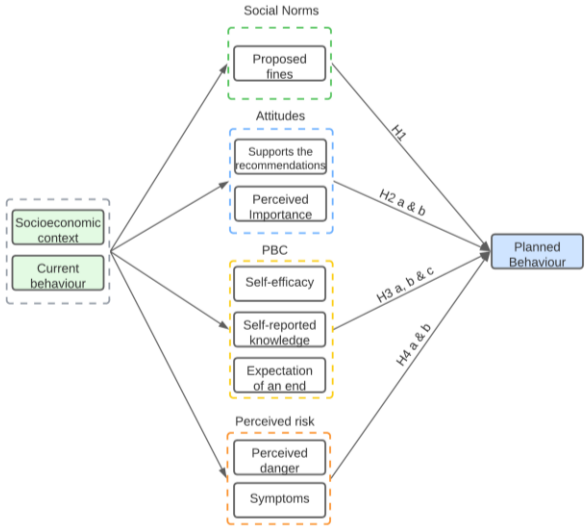


**Figure 2.** *Empirical model based on the TPB-Covid 19/ CDMX.*

We related the willingness to impose fines on the deviant actions of others, such as not wearing a face mask or going to work while having symptoms, to the component of 'social norms' in the TPB. This method of approximating social norms has been well-rooted in the behavioural sciences literature, which has related social norms to the development of third-party punishments to promote cooperation (House et al., 2020). Moreover, we assumed that the attitudinal element of the TPB correlated to explicitly support the recommended preventative measures and the perceived importance of the pandemic. Additionally, we related PBC to a prediction of whether the city would return to the same state as before the pandemic[1], an own-given score of how well an individual prevented being infected compared to others, and a self-reported level of knowledge about the virus. Further, we assumed that the 'perceived risk' element was related to whether the respondent declared having had symptoms and an intrinsic measurement of the estimated probability of dying because of the virus.

***Hypotheses***

Using the empirical model, our hypotheses predicted that social norms, attitudes, PBC, and perceived risk would be correlated to reporting having adopted protective behaviours at the time of the study. Similarly, we predicted that those same constructs would be related to reporting and planning to continue those behaviours after the first wave of the pandemic. We present our exploratory hypotheses in Table 1.

**Table 1.** *Exploratory hypotheses*

| TPB Assumption | Empirical meaning of the assumption | Specific Hypotheses in Our Study |
|---|---|---|
| 'Social norms' are related to 'protective behaviour'. | The average of 'proposed fines for deviant actions' is related to 'protective behaviour'. | H1a. The average proposed fine for deviant action is correlated with the proportion of adopted preventive behaviours.<br>H1b. The average proposed fine for deviant action is correlated with the proportion of behaviours planned to continue after the first wave of the pandemic. |
| 'Attitudes' are related to 'protective behaviour'. | 'Supporting the recommended measures' is related to 'protective behaviour'. | H2a/1. Supporting the recommended measures is correlated with the proportion of adopted preventive behaviours.<br>H2a/2. Supporting the recommended measures is correlated with the proportion of behaviours planned to continue after the first wave of the pandemic. |
| | 'Perceived importance of the pandemic' is related to 'protective behaviour'. | H2b/1. The perceived importance of the pandemic is correlated with the proportion of adopted preventive behaviours.<br>H2b/2. The perceived importance of the pandemic is correlated with the proportion of behaviours planned to continue after the first wave of the pandemic. |
| 'Perceived behavioural control' is related to 'protective behaviour'. | 'Reported knowledge' is related to 'protective behaviour'. | H3a/1. Reported knowledge is correlated with the proportion of adopted preventive behaviours.<br>H3a/2. Reported knowledge is correlated with the proportion of behaviours planned to continue after the first wave of the pandemic. |
| | The score of good behaviour given to others is related to 'protective behaviour'. | H3b/1. The score of good behaviour given to others is correlated with the proportion of adopted preventive behaviours.<br>H3b/2. The score of good behaviour given to others is correlated with the proportion of behaviours planned to continue after the first wave of the pandemic. |
| | 'Optimism' is related to 'protective behaviour'. | H3c/1. Optimism is correlated with the proportion of adopted preventive behaviours. |

[1] We call this *optimism* in the rest of the article.

| TPB Assumption | Empirical meaning of the assumption | Specific Hypotheses in Our Study |
|---|---|---|
| | | H3c/2. Optimism is correlated with the proportion of behaviours planned to continue after the first wave of the pandemic. |
| 'Perceived risk' is related to 'protective behaviour'. | Having experienced symptoms is related to 'protective behaviour'. | H4a/1. Having experienced symptoms is correlated with the proportion of adopted preventive behaviours.<br>H4a/2. Having experienced symptoms is correlated with the proportion of behaviours planned to continue after the first wave of the pandemic. |
| | The perceived danger of the virus is related to 'protective behaviour'. | H4b/1. The perceived danger of the virus is correlated with the proportion of adopted preventive behaviours.<br>H4b/2. The perceived danger of the virus is correlated with the proportion of behaviours planned to continue after the first wave of the pandemic. |

Although the correlational literature supporting the TPB is undisputedly vast, the related experimental evidence of the causal effects remains limited (Conner, 2020). To design evidence-based public policy, it is critical to understand not only that two variables are correlated, but also that an outcome can be affected through intervention with one of its causes. Survey experiments can be the first step to undercover causal relationships between constructs (Mullinix et al., 2015). Therefore, to answer the research question of whether simple behavioural interventions based on the TPB could be a tool to respond to Covid-19 and future health crises, we designed four survey experiments. These experiments were based on simple vignettes and asked direct questions. Table 2 presents our hypotheses about causality. We detail the specific motivations and context of each hypothesis in Section 7.

**Table 2.** *Causal hypotheses (Experiments).*

| Experiment | TPB Element | Hypotheses |
|---|---|---|
| *Experiment 1.*<br>The effect of perceived corruption on trust in the government during the health crisis. | Perceived behavioral control | H4/E1/1. Higher perception of corruption decreases trust that the government is being honest with respect to the pandemic.<br>H4/E1/2. A higher perception of corruption decreases trust in medical personnel.<br>H4/E1/3. A higher perception of corruption decreases willingness to stay at home right after the peak of contagion. |
| *Experiment 2.*<br>The effect of different actions on the credibility of the recommendations. | Social norms | H4/E2/1. Different social actors have different levels of credibility regarding influencing the behaviour of using a face mask.<br>H4/E2/2. Different social actors have different levels of credibility regarding influencing the willingness to stay at home right after the peak of contagion. |
| *Experiment 3.*<br>The effect of widespread face mask usage on feelings of safety. | Social norms | H4/E3/1. Widespread face mask usage causes feelings of safety.<br>H4/E3/2. Widespread face mask usage increases willingness to stay at home right after the peak of contagion. |
| *Experiment 4.*<br>The effect of different messages on compliance with protective behaviours. | Attitudes | H4/E4/1. Different messages promote different levels of commitment to protective behaviours.<br>H4/E4/2. Different messages promote different levels of willingness to stay at home right after the peak of contagion. |

## 3. Methods, techniques, and instruments

### 3.1. Description of the survey

To answer our research questions, we designed an online survey concentrated on actions, attitudes, and beliefs related to Covid-19 in Mexico City. The content of the survey was distributed in three parts. First, we asked participants about their knowledge of the virus, their protective behaviours, and the social norms surrounding them. Second, we randomised each participant into one of four experiments. Third, we asked them about their expectations regarding the end of the pandemic and conducted a standard socioeconomic questionnaire. We present a flowchart of the survey in the Appendix 1.

Given that we designed the survey to be distributed through social networks, ensuring the quality of the collected data was a key challenge from the conception of the study. Therefore, we intended the questionnaire to be as easy to answer as possible by avoiding complex language, using closed answers, and prioritising interactive graphics such as sliders and graphs instead of text-based answers. As some of the questions were dependent on others and participants answered one of four different experiments, the length of the survey varied; respondents answered at least 31 questions and at most 45. On average it took respondents less than 15 minutes to answer all the questions in the survey (M= 13.909, SD= 5.967).

