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Citizen Behaviour During COVID-19: Determinants of Preventive and Maladaptive Responses in Kazakhstan

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Abstract

This study intends to understand the predictors of preventive and maladaptive practices during the COVID-19 pandemic. The association between risk perception, behaviour, knowledge, trusted sources of information, attitudes toward the COVID-19 pandemic, response initiative, and other variables from June to September 2020, and people's behaviour to inform COVID-19 outbreak responses was assessed. Four samples, composed of about 1,000 respondents aged 18 years and above, were interviewed online or via telephone in four rounds every two weeks from June to September 2020. Descriptive and inferential analyses of the data were conducted using Stata 18. Multivariate regression analyses, including logistic and linear regression models, were used to identify predictors of preventive and maladaptive behaviours. The study findings revealed distinct factors associated with both preventive and maladaptive measures. These findings are significant as they provide a deeper understanding of the predictors of preventive and maladaptive practices. The existence of different predictors in favour of maladaptive behaviour calls for policy intervention to increase the uptake of preventive behaviour rather than maladaptive behaviour. Therefore, consideration of all people, regardless of their place of residence, level of education, and health status, is needed through increased exposure to the right information and undertaking measures that will increase trust in the disseminated information. Policy interventions should focus on increasing exposure to accurate information to encourage preventive behaviours.

Keywords: COVID-19, Kazakhstan, maladaptive behaviour, preventive behaviour, attitude.

Introduction

The present study aims to understand the determinants of preventive measures and maladaptive behaviour during COVID-19 in Kazakhstan. The outbreak of coronavirus disease (COVID-19) in China at the end of 2019 had a profound impact on the world, resulting in not only the disruption of people's lives but also many deaths globally (Aidossov et al., 2025; Kuandyk (Sabitova) et al., 2024; Panneer et al., 2022). According to the World Health Organization (WHO), as of January 19, 2023, there were more than 663 million cases with more than 6.7 million deaths globally (World Health Organization, n.d.). To control the spread of the disease, the Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO) recommended adopting non-pharmaceutical interventions (NPIs) such as lockdowns, movement restrictions, mass testing, contact tracing, mask mandates, social distancing, frequent hand washing, and staying at home when feeling sick (Ayouni et al., 2021). These measures were intended to prevent the spread of the virus and the consequent deleterious effects of the outbreak. Countries in the world responded to the pandemic by imposing these measures to protect their population. Understanding behavioural responses in Kazakhstan, where unique cultural and socioeconomic factors may influence health behaviours, is crucial for tailoring effective public health interventions.

In the Republic of Kazakhstan, the first confirmed cases of the infection were registered on 13 March 2020. The transmission rate dramatically rose between 17 March and 25 May 2020, with 8,531 confirmed cases and 35 deaths (World Health Organization, n.d.). Also, since March 26, 2020 (when the first death was registered), the number of severe cases began to rise as well. Additionally, as of June 2022, Kazakhstan had

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1.3 million confirmed cases, 88,815 probable PCR-negative cases, and 13,660 deaths from coronavirus infection (World Health Organization, n.d.). To prevent the overburden on the healthcare system and other complications related to the outbreak of coronavirus, the government of the Republic of Kazakhstan announced the introduction of the emergency state in the country on 16 March 2020, including restrictions on country border crossing, quarantine, and other measures in all regions of the country.

In Kazakhstan, the Ministry of Health had to lead the public communication regarding health issues, including the communication on developing vaccination and other measures. However, the outbreaks of new infectious diseases are associated with uncertainty about the risk factors of the disease, transmission routes, severity of the disease, and immunity resistance. Since the outbreak of COVID-19, the population has faced a large flow of epidemiological information, reports from government agencies, and publications on the internet, social networks, conspiracy theories, misinformation, and divergent opinions of scientists. The Government of Kazakhstan introduced non-pharmacological measures to limit the spread of coronavirus infection, such as careful hand washing, social distancing, wearing masks, restriction of movement and staying in public places, and isolation.

The outbreak and the introduction of non-pharmaceutical interventions caused certain behavioural reactions in the population. People had to decide on protective or risk behaviours in a daily changing information environment. Additionally, their risk of anxiety, loneliness, and depression increased as a result of isolation and worries about health and income losses. By weighing the risks, health consequences, and benefits of preventive behaviour, individuals make health decisions (van der Pligt, 1996). An important role in the commitment of the population to measures to control coronavirus infection is trust in the authorities and the information they provide (Rodríguez-Blázquez et al., 2021). Generally, the outbreak of the pandemic had an impact on people's lives and their adherence to the imposed measures. While others followed the recommended NPIs, others practised maladaptive behaviours such as substance use, avoiding medical treatments, or complete social isolation.

The perception and desire to follow restrictive measures may vary in different populations and geographical regions and may change over time during the pandemic. Additionally, all these determinants might explain behaviours during the pandemic. While it is important to examine determinants of protective behaviours, it is also important to understand maladaptive behaviour and its predictors. In health behaviour theories, behavioural determinants are used to understand and change behaviours. Thus, we explore which determinants are important for protective and maladaptive behaviour in the four representative surveys.