### 3.2. Materials and software

We implemented the survey using Qualtrics, a platform that enables the development, distribution, and reporting of online questionnaires. Data analysis conducted in the statistical program Stata 17. We present a detailed version of the survey in Spanish and English on the OSF page. In the same repository, we included the anonymised version of the database and detailed documentation of its preparation and our analysis in do-files. Additionally, it is possible to find a data dictionary with the precise definitions of all the variables collected in the data and used in the analysis. Finally, that repository includes the Appendix of this paper[2].

For our exploratory results presented in section 6 we use multivariate linear regressions to estimate our models. For the experimental results we use logistic and multivariate regressions. The Romano-Wolf p-value corrections were implemented using the algorithm described by Clarke et al. (2020). Further, we present the majority of our results in coefficient graphs created using the Stata command developed by Jann (2014).

### 3.3. Distribution of the survey and sample selection

We distributed the survey to a convenience sample of Mexico City adult residents. Our main distribution outlet was social networks and our strategy focused on publishing the survey link in neighborhood groups on Facebook. These are groups organised by the residents of different areas of Mexico City, which function as local support networks. To motivate people to participate, we raffled 10 gift cards with an individual value of approximately two days of minimum daily wage (200 MXN or 10 USD).

The link we distributed received 3,619 interactions between June 1 and June 18, 2020, during the first wave of the pandemic in Mexico City. After we closed the data collection, we excluded answers from participants who did not complete it or answered carelessly. Therefore, we eliminated the observations of those who did not answer all the questions (n = 645), those who took less than 5 minutes (n = 28) or more than 40 minutes (n = 151), and those who declared to be younger than 18 years old (n = 1). We retained answers from 2,794 respondents. In the Appendix we include a STROBE flowchart of the sample selection process (von Elm et al., 2007).

### 3.4. Sociodemographic Characteristics of Survey Respondents

Table 3 presents an overview of the participants' sociodemographic characteristics. According to the 2020 Mexican Census, the median age of residents in Mexico City was 35 years old and the average number of people per household was 3.3 (Instituto Nacional de Estadística, Geografía e Informática [INEGI], 2021). In our sample,

[2] These materials can be found at https://osf.io/a9wft/?view_only=6e143395311d474c91878669f3c31084

the average age of respondents and the average size of their households were similar to those of the population in Mexico City, based on the 2020 Census. Nonetheless, we found expected differences given the online nature of the survey and our distribution method. For example, the proportion of participants who identified as female, 63.49%, was higher than that of the population (52.2%). Similarly, although we had answers from individuals across all levels of education and income, respondents in the survey were more educated and earned more money than the average inhabitant of Mexico City. Our efforts to reach a diverse set of participants were successful, but not to the extent that a representative sample was obtained. Public officials should not view these difficulties as an obstacle to attempting to collect answers quickly following a similar method.

**Table 3.** *Participants' Characteristics*

| | | Gender | | | |
|---|---|---|---|---|---|
| | | **Men** | **Women** | **Non-Binary / Other** | **Total** |
| N | | 1,010 | 1,774 | 10 | 2,794 |
| Percent | | 36.15% | 63.49% | 0.36% | 100.00% |
| Age | | 37.81 | 38.56 | 30.60 | 38.26 |
| | | (12.54) | (12.10) | (7.99) | (12.26) |
| Household size | | 3.28 | 3.49 | 3.10 | 3.41 |
| | | (1.37) | (1.40) | (1.20) | (1.40) |
| Rooms in the house | | 3.37 | 3.31 | 3.90 | 3.33 |
| | | (1.18) | (1.19) | (1.10) | (1.18) |
| Receives support from the government | | 0.06 | 0.09 | 0.00 | 0.08 |
| | | (0.25) | (0.28) | (0.00) | (0.27) |
| Lives with someone with comorbidities | | 0.51 | 0.55 | 0.70 | 0.54 |
| | | (0.50) | (0.50) | (0.48) | (0.50) |
| Lives with a comorbidity | | 0.32 | 0.35 | 0.30 | 0.34 |
| | | (0.47) | (0.48) | (0.48) | (0.47) |
| Education | Primary School | 0.20% | 0.51% | 0.00% | 0.39% |
| | Secondary School | 1.29% | 3.83% | 0.00% | 2.90% |
| | High School | 11.19% | 16.97% | 0.00% | 14.82% |
| | Bachelor's degree | 60.40% | 58.79% | 80.00% | 59.45% |
| | Master's degree | 20.69% | 16.74% | 20.00% | 18.18% |
| | Doctoral Degree | 6.24% | 3.16% | 0.00% | 4.26% |
| Income | Less than 6,000 MXN | 16.35% | 31.01% | 10.00% | 25.63% |
| | 6,000–12,000 MXN | 21.87% | 25.34% | 20.00% | 24.07% |
| | 12,000–18,000 MXN | 19.56% | 18.02% | 20.00% | 18.58% |
| | More than 18,000 MXN | 42.23% | 25.63% | 50.00% | 31.72% |

*Note:* The table shows the mean outside of parenthesis and SD in the parentheses. For the variables Education and Income, we show percentage of participants in each level. Household size includes the respondent. Comorbidities are medical conditions related to a higher risk of contracting or developing more severe symptoms of Covid-19; they include diabetes, hypertension, obesity, and asthma. The income level responses were reported Mexican Pesos (300 USD equals approximately 6,000 MXN).

### 3.5. Definition of the variables related to the elements in the TPB

To measure the main elements of the empirical model based on the TPB, we included a broad set of questions about the attitudes, beliefs, and perceptions regarding the pandemic in the survey. In this section, we describe the methods and questions we used and provide basic descriptive statistics of those variables. We highlight that the possible analyses that can be derived from the database we built with our survey are not limited to those presented in this article. We encourage future investigations to seize the possible uses of the database.

#### 3.5.1. Social Norms

We related the construct of 'social norms' in the TPB to the average of the proposed fine by the survey participant for 11 behaviours that may increase the risk of contagion. The complete list of these behaviours can be found in the Appendix and includes actions ranging from coughing without covering the mouth in a public space to intimidating medical personnel. In using this variable, we assumed that, if a person perceives others

taking precautions, they receive doing so as the social norm. Additionally, we assumed that a person proposes higher fines against deviant behaviour after internalising the social norms that prevent those behaviours. Hence, higher scores on the questions about behaviour of others and higher proposed fines may signal a stronger influence of social norms.

### 3.5.2. Attitude

In the TPB, attitudes have been defined as reflecting 'the overall evaluations of the behaviour by the individual' (Conner, 2020, p. 24). We assumed that we could relate this to two variables: one regarding the support of the behaviour and another concerning the importance of the pandemic as a topic. The logic behind this is that the evaluation of the behaviour will be positive, and thus the individual's attitude toward that behaviour will be as well, if they believe that the behaviour is convenient and if they consider that the pandemic is important. Therefore, in our analysis we included two questions related to this construct. The first asks the participants directly if they support the recommended actions or not, with a value of one or zero, respectively. The second asks about the perceived importance of the pandemic in Mexico. This variable takes values from 1 to 10, where 0 represents thinking that it is not important and 10 is the belief that it is the most important topic.

### 3.5.3. Perceived Behavioural Control (PBC)

PBC is a construct of an individual's opinion that they can behave in a certain way; in this case, they can comply with the protective recommendations. This perception is related to the sense of self-efficacy, knowledge about the virus, and the cost of the behaviour. We understood three variables in our database as related to PBC.

The first measurement was how costly the protective behaviours are. We assumed that, all else constant, the costs of a protective behaviour were lower if an individual thought it was a temporary precaution. Thus, we approximated these costs with the optimism of the participant regarding the pandemic. In our analyses, this variable assumed the value of 1 if the participant believes that the city would eventually come back to its previous state irrespective of the effectiveness of the recommendations. The second variable was a measure of self-efficacy. We asked participants to give a grade from 1 to 5 concerning how well they and others have protected themselves from Covid-19 during the preceding week. We understood self-efficacy as how much better or worse an individual perceives that they are taking care compared to others. Finally, we used a unique and direct question about their knowledge of the virus to measure the level of information participants had about it. Thus, the variable 'self-reported knowledge about Covid-19' assumed values from 0 to 10, where 0 represented declaring to have no information at all and 10 represented having all the relevant information about it.

### 3.5.4. Perceived Risk

We use two variables related to perceived risk. The first was a dummy variable that took the value of 1 when the participant answered that they had experienced symptoms of Covid-19. We assumed that if a participant felt they had been infected with the virus, they understood it as more contagious and, thus, perceived a higher risk from the pandemic. The construction of the second variable was more elaborate. Here, we used two questions in the survey: One asked participants to estimate the number of people out of 100 that would die if infected with the virus, while the other asked participants to estimate their probability of being infected in the near future. The product of these variables can be understood as the implied perceived probability of dying from Covid-19.

On average, the implied probability in our sample (M= 0.116, SD = 0.154) proved much higher than the actual mortality rate of Mexico City residents two years after the start of the pandemic. However, we must consider that at the time of the distribution of the survey, there was significant uncertainty concerning the virus, and both probabilities addressed in the questions regarding risk were relatively small in reality. Thus, it is unlikely that these variables represent respondents' actual estimates in terms of probability. However, the

implicit probability of dying from Covid-19 can be used as a proxy for the respondent's subjective perception of danger at that moment in time.

### 3.5.5. Attitudes and beliefs about Covid-19

Table 4 presents a comparison of the control variables by gender. In column 5, we present the p-value for independent samples t-tests of the differences in means between genders. Column 6 presents Romano-Wolf's adjusted p-values (RW p-values) to correct for multiple hypothesis testing. We observed that by the time participants answered the questionnaire, men and women had significant differences in most of the explanatory variables of the TPB. Men reported more knowledge of the virus, graded their own and others' behaviour better, and appeared to be more optimistic concerning the pandemic. Women reported more support for the recommended measures and perceived the virus as more dangerous. It is important to note that we do not deem from this that men were more informed or behaved better than women, but only that their attitudes, their sense of control, and the way they internalised social norms differed.

An interesting secondary observation from this data is the difference between the score given to the own behaviour and the behaviour of others. Previous research has shown that 'the scope of people's ignorance is often invisible to them' (Dunning, 2011, p. 247). This phenomenon has been mentioned in literature as the Dunning-Krueger effect, of which a consequence in many domains is that poor performers tend to be largely unaware of the deficiency of their level. It is possible that individuals in our sample were affected by the Dunning-Krueger effect and, consequently, considered that their protective habits were much better than the habits of others in Mexico City. This phenomenon is far from innocuous during a health crisis. Previous research has found that more optimistic individuals engage in fewer behavioural changes (Fragkaki et al., 2021; Pascual-Leone., 2021). Therefore, people who misjudge their good behaviour and who are, in general, optimists concerning a crisis will show more resistance to adopting new protective habits. In our sample, that could be the case for men.

**Table 4.** *Attitudes and Beliefs about Covid-19 Among Survey Participants.*

| | Men | Women | Diff. | p-value | RW p-value |
|---|---|---|---|---|---|
| Self-reported knowledge of the virus. | 8.426 | 8.199 | 0.226 | < 0.001 | 0.002 |
| | (1.405) | (1.527) | (0.061) | | |
| How well are the others taking care? | 3.264 | 3.191 | 0.073 | 0.0036 | 0.023 |
| (1 to 5) | (0.626) | (0.646) | (0.025) | | |
| Average proposed fine | 3.800 | 3.984 | -0.185 | 0.0186 | 0.0649 |
| (thousands of MXN). | (1.976) | (1.996) | (0.078) | | |
| Support the recommended measures. | 0.833 | 0.917 | -0.084 | < 0.001 | < 0.001 |
| | (0.373) | (0.277) | (0.012) | | |
| Stated importance of Covid-19. | 8.936 | 8.942 | -0.006 | 0.9207 | 0.9161 |
| | (1.456) | (1.432) | (0.059) | | |
| Perceived danger of Covid-19 | 8.318 | 13.518 | -5.200 | < 0.001 | < 0.001 |
| (0 to 100). | (12.205) | (16.734) | (0.624) | | |
| Optimism. | 0.371 | 0.271 | 0.101 | < 0.001 | < 0.001 |
| | (0.483) | (0.444) | (0.018) | | |
| How well are you taking care? | 4.375 | 4.449 | -0.074 | 0.0078 | 0.032 |
| (1 to 5) | (0.703) | (0.706) | (0.028) | | |
| Has had symptoms of Covid-19. | 0.344 | 0.328 | 0.015 | 0.4047 | 0.6583 |
| | (0.475) | (0.470) | (0.019) | | |

*Note*: n = 2,784. Observations with gender 'other' were omitted (n = 10).

### 3.5.6. Adherence to Protective Behaviours Among Survey Participants

In June 2020, a few months after the beginning of the pandemic, there was still uncertainty about the ways in which the virus was transmitted (Carvalho et al., 2021). Consequently, the recommended and enforced protective measures varied in content and stringency (Hale et al., 2021). In Mexico, there was an absence of a uniform national response to the virus, therefore reactions varied across federal states. The government of

Mexico City focused its recommendations on social isolation, increased hygiene, and the use of face masks (Knaul et al., 2021). However, according to anecdotal reports, inhabitants of Mexico City began to take additional protective measures such as changing clothes, leaving their shoes out when arriving home, and increasing exercise. Although beneficial for general health and to some extent espoused by the authorities of the city, these additional measures were never supported by robust scientific evidence as effective in preventing Covid-19, however, such behaviours probably increased feelings of safety and reduced stress (Carmona, 2021). Future research should investigate the effect of adopting non-effective measures on the acceptance of scientifically based measures.

We included questions about adherence to 10 protective behaviours in the survey. The government recommended seven of these measures and these measures effectiveness against the spread of the virus were, at least at that time, scientifically supported. We called these measures useful behaviours: using face masks, washing hands often, avoiding crowded places, avoiding hugging, avoiding going out, keeping recommended distances, and using disinfectant. For the other three measures included in our study, there was no scientific support nor an explicit recommendation from the government: leaving shoes outside, changing clothes, and doing more exercise. In the Appendix we show a comparison of the proportions of adoption of these measures by gender.

Additionally, we asked participants which of the protective actions they planned to maintain after that first phase of the health crisis. We present the findings of both questions in Figure 3. It is noteworthy that individuals planned to maintain all measures less after the first wave of the pandemic. Likewise, we observed that costly actions like avoiding going out and keeping a safe distance were planned to have the most significant changes in adherence. In the Appendix, we present the proportions of adherence to the protective behaviours. We used these proportions as dependent variables for testing our exploratory hypotheses.