The available literature has identified several factors that influence the use of preventive measures or maladaptive behaviour during a pandemic like COVID-19. As suggested by Ntegwa et al., multifaceted factors include sociodemographic, behavioural, economic, cultural, and political influences on the uptake of services (Ntegwa et al., 2023). Liu and Jiang's study in China revealed that media exposure is associated with increased self-efficacy and compliance through protection motivation (Liu & Jiang, 2023). A study revealed that women participate in more preventive behaviour as they perceive a higher severity of COVID-19 and the benefit of preventive behaviour (Can et al., 2022). Thus, the perceived severity of COVID-19 infection is a protective factor for preventive health behaviour (Can et al., 2022). Also, the perceived severity of the COVID-19 infection predicts social distancing (Hadizadeh-Talasaz et al., 2022). However, a study in South Africa shows little evidence of the severity of the disease if contracted on the decision to wear a mask (Burger et al., 2022). On the other hand, the study shows that being male is a risk factor for preventive behaviour (Can et al., 2022). Another study in Singapore revealed that women were associated with an increase in handwashing frequency and also adopting avoidant behaviour (Long & Liu, 2021).

Furthermore, the study by Vally revealed a greater adherence to preventive measures among those who are educated and/or have chronic illnesses (Vally, 2020). However, chronic illnesses such as hypertension, obesity, or being overweight were not significantly associated with mask-wearing in the study conducted in South Africa (Burger et al., 2022). While the elderly had significantly lower odds of mask-wearing (Burger et al., 2022), younger individuals were more likely to wear face masks (Long & Liu, 2021). A study conducted in Kenya, Uganda, and Tanzania revealed that barriers to hand washing were a lack of trust in the government's recommendations or messaging (Muchangi et al., 2024). On the other hand, the confidence in the government to tackle the pandemic is related to compliance (Wright et al., 2021). Pilch suggested that persuasive communication to the public should be formulated (Pilch et al., 2021). However, the study revealed that the perceived severity, age, gender, and education were not significant predictors of adaptive and maladaptive behaviour (Downing et al., 2023). Also, the low compliance with protective measures was strongly related to younger age and risk attitudes (Wright & Fancourt, 2021).

It is clear from the existing evidence that predictors of preventive and maladaptive behaviour show mixed results depending on the context and time. Thus, it is important to understand the predictors of different behaviours during the pandemic in the context of Kazakhstan and how they change over time. Therefore, we explore determinants such as risk perceptions, emotional reactions to the pandemic, such as fears and worries, trust, and conspiracy beliefs, in addition to sociodemographic factors. We investigate the determinants of uptake of protective behaviour and maladaptive behaviour over time. This study contributes to understanding both the behavioural determinants, uptake of protective behaviour, and uptake of maladaptive behaviour changes over time, and how these changes are important for policies, interventions, and communications during the pandemic. Previous studies focused on these determinants using data from a single period, whereas our study uses four cross-sectional datasets collected at different times to understand how the determinants change over time. While previous research has examined predictors of health behaviours during the pandemic, this study uniquely examines how these predictors change over time in a Central Asian context.

Methodology

Data source

Data used for this study is part of the COVID-19 Snapshot Monitoring (COSMO) survey created by the WHO in March 2020 in collaboration with the University of Erfurt, Germany. Subsequently, it provided an adaptable protocol and questionnaire for use by stakeholders. Kazakhstan implemented the survey instrument made available by WHO/Europe in the context of the COVID-19 scenario in the nation to understand these aspects better and adapt to the quickly changing situation. Thus, the COSMO Standard protocol variables were adapted to the local cultural context (Rodríguez-Blázquez et al., 2021). Additionally, the survey was modified by updating variables in the policy acceptance section to reflect the Kazakhstan epidemiological situation.

Study design and settings

This study uses a repeated cross-sectional survey where cross-sectional data were collected in four rounds on a bi-weekly basis from June to September 2020 by the Centre for Applied Research “TALAP”. Data from a sample of 1029, 1026, 1040, and 1035 individuals were collected during the first, second, third, and fourth rounds, respectively. The sample was representative of Kazakhstan's general population in terms of age, gender, and area of residence. Quota sampling was employed, stratified by age, gender, and area of residence, to ensure representation of the general population of Kazakhstan.A one-stage stratified quota sampling method was used to select respondents from a database of 12,372,754 eligible individuals aged 18 years or older. Selected respondents were invited to complete an online questionnaire. Since an online survey is likely to produce biases against older people and people without access to an internet connection, smartphones, and other digital devices, Computer-Assisted Telephone Interviews (CATI) were utilized to reach older, rural people and other underrepresented populations. A mixed mode was used for data collection: 70 % via an online mobile application survey and 30 % via CATI. The survey took approximately 15-25 minutes to complete.