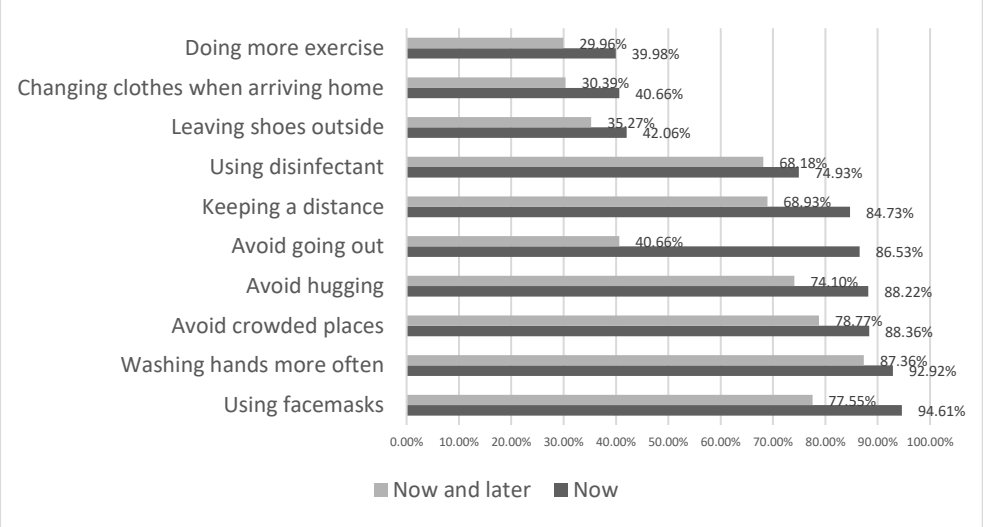


**Figure 3.** *Adherence to 10 Protective Behaviours.*
*Note:* n = 2,794. Respondents could select more than one option. 'Now' means that the participant declared adhering to the behaviour at the time of the study. 'Now and later' means that the participant declared both adhering to the behaviour and planning to maintain it after the first peak of contagion.

### 3.6. Test of exploratory hypotheses

#### 3.6.1. Empirical strategy: exploratory hypotheses

The exploratory hypotheses of this study are about the relation of some variables associated with the elements in the TPB with the reported protective behaviours. Applying the TPB, we predicted that its elements were directly related to the reports of the current and planned behaviours and that they are correlated with each

other. Therefore, to test our hypotheses, we needed to control for the other explanatory variables jointly with the socioeconomic context of the individual, as Figure 2 presents. Therefore, we used multivariate linear regression as an empirical strategy to observe those relations. We estimated the following model:

$$Y_{i,j,k} = \alpha_i + \boldsymbol{\beta}\mathbf{X_i} + \boldsymbol{\delta}\mathbf{Z_i} + \varepsilon_{ihd} \qquad (1)$$

In equation (1), $Y_{i,j}$ is the proportion of protective actions that the respondent *i* reported to undertake at that moment—signalled by $j = now$—or planned to continue after the first wave of contagion—signalled by $j = now\ and\ after$. These protective measures are explained in Section 5. We estimated two independent analyses for two sets of protective actions. One, $k = all$, includes all protective behaviours explained in Section 5; the other, $k = useful$, includes only the protective behaviours explained in the previous section that were outlined as useful and promoted by the city's government. $\mathbf{X_i}$ is a vector of the variables related to the components of the TPB detailed in Section 5. $\mathbf{Z_i}$ is a vector of socioeconomic controls such as age, household size, rooms in the house, and comorbidities. $\boldsymbol{\beta}$ are the coefficients of interest, which reflect the relation of the explanatory variables to the proportion of adopted actions.

### 3.6.2. Results: Exploratory Hypotheses

Figures 4 and 5 present the coefficients of interest, including standard errors at the 95% level. The first figure presents the results for current protective behaviours. The second figure presents the results for plans to continue with the behaviours after the first wave of contagion. Significant point estimates on the right-hand side of zero represent rejections of the null hypothesis of no-effect of the explanatory variable. Table 5 presents the results of these regressions, including all control variables and using standard errors robust to heteroscedasticity. The Appendix includes kernel-density graphs that show the normality of the residuals in our regressions.

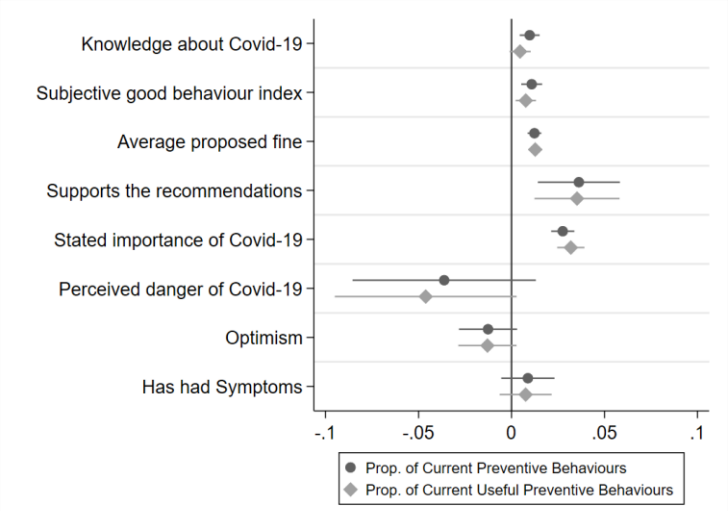


**Figure 4.** *Factors related to adherence to protective behaviours.*

As depicted in Figure 4, we observed that for current behaviours, all variables, except those related to the perception of risk, are correlated to the proportion of preventive behaviours. It is noticeable that the main predictors of the proportion of adopted behaviours were (1) supporting the recommendations and (2) the stated importance of the pandemic. Those variables relate to the 'attitude' element in our theoretical model, which highlights the importance of convincing the population of the relevance of the health crisis and the

effectiveness of the recommendations. We interpreted the null effects of the variables related to risk as indicative that there was, at least during the first months of the pandemic, significant confusion and misinformation about the situation. Thus, a correct analysis of its risk was not determinant of the individual response to the new environment. Individuals adopted behaviours based on their perceived knowledge, the social norms, and recommendations from the government.

When we restricted our analysis to the useful behaviours we obtained similar results. However, we no longer observed an effect of knowledge of the virus. A possible interpretation of this lesser effect of knowledge is that, in the initial environment of confusion and contradictory information, increased knowledge was enough to convince individuals to adopt protective behaviours, although it was not yet enough to be informative as to which actions were useful.

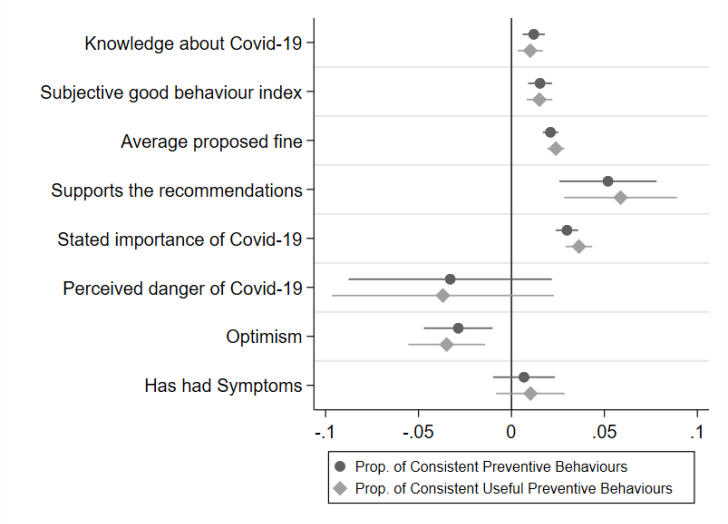


**Figure 5.** *Factors related to planning to continue adherence to protective behaviours*

In the analysis of actions planned to be undertaken after the first peak of the pandemic we found similar correlations, as shown in Figure 5. However, in contrast with those results, optimism, that is, believing that the city would return to its previous state regardless of the recommendations, was negatively correlated with continuing the protective behaviours. This indicates a sense that taking individual care was irrelevant to the outcome in the city, thereby reducing the chance of sustained effort in preventing the spread of the virus and so decreasing the chance of returning to normality. This highlights the need to appeal to individual responsibility and the need for sustained action to prevent new contagions.

It is noteworthy that few of the socioeconomic controls were related to the adherence to the protective actions, as shown in Table 5. Concerning answers about actions undertaken—columns (1) and (2)—only household size and level of education were exceptions. Additionally, income was related to actions planned to be taken after the first wave of contagion—columns (3) and (4). We interpreted this as suggestive of the robustness of the TPB as an explanatory model, given the variables related to the elements of the TPB carry the majority of the explanatory weight of the behaviour. Wealthier, more educated, and older individuals were shown to adopt a higher proportion of protective actions, which highlights the importance of not only wanting to take preventive actions but having the resources to do so as an explanation for this type of behaviours.

**Table 5.** *Factors Associated with the Adoption of Protective Behaviours.*

| | (1) Prop. Actions Now | (2) Prop. Useful Act. Now | (3) Prop. Actions Now & After | (4) Prop. Useful Act. Now & After |
|---|---|---|---|---|
| Self-reported knowledge | 0.009*** | 0.004 | 0.011*** | 0.009** |
| | (0.003) | (0.003) | (0.003) | (0.003) |
| Self-reported good behaviour index | 0.011*** | 0.008** | 0.015*** | 0.015*** |
| | (0.003) | (0.003) | (0.003) | (0.004) |
| Average proposed fine | 0.012*** | 0.012*** | 0.020*** | 0.023*** |
| | (0.002) | (0.002) | (0.002) | (0.002) |
| Supports the recommendations | 0.036** | 0.034** | 0.050*** | 0.055*** |
| | (0.011) | (0.012) | (0.013) | (0.015) |
| Stated importance of Covid-19 | 0.028*** | 0.032*** | 0.030*** | 0.036*** |
| | (0.003) | (0.004) | (0.003) | (0.004) |
| Perceived danger of Covid-19 | -0.034 | -0.045 | -0.029 | -0.033 |
| | (0.025) | (0.025) | (0.028) | (0.031) |
| Optimism | -0.013 | -0.011 | -0.026** | -0.030** |
| | (0.008) | (0.008) | (0.009) | (0.011) |
| Has had symptoms | 0.009 | 0.009 | 0.008 | 0.014 |
| | (0.007) | (0.007) | (0.009) | (0.009) |
| Age | 0.000 | 0.000 | 0.001 | 0.001** |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| Household size | -0.006* | -0.002 | -0.009** | -0.007 |
| | (0.003) | (0.003) | (0.003) | (0.004) |
| Rooms in the house | 0.001 | 0.001 | 0.005 | 0.004 |
| | (0.003) | (0.003) | (0.004) | (0.004) |
| Receives support from the government | 0.020 | 0.021 | 0.026 | 0.031 |
| | (0.012) | (0.012) | (0.015) | (0.017) |
| Lives with someone with a comorbidity | 0.007 | 0.011 | 0.007 | 0.011 |
| | (0.008) | (0.008) | (0.009) | (0.010) |
| Lives with a comorbidity | -0.006 | -0.001 | 0.012 | 0.021* |
| | (0.008) | (0.008) | (0.009) | (0.010) |
| Level of education | 0.024*** | 0.019*** | 0.027*** | 0.028*** |
| | (0.005) | (0.005) | (0.006) | (0.006) |
| Income level | 0.004 | 0.005 | 0.013** | 0.014** |
| | (0.004) | (0.004) | (0.004) | (0.005) |
| Constant | 0.206*** | 0.352*** | -0.084* | -0.058 |
| | (0.040) | (0.044) | (0.041) | (0.047) |
| *N* | 2524 | 2524 | 2524 | 2524 |
| $R^2$ | 0.14 | 0.14 | 0.18 | 0.19 |

*Note:* * p < 0.05, ** p < 0.01, *** p < 0.001. We included only observations for which no variables were missing, in other words, where the participants answered all questions. SEs in parentheses.

### 3.7. Four Behaviourally Informed Survey Experiments

This section shows the results from four behaviourally informed online survey experiments. These studies were embedded in the questionnaire analysed in other sections of this article. Each participant in the questionnaire was randomised into one of the experiments. The experiments used randomisation to test the causal relationships we hypothesised in Section 3, based on our understanding of the TPB[3]. In particular, the experiments addressed four different research questions: (1) Do perceptions of corruption affect the public opinion of and compliance rates with health recommendations? (2) Who might be the go-to agent people should rely on when the government lacks essential credibility? (3) Did face masks provide feelings of security? (4) Is there a message that policymakers could provide to boost compliance rates?

[3] The critical assumption for obtaining causal effects in experimentation is that the different groups of participants are comparable. The Appendix presents balance tables of the four experiments performed in this study. We did not observe systematic difference across the experimental conditions.

### 3.7.1. Experiment 1: The effect of the Perception of Corruption on Public trust

***Motivation: Experiment 1***

Although several definitions exist, corruption is commonly understood as the use of a public office for private gain in a way that breaks the rules in place (Jain, 2001). As corruption is often a hidden behaviour, direct measurements of its occurrence are complicated and researchers rely primarily on indexes of its effects. An example of such an index is the Perceptions of Corruption Index, used by Transparency International (Transparency International, 2020.), which assumes that perceiving corruption is directly linked to actual corruption. According to this index, Mexico is among the countries with the highest perceived levels of corruption in the Latin-American region. However, there have been some marginal improvements during the last years.

Evidence has suggested that corruption erodes citizens' trust in their governments (Richey, 2010 Solé-Ollé & Sorribas-Navarro, 2018). A previous study found a relationship between trust in a government's response to Covid-19 and adherence to protective behaviours (Harring et al., 2021). Likewise, generalised mistrust has been shown to affect the perception of the government's response to the pandemic (Enria et al., 2021). In a survey similar to ours, it was observed that people in less developed countries tended to find their governments were under-reacting to the pandemic (Gómez-García et al., 2020). Further, Lindor (2021) presented conclusive qualitative evidence that the problem of corruption in some regions in Mexico has harmed the governmental response to the pandemic.

The results in previous literature are descriptions based on qualitative research and statistical correlations. It was necessary to show a causal relationship between the perceived levels of corruption and the trust that citizens have in their government's response to the virus. If citizens' perceptions of corruption cause distrust in the government, citizens might think that the public officials are not being truthful regarding the virus and, thus, the communication of and encouraging adherence to adequate measures might be even more challenging. Thus, in Experiment 1, we aimed to answer the following question: Does focusing people's attention on the high level of corruption in the country reduce the perceived honesty of the government concerning the pandemic?

***Method: Experiment 1***

We randomly assigned 700 survey respondents to participate in this experiment. These participants were randomly allocated into two groups, where each was shown one of two messages. The first message informed participants that, according to the index of Transparency International, corruption in Mexico had decreased in the last year. The second message informed them that, according to the same index, corruption in Mexico had worsened over the last five years. Notably, both statements were factual. The exact wording of the messages and the images we used can be consulted in the supplementary material to this paper.

After viewing the messages, participants answered three questions. The first asked how much they trusted the health personnel at public hospitals to confront the virus. The second asked if they thought the Mexican government was being honest. Participants could reply either that the government was being honest by not selecting any option of possible dishonesty or respond that the government was being dishonest by selecting one or more options. The options were related to the possibility that the government was misreporting the death toll, the importance of the virus, the usefulness of the measures, and the existence of the virus, among others. The third question proposed to participants a hypothetical case in which, after the firs wave of contagion, a friend invited them to their house for a meeting with other people, asking the participant the likelihood of attending the meeting.

As explained previously, data quality was one of the most significant challenges in the study design. We planned the survey to be accessible by reducing the number of questions and avoiding open answers. However, our efforts meant that participants could respond in an incongruent manner; for example, they could state that the government was being honest but simultaneously that the government was exaggerating the number of

deaths. To ensure data quality, we eliminated incongruent answers from our analysis. We retained 414 observations, with 214 regarding low levels of corruption and 200 concerning high levels of corruption.