Variables

Outcome variables

The outcome variables for this analysis include preventive and maladaptive measures. For the June and July 2020 survey rounds, preventive measures were based on whether participants practised physical distancing, mask-wearing, and hand washing. In the August and September 2020 rounds, the preventive measure was constructed from the average scores of these behaviours, measured on a 5-point Likert scale. Thus, in the August and September 2020 survey rounds, preventive measures, as well as physical distancing, mask-wearing, and hand washing, were treated as continuous variables with values ranging from 1 to 5. Maladaptive behaviour was measured using responses to the question: "Within the last two weeks, have you done the following…?" The behaviours included eating more unhealthy food, drinking more alcohol, exercising less, avoiding the doctor for non-COVID-19 issues, and cancelling treatment. Responses were 1 for "yes" and 2 for "no." Maladaptive behaviour was coded as 1 if the participant engaged in any of these behaviours and 0 if they did not.

Independent variables

This study included several independent variables based on previous research examining factors influencing preventive and maladaptive measures related to COVID-19. Sociodemographic variables included gender (male/female) and education level (high/low). Trust in institutions and healthcare was assessed using

responses to the question, "How much confidence do you have that the following can handle the COVID-19 challenge well?" with responses ranging from 1 (very low confidence) to 5 (very high confidence), averaged to form the variable. Emotionality and conspiracy thinking were included based on their potential influence on health behaviours, as suggested by prior research. Emotionality was measured by responses to questions such as "COVID-19 feels... think about it all the time/never think; helpless/able to combat; stressful/not stressful; media-hyped/not media-hyped; fear-inducing/not fear-inducing," also on a scale of 1 to 5. Conspiracy thinking was based on the average of responses to five questions regarding governmental decisions, with responses ranging from 1 (certainly not true) to 5 (certainly true). Additionally, participants were asked about the presence of chronic illness (yes/no), and knowledge of COVID-19 symptoms was determined by whether respondents identified at least five common symptoms, such as fever, cough, and shortness of breath.

Health literacy was evaluated through questions on the ease of finding, understanding, judging, and following COVID-19-related information, with responses ranging from 1 (very difficult) to 5 (very easy). Finally, resilience was measured based on responses to three scenarios assessing how respondents coped with stressful events during the pandemic, such as "It does not take me long to recover from a stressful event" (1: strongly disagree to 5: strongly agree). These variables were chosen due to their relevance to understanding public responses to the COVID-19 pandemic.

Statistical analysis

Descriptive statistics were conducted before performing the multivariate regression analysis. Two types of multivariate regression were employed in this study. For the June and July 2020 survey rounds, variables such as physical distancing, mask-wearing, and hand washing were measured as binary outcomes (yes/no). Given the categorical nature of these variables, multiple logistic regression was used to identify predictors of these preventive measures, as well as the overall use of preventive measures (whether individuals practised any of the three behaviours). For the August and September 2020 survey rounds, these variables were measured on a Likert scale from 1 to 5, allowing us to treat them as continuous variables. Consequently, multiple linear regression analysis was conducted for these rounds, reporting results for physical distancing, mask-wearing, hand washing, and overall preventive measures. Additionally, maladaptive behaviour was measured as a categorical variable across all rounds, and multiple logistic regression analysis was used to examine its determinants. Only completed data sets were considered in the analysis. Missing values were treated as missing values and were not imputed. All analyses are conducted using Stata version 18 (StataCorp, 2023).

Ethical considerations

This study was conducted in accordance with ethical guidelines to protect participants' rights and well-being and ensure inclusivity. Ethical approval was obtained from the Local Committee on Bioethics of the National Center for Public Health of the Republic of Kazakhstan (Approval No. 2, dated May 11, 2020). All participants were fully informed about the study's purpose, procedures, potential risks and benefits, their voluntary participation, and their right to withdraw at any time without consequences. Informed consent was obtained from all participants in written form. Confidentiality and anonymity were strictly maintained throughout to safeguard personal information and responses. Information confidentiality and protection of personal data were ensured. The study was conducted following the relevant ethical standards and adhered to the principles outlined in the Declaration of Helsinki.

Results

Descriptive statistics

Table 1 shows the socio-demographic characteristics of this study sample. While the sample had 43 % males in June, July, and September 2020, there were 44 % males in August 2020. More than 50 % of respondents had higher education, and the study included approximately 60 % of participants from urban and 40 % from rural areas. Additionally, approximately 20 % of the respondents had chronic health issues. Moreover, the average age of the participants was about 40 years in June 2020, 39 years in July 2020, and 41 years in August and September 2020. The level of correct knowledge about the symptoms of COVID-19 was 0.887 in June and 0.854 in July 2020. On the other hand, health literacy remained slightly constant at 3.9 in August and September 2020. Additionally, the estimate of risk perceptions, probability, and severity of infection was included in all four rounds of data collection and remained high above 3 in all four rounds. Detailed socio-demographic characteristics by each round are presented in Table 1.