***Empirical Strategy: Experiment 1***

As mentioned, there were three outcome variables. We denoted these with $Y_i$. The first outcome variable was the perception that the government was being honest, denoted by a dummy variable that assumed the value of 1 when the participant indicated trust in the government. The second variable was the level of trust in medical staff, measured on a scale from 0 to 10, where higher numbers represented higher levels of trust. The third outcome variable was the likelihood of attending the hypothetical meeting, which was also measured on a scale from 0 to 10, where a higher number represented a higher probability of attending the meeting. As experimental groups are balanced in observables, we were safe to assume that the participants were initially balanced in our outcome variables. Thus, differences in these variables between experimental conditions can be interpreted as the causal effect of making an increase or a decrease in perceived corruption salient. For the first outcome variable, we estimated the following logistic model:

$$P(Y_i = 1 \,|Condition_g) = F(z_{ij}) + \varepsilon_{ij} \quad (2)$$

$F(z_{ij})$ is the logistic function:

$$F(\alpha_i + \boldsymbol{\beta_j Condition_{ji}} + \boldsymbol{\delta \mathbf{Z}_i}) = \frac{\exp(\alpha_i + \boldsymbol{\beta_j Condition_{ji}} + \boldsymbol{\delta \mathbf{Z}_i})}{1 + \exp(\alpha_i + \boldsymbol{\beta_j Condition_{ji}} + \boldsymbol{\delta \mathbf{Z}_i})}$$

For the other two outcome variables, we estimated the following ordinary linear regression model:

$$Y_i = \alpha_i + \boldsymbol{\beta_j Condition_{ji}} + \boldsymbol{\delta \mathbf{Z}_i} + \varepsilon_{ij} \quad (3)$$

In these equations, $\boldsymbol{Condition_{ji}}$ is a vector of two dummy variables where either $j: low\ corruption$ or $j: high\ corruption$, depending on the treatment condition of participant $i$. Similarly, $\mathbf{Z_i}$ is a vector of socioeconomic and behavioural controls. These controls were investigated in the previous sections of the paper. Finally, $\varepsilon_{ij}$ is a systematic error term. Thus $\boldsymbol{\beta_j}$ are the parameters of interest given they reflect the impact of the experimental.

***Results: Experiment 1***

Figure 6 presents the point estimates of interest in equations (2) and (3) for the three dependent variables and their 95% confidence intervals. In all three cases, the benchmark condition was the 'low corruption' treatment. The complete regression table can be found in the Appendix. In the group informed that corruption had worsened over the previous five years, respondents expressed more distrust in the government's honesty about the virus than those informed that corruption had decreased. However, we observed that doubting the government's honesty did not translate into distrust of medical personnel. Further, the priming regarding higher levels of corruption did not cause a higher reported likelihood of attending the meeting in the hypothetical scenario.

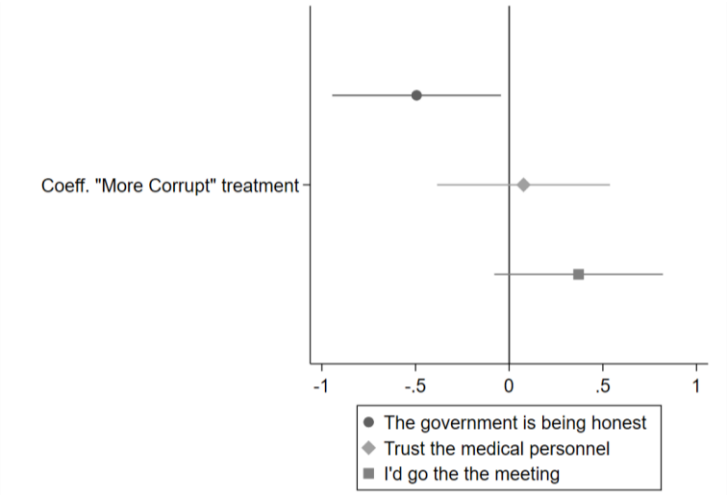


**Figure 6.** *Results of Experiment 1.*

### 3.7.2. Experiment 2

***Motivation: Experiment 2***

Behavioural science studies have documented the effect that different social actors have on the persuasion potential of a message (Dolan et al., 2012). This effect has been observed in health-related studies (Maclean et al., 2019). In a crisis such as the Covid-19 pandemic, it has been relevant to use the social capital of certain actors to inform people about the risks of the virus and recommend the most effective protective measures (Bowman et al., 2021). Experiment 1 revealed that this was particularly critical in countries with high perceived levels of corruption, such as Mexico. To compensate for the government's lack of credibility, policymakers could turn to other social actors to communicate with the population. Hence, we attempted to answer the following question through Experiment 2: Who are the social actors with higher credibility concerning the Covid-19 pandemic?

***Methods: Experiment 2***

From the pool of survey respondents, we randomly selected 680 participants for this experiment. We presented them with a hypothetical scenario in which they were informed that in South Korea, many people wear face masks, which led to the country managing to control the pandemic quickly. Subsequently, we asked them whether they planned to wear a face mask every time they left home. Answers ranged from 1 to 5, where 1 meant they would wear a face mask and 5 the opposite. Participants in the experiment were randomly allocated to three groups. In the first group (n = 226), the person stating this information was a close friend. In the second group (n = 225), the person was the city mayor. In the third group (n = 230), the person was a doctor. The exact wording of the questions in Experiment 2 can be consulted in the Appendix.

***Empirical Strategy: Experiment 2***

In this experiment, there were two outcome variables. We denote these with $Y_i$. The first outcome variable was how many would disagree with or disregard the advice. This variable was measured on a Likert scale from 1 to 5, where 1 represented total agreement and 5 total disagreement. The second outcome variable was the likelihood of attending the hypothetical meeting detailed before. To obtain the effect of the conditions on these dependent variables, we estimated a linear model similar to equation (3). As in the previous experiment, $\boldsymbol{Condition_{ji}}$ is a vector of the different experimental groups, whereby $j$ assumes three values: friend, city mayor, and doctor. Moreover, $\mathbf{Z_i}$ is the vector of socioeconomic and behavioural controls and $\varepsilon_{ij}$ is a systematic error term. $\boldsymbol{\beta_j}$ are the parameters of interest.

***Results: Experiment 2***

In Figure 7, the friend condition is used as a baseline and the graph shows the causal effect of being assigned to the other conditions with respect to the baseline. The full regression tables are found in the Appendix. These results combine to suggest that different messengers do influence the credibility of the recommendations and thus individuals' intention of their adoption. Specifically, our results suggest that when medical doctors provide a protective recommendation, they are perceived as more credible. However, it should be noted that most participants declared intent to use the face mask no matter the messenger. Therefore, it is necessary to conduct further research on other protective behaviours to analyse these effects completely.

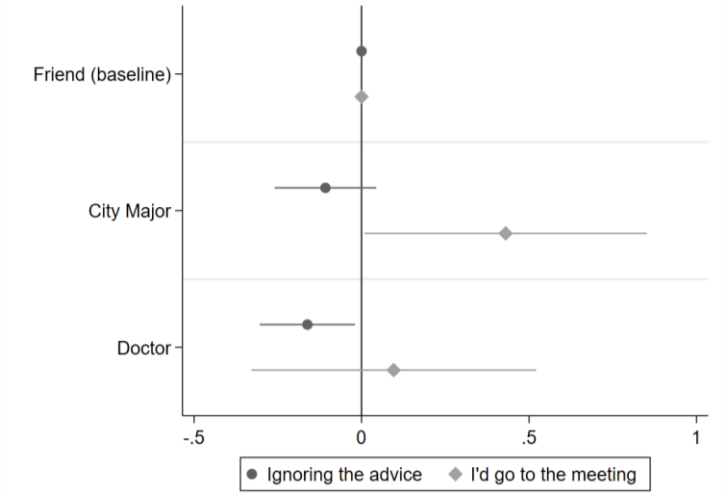


**Figure 7.** *Results of Experiment 2.*

Interestingly, we noted an effect of the city mayor condition on the likelihood of the hypothetical scenario from 8.1.2 regarding attending the meeting. This result suggests a relationship between receiving advice from the mayor instead of a friend and the likelihood of reduced level of care after the first peak of the pandemic. We understand this as a suggestion of the importance of the messenger when informing regarding a health crisis. A possible interpretation is that, given the perception of the government as dishonest, all their recommendations could be seen as less important once the first wave of the pandemic ended. However, we accept the limitations of our experiment and encourage future researchers to investigate the effect of health recommendations from governments perceived as corrupt.

### 3.7.3. Experiment 3

***Motivation: Experiment 3***

During the first wave of the pandemic, one of the most critical strands of the public debate—both in Mexico and elsewhere—concerned the pertinence of using face masks in public spaces. The main concern was that people might have a false perception of safety while wearing a face mask, leading to compensatory behaviours such as carelessness regarding other measures. Whether this concern was justified was not evident due to the almost complete lack of evidence on the topic. Additionally, it seemed natural that face masks could be interpreted as a sign of danger in countries like Mexico, where their use was not common before the pandemic. The Mexican government maintained this worry (*¿Qué Dice López-Gatell Sobre el Uso de Cubrebocas?*, 2020). Institutes in other countries, such as Norway, stated similar recommendations on this basis (Iversen et al., 2020). However, many specialists nevertheless urged the use of face masks (Mantzari et al., 2020; Soriano et al., 2020). In an attempt to contribute to this discussion, the objective of Experiment 3 was to test the hypothesis that individuals felt safer if they saw others using a face mask during the pandemic.

***Method: Experiment 3***

Experiment 3 consisted of one question concerning feelings of safety in a hypothetical scenario where the number of people who wore face masks was varied across three experimental groups. We asked 700 randomly selected survey respondents to imagine themselves entering a supermarket in July 2021. We placed this hypothetical scenario in the future to avoid differences in the perception of current danger that the participant may have and to help them to imagine a situation where the pandemic had already been normalised in the population. Subsequently, we told these participants that one of three situations had occurred depending on the proportion of people who were wearing a face mask: everyone (n = 229), half (n = 233), or none (n = 238). Finally, we asked these participants whether or not they felt that it was a safe place and if they needed to be careful. The dependent variable was the proportion of people who said they felt safe. The exact phrasing of the experiment can be found in the Appendix.

***Empirical Strategy: Experiment 3***

As in the previous experiment, there were two outcome variables. The first was a dummy variable that assumed the value of 1 when the participant declared that they would feel safe in the hypothetical situation. The second was the likelihood of attending the hypothetical meeting detailed before. Consequently, to obtain the effect of the experimental conditions on the first outcome variable, we estimated a logistic model like the one in equation (2). For the other outcome variable, the likelihood of attending the meeting, we estimated the model in equation (3). Just as in the previous experiments, $\boldsymbol{\beta_j}$ are the parameters of interest.

***Results: Experiment 3***

The results of Experiment 3 are presented in Figure 8. In the figure, the point estimates are presented, assuming the condition where all clients are wearing a face mask as a baseline. We observed that the likelihood of feeling unsafe was significantly higher for participants in conditions with fewer people wearing a face mask. Thus, we conclude that wearing a face mask has a strong effect on feelings of safety. Furthermore, our treatments were unrelated to the reported likelihood of attending the meeting in the next question.

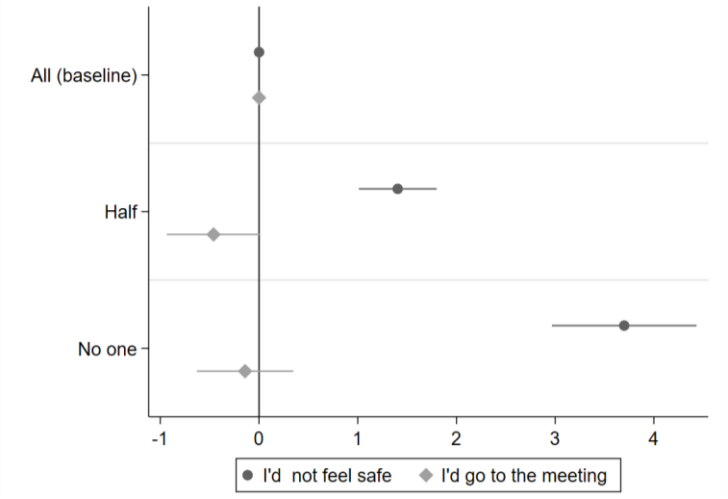


**Figure 8.** *Results of Experiment 3.*

At the time of writing this paper, there was a growing consensus that face masks were appropriate tools for preventing the spread of the virus (Liao et al., 2021; Mitze et al., 2020). Therefore, given what we know today, it is possible to conclude that the resistance of the Mexican government to promoting the use of face masks at the beginning of the first wave of the pandemic was unfortunate. In any case, the debate concerning the issue of face masks underscores the importance of having reliable scientific evidence to inform public policy.

### 3.7.4. Experiment 4

***Motivation: Experiment 4***

One possible method for increasing the effectiveness of protective recommendations is to frame them as appealing to social norms, such as taking care of others. Previous research has shown that framing behaviours by appealing to social norms can effectively promote those behaviours. Various examples exist in the promotion of diverse behaviours, such as environmental protection (Cheng et al., 2011), health promotion (Salovey & Williams-Piehota, 2004), and saving for retirement (Eberhardt et al., 2021). Thus, a potential initial approach to increase the following of protective recommendations was to frame them as appealing to norms related to taking care of oneself and others. We implemented Experiment 4 to evaluate whether simple frames could increase the intention of following health recommendations to prevent the spread of the virus.

***Method: Experiment 4***

We assigned 646 survey respondents to participate in Experiment 4, which consisted of two stages. First, participants randomly viewed one of three messages with a graphic figure and a short text inviting them to follow the protective measures. The first message appealed to family values, stating that preventive behaviours would protect one's family (n = 229). The second message appealed to social values, stating that by adopting the protecting behaviours, one was protecting one's neighbours (n = 201). The third message appealed to self-protection (n = 216). In the second stage of the experiment, participants were presented with a hypothetical scenario where the Mexican government imposed a rule that face masks should be used at all times when in the street but did not impose any fine for those who refused to comply. Immediately after, participants were asked how sure they were that they would follow the new hypothetical rule. The materials of the experiment can be consulted in the Appendix.

***Empirical Strategy: Experiment 4***

In this experiment, there were two outcome variables. The first was the reported willingness to comply with the recommendation. This variable assumed values from 0 to 1, where the higher value represented greater willingness. The second was the likelihood of attending the hypothetical meeting. To estimate the causal effect of the experimental conditions on the dependent variables, we used a similar linear model to that of equation (3).

***Results: Experiment 4***

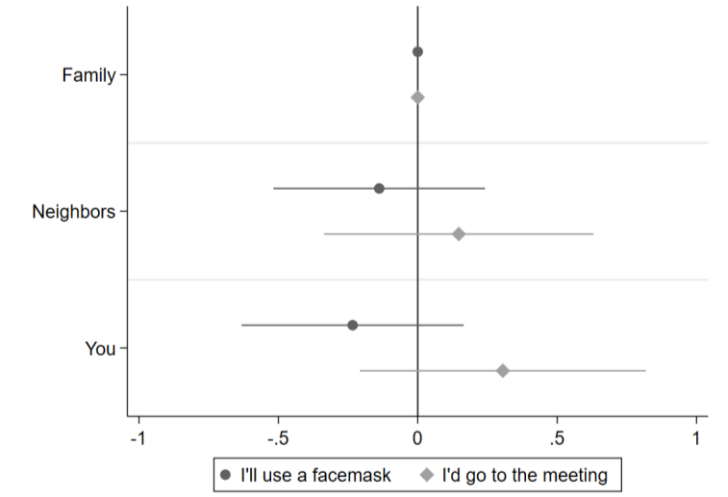


**Figure 9.** *Results of Experiment 4.*

As Figure 10 shows, we found no differences across the experimental groups. Likewise, we observed no difference in the effect of our treatments on the likelihood of attending the hypothetical meeting common to the four experiments. Detailed tables of the regressions can be found in the Appendix. Other than the possibility that these frames were ineffective, we interpret the results in the context of the limitations of our study. Other experiments with similar designs have obtained null results (Bahety et al., 2021; Hume et al., 2021). However, studies conducted with real decisions or in incentivised settings rather than hypothetical scenarios found the expected effects (Heffner et al., 2021; Jordan et al., 2021). We motivate future researchers to investigate which values are more effective at promoting protective behaviours in health-related crises.