Table 1: Socio-demographic characteristics of the samples in each round of the survey

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	June 2020		July 2020		August 2020		September 2020	
VARIABLES	N	mean	N	mean	N	mean	N	mean
Age	1,029	39.81	1,026	39.31	1,040	40.67	1,035	40.91
Male	1,029	0.427	1,026	0.429	1,040	0.444	1,035	0.429
High education	1,029	0.573	1,026	0.619	1,040	0.537	1,035	0.565
Chronic	968	0.246	984	0.230	985	0.211	968	0.195
Urban	1,029	0.576	1,026	0.593	1,040	0.593	1,035	0.603
Perceived probability of infection	1,029	3.294	1,026	3.358	1,040	3.215	1,035	3.125
Perceived severity of an infection	1,029	3.360	1,026	3.481	1,040	3.249	1,035	3.187
Frequency of media consumption	1,029	3.543	1,026	3.412	1,040	3.239	1,035	3.127
Knowledge	746	0.887	852	0.854				
Trust in institutions and healthcare	961	3.027	1,026	3.243	1,040	5.265	1,035	4.609
Emotionality	1,029	2.895	1,026	2.814	1,040	3.052	1,035	3.141
Conspiracy thinking	1,029	3.189	1,026	3.038	1,040	3.418	1,035	3.398
Health literacy					1,040	3.902	1,035	3.933
Resilience	1,029	2.434	1,026	2.543	1,040	2.608	1,035	2.605
Physical distance	1,012	0.822	988	0.786	997	4.136	1,004	4.093
Wearing mask	1,019	0.948	1,016	0.935	987	4.314	1,003	4.273
Hand washing	1,012	0.899	1,005	0.861	1,025	4.156	1,025	4.244
Preventive measure	1,029	0.742	1,026	0.635	1,030	4.196	1,027	4.210
Maladaptive behaviour	1,029	0.716	1,026	0.779	1,040	0.640	1,035	0.590

Predictors of Preventive Behaviour Uptake

Predictors of physical distancing

The predictors of uptake of preventive behaviour (physical distancing, mask-wearing, and hand washing) are shown in Table 2. The result shows that a unit increase in participants' age was associated with a 0.007 increase in the practice of physical distancing in August 2020 (β=0.007; $p<0.01$). Also, the participants with higher education were 1.502 times more likely to practice physical distancing in July 2020 than participants with low education (OR=1.502; $p<0.05$). Additionally, being an urban resident was associated with a 0.147 increase in the use of physical distancing in August 2020 (β =0.147; $p<0.05$). Also, participants with trust in institutions and healthcare were 1.216 times more likely to practice physical distancing in June 2020 (OR=1.216; $p<0.05$). Contrary to expectations, participants who perceived a high probability of being infected with COVID-19 were 18 % less likely to practice physical distancing in June 2020 (OR=0.818; $p<0.10$).

Similarly, participants who perceived the high severity of infection were 21 % less likely to use physical distancing in June 2020 (OR=0.792; p<0.10).

Moreover, a unit increase in emotionality was associated with the increases in the use of physical distancing in August and September 2020 (β=0.081; p<0.05 and β=0.142; p<0.01). Participants with conspiracy thinking in August and September were associated with a 0.066 and 0.104 increase in the use of physical distancing (β=0.066; p<0.05 and β=0.104; p<0.01). Also, the increase in the frequency of information was associated with the increase in the practice of physical distancing in June (OR=1.350; p<0.01) and July 2020 (OR=1.248; p<0.01). Furthermore, an increase in the knowledge about symptoms of COVID-19 was associated with the use of physical distancing in June 2020 (OR=5.506; p<0.01) and July 2020 (OR=4.679; p<0.01). Similarly, an increase in health literacy was associated with an increase in the use of physical distancing in August and September 2020. Also, an increase in resilience was associated with 0.119 and 0.132 increases in the use of physical distancing in August and September, respectively.

Predictors of mask-wearing

A unit increase in the age of the participant was associated with a 0.006 increase in mask-wearing in August 2020 (β=0.006; p<0.05). Male respondents were 57 % less likely to wear masks compared to females in June 2020 (OR=0.434; p<0.10). Also, urban participants were 1.904 times more likely to wear masks than rural participants in July 2020 (OR=1.904; p<0.05), and urban participants were associated with a 0.154 increase in mask-wearing compared to rural residents in August 2020 (β =0.154; p<0.05). An increase in the perceived probability of COVID-19 infection was associated with a 30 % lower likelihood of wearing the mask in July 2020 (OR=0.701; p<0.05). Additionally, participants who perceived high severity of COVID-19 infection were 1.326 more likely to wear masks in July 2020 (OR=1.326; p<0.10). Furthermore, an increase in emotionality was associated with 1.266 times increase in wearing masks in July 2020 (OR=1.266; p<0.10). Similarly, a unit increase in emotionality was associated with a 0.088 and 0.184 increase in mask-wearing in August and September 2020, respectively (β=0.088; p<0.05 and β=0.184; p<0.001). Moreover, conspiracy thinking was associated with a 1.324, 0.090, and 0.119 increase in mask-wearing in June, August, and September, respectively (OR=1.324; P<0.10, β=0.090; p<0.01 and β=0.119; p<0.01).