## 4. Limitations, Conclusions, and Discussion

### *Limitations*

Our study has some limitations that need to be considered to correctly interpret the results and applicability in public policy. These limitations are common to studies with similar designs and methods of distribution. This is of particular importance in the context of the Covid-19 pandemic when the informed policy was needed, but the conditions for ideal designs were absent. Therefore, we encourage decision-makers not to see the limitations of these types of studies as a barrier to using them to inform public policy but as an invitation to consider our results in context. Likewise, we urge other researchers to use the data we produced with understanding of its constraints.

First, the observed proportions of adherence to protective actions should not be understood as a precise measure of the response of the inhabitants of Mexico City to the pandemic. Our survey is not representative of the population of the city. It is possible that respondents elected to participate in the study because they were more interested in the development of the pandemic in general. Consequently, it is likely that these participants were following more precautions than other inhabitants of Mexico City.

Second, in all our experiments, we used intent to undertake specific actions or to feel in particular ways in the context of hypothetical scenarios as an outcome variable. However, these answers do not necessarily translate into actual behaviour. Nevertheless, this does not render our vignette experiments uninformative. In the context of the TPB, we assume that behaving in a certain way is positively correlated with intending to do it, even if such intention is hypothetical.

Third, at the time of the study, it was likely that respondents had already received significant amount of information about the virus. Our survey experiments were based on the provision of information. Hence, it is possible that the effect of our treatments was limited by what participants already knew and the opinions they previously had.

Finally, answers in the experiments and the rest of the survey were likely affected by social-desirability bias, that is, it is possible participants answered according to what they considered socially acceptable and not the reality of their actions (Krumpal, 2013). A consequence of this is that our estimates should be considered, at best, upper limits to the actual behaviour of the population.

### *Conclusions*

This study presented the results from a survey conducted in June 2020, during the first wave of the Covid-19 pandemic in Mexico City. Our study focused on two main research questions. First, using the conceptual framework of the TPB, we outlined the factors associated with protective behaviours. We analysed both the protective behaviours being followed at the time of the questionnaire and those behaviours that participants planned to continue after the first wave. Second, we implemented four simple survey experiments that, inspired by the TPB, explored the most effective ways to promote health-related recommendations. By answering these questions, we wish to encourage policymakers to use proven theories of human behaviour, such as the TPB, to design the first response to future health-crisis.

In the Appendix, we include a table with a summary of the results of all the hypotheses presented in Section 3. We observed that the majority of the variables we related to the main elements of the TPB—norms,

attitudes, and behavioural control—correlated with the planning and adoption of protective actions. However, the variables related to the perception of risk were not. We conclude that the TPB assists in understanding data from surveys such as ours. We interpret the null results of the variables related to the perceived risk element of the theory as a suggestion that, at the beginning of the pandemic, there was significant confusion about the actual danger of the virus. Therefore, the behaviour of Mexico City residents was more dependent on the perceived social norms, their attitude toward the pandemic based on the information at hand, and their perceived capacity to follow the health recommendations.

In the four survey experiments, we found evidence that greater perceived elements of corruption reduce a government's credibility concerning a pandemic. However, this distrust does not extend to medical staff. Further, we observed evidence of different levels of persuasion between social actors. Specifically, we found that doctors are more persuasive than friends and politicians in health-related crises. Nevertheless, we did not find significant effects of messages that promoted health behaviours appealing to different values. Finally, we observed that the use of face masks generally generates feelings of safety.

Future research should exploit the remainder of the data in our survey, in combination with other sources of information, to form a clearer image of the determinants of the response to the pandemic in its different stages. Additionally, we encourage investigation into whether feelings of safety created by protective actions, such as face masks, leads to an overconfidence bias that might reduce adherence to other protective behaviours. Moreover, further research is required to determine efficient modes of communicating protective behaviours in developing countries like Mexico, where the population starts from the default of distrusting the government.

***Discussion***

The Covid-19 pandemic has had global effects across society in diverse areas, from health and economics to education and security (Padhan & Prabheesh, 2021). In Latin America, the effects of the pandemic have been harsher for less developed countries and, within each country, for more vulnerable individuals in society (Bottan et al., 2020). The health crisis has highlighted each country's systemic weaknesses and existing inequalities (Kim & Ryu, 2021) and the case of Mexico has been no different. Perceived high levels of corruption, weak public health systems, and widespread comorbidities created the perfect storm for attempting to battle the virus (Kammar-García et al., 2020). The Mexican government had to interact with each problem while simultaneously coping with the pandemic. The results remain observable more than two years after the pandemic onset. Mexico has recorded one of the highest figures of deaths of any country during the pandemic, with more than 250,000 officially related to Covid-19. More than 42,000 of those deaths occurred in Mexico City.

To prevent future crises, countries must focus primarily on solving their institutional and political weaknesses, strengthening their public health system, and reducing the fragility of the population's health. However, governments need tools to potentiate their short-term responses even within those institutional limitations. Behavioural science offers insights that help design public policy in adverse situations. However, behavioural scientists require data and theoretical frameworks to generate recommendations. This study showed that it is possible to produce descriptive information and experimental evidence that could inform policy quickly and at a low cost using the TPB as a conceptual framework.

Our results suggest that at the beginning of the pandemic, Mexico City residents based their responses not necessarily on risk calculations but on the social norms, attitudes, and perceived capacity to take care of themselves and others. Further, we find that individuals plan their behaviour during the first moments of a health crisis and that the costliest preventive actions are less likely to be maintained. In addition, we obtained causal evidence that the high levels of perceived corruption cost a government credibility. We suggest that governments can use the persuasiveness of professional doctors, who are perceived as independent of the government, in such situations. Finally, we observed that widespread preventive behaviours such as using face

masks generate feelings of safety. We conclude that the interaction between feelings of safety and disregarding other protections is an avenue of research that should be prioritised.

We encourage policymakers to rely on existing theories in behavioural science to gather and interpret data. Specifically, the TPB can be a resource to predict and interpret the population's response in a crisis. In addition, the TPB can be a tool for designing public policies to prevent future health crises. We encourage researchers and practitioners to use the database we generated in their future projects.

Based on these results, we recommend that public officials implement surveys such as ours as part of the first response to a health-related crisis. Conducting our study cost little more than our time and a small number of gift cards. More resources and governmental support would allow for a representative sample, better data quality and, consequently, more robust results. People in developing countries are willing to answer questions on topics that affect them—public officials simply need to ask in the right way and at the right time.

**Supplementary information**

The reader will find the appendix, additional material, our database, and suplementary information at: https://osf.io/a9wft/?view_only=6e143395311d474c91878669f3c31084

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Nuria Álvarez Agüí: conceptualisation, study design, data collection, and writing—review and editing; Enrique Cáceres Nieto: data collection, and writing—review, and editing; Manuel Alejandro García Martínez: data collection, writing—review and editing; Josafat Hernández: conceptualisation, study design, data collection, writing—review and editing; Rosa Lidia López Bejarano: data collection, writing—review and editing; Pablo Soto-Mota: conceptualisation, study design, data collection, data curation, formal analysis, software, methodology, writing—original draft, writing—review and editing, project administration; Adrian Vargas-Lopez: conceptualisation, study design, data collection, data curation, software, writing—review and editing.

## Conflict of Interest

*The authors declare no conflict of interest.*

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