Moreover, the frequency of media consumption was associated with a 0.046 decrease in mask-wearing in August 2020 (β =-0.046; p<0.10). Also, participants with chronic health conditions were associated with a 0.210 increase in mask-wearing (β=0.210; p<0.01). An increase in knowledge about COVID-19 symptoms was associated with 12.463 and 7.674 times increase in the likelihood of wearing masks in June and July 2020, respectively (OR=12.463; p<0.01 and OR=7.674; p<0.01). On the other hand, an increase in health literacy was associated with a 0.488 and 0.498 increase in mask-wearing in August and September 2020, respectively (β=0.488; p<0.01 and β=0.498; p<0.01). Also, resilience is associated with a 0.055 and 0.139 increase in mask-wearing in August and September, respectively (β=0.055; p<0.10 and β=0.139; p<0.01).

Predictors of hand washing

The age of the respondent positively influenced hand washing in August (β=0.005; p<0.1) and September (β=0.007; p<0.01). Males were 45 % and 31 % less likely to practice hand washing in June and July, respectively, compared to females (OR=0.554; p<0.05, and OR=0.629; p<0.05). Higher education was associated with a 0.104 decrease in hand washing in September 2020 (β=-0.104; p<0.10). Also, urban residence was associated with a 0.231 increase in hand washing in August 2020 (β=0.231; p<0.01). The increase in trust in institutions and healthcare increases the likelihood of hand washing by 1.165 times more in July 2020 (OR=1.165; p<0.10). An increase in the perceived probability of COVID-19 infection is associated with 24 % less likelihood of washing hands in June 2020 (OR=0.763; p<0.10). The increase in perceived severity of infection was associated with a 29 % lower likelihood of practising hand washing in July 2020 (OR=0.708; p<0.01). Additionally, the increase in emotionality was associated with 1.259 times increase in hand washing in June 2020 (OR=1.259; p<0.10) and was associated with a 0.162 increase in hand washing practices in September 2020 (β=0.162; p<0.01). Conspiracy thinking was associated with a 16 % lower likelihood to practice hand washing in June 2020 (OR=0.838; p<0.05) and was associated with an increase in hand washing practice in August 2020 (β=0.133; p<0.01) and September 2020 (β=0.108; P<0.01). Moreover, the increase in the frequency of media consumption among respondents was associated with a 0.057 decrease in handwashing practice in September 2020 (β=-0.057; p<0.05). Respondents with chronic health issues were associated with a 0.140 increase in hand washing practice in September 2020 (β =0.14; p<0.10). An increase in resilience among respondents was positively associated with hand-washing practices in August (β=0.056; p<0.10) and September (β=0.135; p<0.01). Moreover, the increase in health literacy among re-

spondents was associated with an increase in hand-washing practice in August (β=0.460; p<0.01) and September (β=0.503; p<0.01). The increase in knowledge about COVID-19 symptoms was associated with 6.935 times more likely to practice hand washing in July 2020 (OR=6.935; p<0.01).

Table 2: Regression analysis for the predictors of uptake of preventive measures

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
VARIABLES	June 2020	July 2020	August 2020	September 2020	June 2020	July 2020	August 2020	September 2020	June 2020	July 2020	August 2020	September 2020
	Physical distancing				Mask wearing				Hand washing			
Age	1.014	0.999	0.007***	0.003	1.024	0.997	0.006**	0.003	1.009	1.011	0.005*	0.007***
	(0.009)	(0.008)	(0.002)	(0.002)	(0.022)	(0.014)	(0.002)	(0.002)	(0.012)	(0.009)	(0.003)	(0.002)
Male	0.886	0.901	-0.043	-0.053	0.434*	1.154	-0.065	-0.037	0.554**	0.629**	-0.036	-0.061
	(0.204)	(0.178)	(0.066)	(0.063)	(0.187)	(0.356)	(0.062)	(0.057)	(0.159)	(0.139)	(0.068)	(0.060)
High education	0.977	1.502**	-0.046	0.057	0.802	1.298	-0.021	-0.013	0.735	0.849	0.017	-0.104*
	(0.232)	(0.304)	(0.067)	(0.064)	(0.335)	(0.396)	(0.061)	(0.058)	(0.215)	(0.197)	(0.070)	(0.061)
Urban	0.946	0.812	0.147**	-0.106	0.859	1.904**	0.154**	-0.062	1.130	0.936	0.231***	-0.007
	(0.228)	(0.165)	(0.068)	(0.065)	(0.390)	(0.582)	(0.062)	(0.059)	(0.356)	(0.204)	(0.071)	(0.061)
Trust in institutions and healthcare	1.216**	1.080	-0.002	0.005	0.987	0.919	0.000	0.003	0.843	1.165*	0.000	0.003
	(0.110)	(0.085)	(0.003)	(0.003)	(0.161)	(0.095)	(0.002)	(0.004)	(0.110)	(0.098)	(0.003)	(0.004)
Perceived probability of an infection	0.818*	1.035	-0.027	-0.025	1.201	0.701**	0.001	-0.020	0.763*	0.993	0.032	-0.022
	(0.092)	(0.091)	(0.027)	(0.028)	(0.238)	(0.120)	(0.024)	(0.024)	(0.111)	(0.099)	(0.029)	(0.028)
Perceived severity of an infection	0.792*	1.002	-0.005	0.014	0.737	1.326*	-0.026	0.003	0.993	0.708***	-0.032	-0.010
	(0.104)	(0.093)	(0.032)	(0.034)	(0.185)	(0.206)	(0.029)	(0.028)	(0.162)	(0.080)	(0.031)	(0.030)
Emotionality	0.917	1.097	0.081***	0.142***	1.094	1.266*	0.088***	0.184***	1.259*	0.943	0.031	0.162***
	(0.095)	(0.094)	(0.039)	(0.035)	(0.216)	(0.169)	(0.034)	(0.031)	(0.176)	(0.090)	(0.040)	(0.035)
Conspiracy thinking	0.958	0.911	0.066***	0.104***	1.324*	0.972	0.090***	0.119***	1.058	0.838***	0.133***	0.108***
	(0.089)	(0.068)	(0.033)	(0.031)	(0.221)	(0.101)	(0.029)	(0.030)	(0.108)	(0.069)	(0.033)	(0.031)
Frequency of media consumption	1.350***	1.248***	0.035	0.002	1.151	1.058	-0.046*	-0.026	1.205	1.119	-0.015	-0.057**
	(0.146)	(0.099)	(0.028)	(0.032)	(0.260)	(0.110)	(0.024)	(0.027)	(0.179)	(0.105)	(0.028)	(0.029)
Chronic	0.837	0.838	-0.067	0.086	0.806	1.290	0.013	0.210***	1.374	0.951	0.097	0.140*
	(0.252)	(0.196)	(0.094)	(0.085)	(0.519)	(0.563)	(0.083)	(0.075)	(0.635)	(0.266)	(0.090)	(0.079)
Knowledge	5.506***	4.679***			12.463***	7.674***			1.779	6.935***		
	(2.749)	(1.691)			(9.722)	(3.479)			(1.401)	(2.611)		
Resilience	0.966	0.986	0.119***	0.132***	0.874	1.017	0.055*	0.139***	0.913	1.006	0.056*	0.135***
	(0.110)	(0.082)	(0.032)	(0.033)	(0.193)	(0.130)	(0.029)	(0.030)	(0.129)	(0.101)	(0.033)	(0.034)
Health literacy			0.506***	0.533***			0.488***	0.498***			0.460***	0.503***
			(0.040)	(0.039)			(0.037)	(0.037)			(0.042)	(0.036)
Constant	1.216	0.460	1.094***	0.772***	1.284	1.517	1.652***	1.026***	9.151*	3.803	1.393***	1.086***
	(0.997)	(0.344)	(0.256)	(0.235)	(2.153)	(1.795)	(0.246)	(0.229)	(10.672	(3.526)	(0.271)	(0.234)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
VARIABLES	June 2020	July 2020	August 2020	September 2020	June 2020	July 2020	August 2020	September 2020	June 2020	July 2020	August 2020	September 2020
	Physical distancing				Mask wearing				Hand washing			
									)			
Observations	668	798	948	940	669	815	937	939	664	811	971	958
R-squared			0.262	0.353			0.282	0.397			0.228	0.362

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Predictors of preventive measures

Overall, the age of the respondents had a positive impact on using preventive measures in June, August, and September 2020 (OR=1.015; p<0.10, β=0.005; p<0.05, and β=0.005; p<0.05). Male participants were 34 % less likely to use preventive measures in June 2020 than female participants (OR=0.663; p<0.05). On the other hand, participants with higher education were 1.416 times more likely to use preventive measures than their counterparts, participants with lower education levels in July 2020 (OR=1.416; p<0.05). Moreover, participants living in urban areas were associated with a 0.169 increase in the use of preventive measures in August 2020 than rural participants (β=0.169; p<0.01). The increase in the perceived probability of COVID-19 infection was associated with a 21 % decrease in the likelihood of using preventive measures in June 2020 (OR=0.788; p<0.05). On the other hand, the increase in the perceived severity of infection was associated with a 14 % lower likelihood to use preventive measures in July 2020 (OR=0.863; p<0.10). Participant's emotionality was significantly associated with increases in the use of preventive measures in August 2020 (β=0.065; p<0.10) and September 2020 (β=0.161; p<0.01).

Also, an increase in conspiracy thinking among participants was associated with a 0.102 and 0.112 increase in the use of preventive measures in August and September 2020 (β =0.102; p<0.01 and β =0.112; p<0.01). The increase in the frequency of media consumption was associated with the increase in the likelihood of using preventive measures in June 2020 (OR=1.253; p<0.05) and July 2020 (OR=1.178; p<0.05). Participants having chronic conditions were significantly associated with increased preventive measures in September 2020 (β=0.150; p<0.05). The increase in participants' knowledge about symptoms of COVID-19 was 3.902, and 5.911 times more likely to practice preventive measures in June 2020 (OR=3.902; p<0.01) and July (OR=5.911; p<0.01). Similarly, an increase in health literacy was associated with an increase in the use of preventive measures in August 2020 (β=0.470; p<0.01) and September (β=0.509; p<0.01). Moreover, increased resilience was associated with an increase in the use of preventive measures in August (β=0.077; p<0.01) and September 2020 (β=0.137; p<0.01).

Table 3: Predictors of preventive measures

	(1)	(2)	(3)	(4)
VARIABLES	June 2020	July 2020	August 2020	September 2020
Age	1.015*	0.997	0.005**	0.005**
	(0.008)	(0.006)	(0.002)	(0.002)
Male	0.663**	0.850	-0.052	-0.051
	(0.132)	(0.137)	(0.057)	(0.052)
High education	0.937	1.416**	-0.023	-0.016
	(0.192)	(0.234)	(0.058)	(0.053)
Urban	1.126	0.801	0.169***	-0.058
	(0.231)	(0.132)	(0.057)	(0.055)
Trust in institutions and healthcare	1.075	1.040	-0.000	0.003
	(0.088)	(0.066)	(0.002)	(0.003)
Perceived probability of an infection	0.788**	0.953	0.003	-0.021
	(0.082)	(0.070)	(0.023)	(0.024)
Perceived severity of an infection	0.885	0.863*	-0.016	-0.003
	(0.105)	(0.067)	(0.027)	(0.027)
Emotionality	1.037	1.003	0.065*	0.161***
	(0.096)	(0.073)	(0.035)	(0.030)
Conspiracy thinking	0.954	0.929	0.102***	0.112***
	(0.077)	(0.058)	(0.028)	(0.028)
Frequency of media consumption	1.253**	1.178**	-0.011	-0.023

	(0.120)	(0.079)	(0.023)	(0.026)
Chronic	0.973	1.023	0.018	0.150**
	(0.261)	(0.203)	(0.077)	(0.069)
Knowledge	3.902***	5.911***		
	(1.794)	(2.204)		
Resilience	0.882	0.985	0.077***	0.137***
	(0.087)	(0.071)	(0.028)	(0.029)
Literacy			0.470***	0.509***
			(0.035)	(0.034)
Constant	1.369	0.691	1.439***	0.966***
	(1.013)	(0.449)	(0.233)	(0.210)
Observations	672	821	976	960
R-squared			0.292	0.425

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Maladaptive behaviour

An increase in participant age was negatively associated with the practice of maladaptive behaviour in July (OR=0.983; p<0.05), August 2020 (OR=0.979; p<0.01), and September 2020 (OR=0.988; p<0.05). Males were less likely to practice maladaptive behaviour than females in July (OR=0.677; p<0.05) and August (OR=0.702; p<0.05). Participants with higher education levels were 41 % less likely to practice maladaptive behaviour than participants with lower education in July 2020. Urban residents were 23 % and 30 % less likely to practice maladaptive behaviour in August (OR=0.769; p<0.10) and September (OR=0.697; p<0.05), respectively. Also, an increase in trust in institutions and healthcare was positively associated with the use of maladaptive behaviour in August 2020 (OR =1.020; p<0.05) and September (OR=1.025; p<0.05). The increase in the perceived probability of COVID-19 infection was associated with a 15 % lower likelihood of practising maladaptive behaviour in August 2020 (OR=0.854; p<0.01). On the other hand, the increase in the perceived severity of COVID-19 was associated with 1.250 times increase in the practice of maladaptive behaviour in August 2020 (OR=1.250; p<0.01).

The increase in emotionality was 38 %, 22 % and 24 % less likely to use maladaptive in June (OR=0.622, p<0.01), July (OR=0.775; p<0.01), and September (OR=0.764; p<0.01), respectively. Moreover, an increase in conspiracy thinking was associated with 1.498 times more likely to practice maladaptive behaviour in July 2020 (OR=1.498; p<0.01) but 14 % less likely associated with the practice of maladaptive behaviour in August 2020 (OR=0.861; p<0.05). The increase in the frequency of media consumption was associated with 25 % and 14 % less likelihood to practice maladaptive behaviour in August (OR=0.752; p<0.01) and September (OR=0.859; p<0.05), respectively. Also, individuals with a chronic health condition were 1.585 and 1.521 times more likely to practice maladaptive behaviour in June (OR=1.585; p<0.10) and August (OR=1.521; p<0.05), respectively. Further, the increase in participants' resilience was 1.354 times more likely to practice maladaptive behaviour in June (OR=1.354; p<0.01). The increase in health literacy was associated with a 26 % lower likelihood of practising maladaptive behaviour in August 2020 (OR=0.739; p<0.01).

Table 4: Predictors of maladaptive behaviour

	(1)	(2)	(3)	(4)
VARIABLES	June 2020	July 2020	August 2020	September 2020
Age	0.996	0.983**	0.979***	0.988**
	(0.007)	(0.007)	(0.005)	(0.005)
Male	0.749	0.677**	0.702**	0.968
	(0.139)	(0.118)	(0.100)	(0.132)
High education	0.952	0.594***	1.160	1.085
	(0.181)	(0.116)	(0.169)	(0.148)
Urban	1.337	0.904	0.769*	0.697**
	(0.251)	(0.161)	(0.113)	(0.099)
Trust in institutions and healthcare	0.962	0.935	1.020**	1.025**
	(0.080)	(0.067)	(0.009)	(0.010)
Perceived probability of an infection	1.116	1.081	0.854***	0.933
	(0.096)	(0.090)	(0.050)	(0.056)
Perceived severity	1.136	1.021	1.250***	0.994

	(1)	(2)	(3)	(4)
VARIABLES	June 2020	July 2020	August 2020	September 2020
of an infection				
	(0.099)	(0.089)	(0.086)	(0.066)
Emotionality	0.622***	0.775***	1.014	0.764***
	(0.055)	(0.067)	(0.078)	(0.057)
Conspiracy thinking	0.968	1.498***	0.861**	0.921
	(0.083)	(0.117)	(0.060)	(0.059)
Frequency of media consumption	0.966	0.887	0.752***	0.859**
	(0.084)	(0.071)	(0.047)	(0.054)
Chronic	1.585*	1.181	1.521**	1.303
	(0.407)	(0.270)	(0.293)	(0.238)
Knowledge	1.944	0.746		
	(0.820)	(0.360)		
Resilience	1.354***	1.083	1.105	1.031
	(0.139)	(0.093)	(0.082)	(0.078)
Literacy			0.739***	0.989
			(0.063)	(0.073)
Constant	1.903	10.712***	38.369***	15.142***
	(1.283)	(8.294)	(21.582)	(8.191)
Observations	672	821	985	968

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Discussion

This study's analysis revealed different factors associated with the practice of preventive measures or maladaptive behaviour over time. The multivariate regression revealed that the increased age of the participants, urban residents, emotionality, increase in conspiracy thinking, media consumption frequency, having a chronic disease condition, increased knowledge about COVID-19 symptoms, increased health literacy, and resilience were positively associated with the practice of preventive measures. On the other hand, in male participants, increased perceived probability and severity were associated with a decrease in the practice of preventive behaviours.

Moreover, the practice of maladaptive behaviour was positively associated with increased trust in institutions and healthcare, an increase in the perceived severity and chronic health conditions, and resilience. An increase in age, male participants, higher education, urban residence, increased perceived probability, increased emotionality, and increased media frequency predict less practice of maladaptive behaviour. However, the increase in conspiracy thinking was associated with increased practice of maladaptive behaviour in July, then decreased practice of maladaptive behavior in August 2020. The unexpected positive association between trust in institutions and maladaptive behaviours in Kazakhstan may be due to cultural factors, such as historical skepticism towards government interventions.

Results showed that increased media consumption is positively related to the practice of preventive measures. Other studies have revealed that media consumption is positively related to self-efficacy, which is related to compliance with preventive measures (Liu & Jiang, 2023). Media increases awareness, which in turn makes participants informed about their decisions and practices, and thus results in a decrease in the practices of maladaptive behaviour. Dissemination of COVID-19 information through television, healthcare providers, and health officials contributes to greater adherence to infection prevention behaviour.

Moreover, the results show that male participants were less likely to practice both preventive and maladaptive behaviour compared to female participants. This is consistent with a previous study, which revealed that being male is a risk factor for preventive behaviour, and females predict the practices of preventive behaviour in China (Can et al., 2022). Also, a study in Singapore revealed that females were more likely to practice both preventive measures and maladaptive measures in Singapore (Long & Liu, 2021). However, other studies indicated that gender is not a significant predictor of preventive measures (Downing et al., 2023).

Additionally, the increased perceived severity of COVID-19 was associated with a decrease in the practice of preventive measures and an increase in the practice of maladaptive behaviour in Kazakhstan. This could be attributed to increased worries that influence the practices of maladaptive behaviours. This contradicts previous studies' findings that revealed that an increase in the perceived severity of COVID-19 predicts

an increase in the practices of preventive measures (Can et al., 2022; Hadizadeh-Talasaz et al., 2022). However, other studies have revealed there is little evidence of perceived severity to influence the practice of preventive measures (Burger et al., 2022; Downing et al., 2023). Further, education was found to be associated with preventive measures in this study. This is consistent with the study conducted, which revealed that education influences preventive measures practices (Vally, 2020). However, the study revealed no significant association between the practice of preventive measures and the education of the participants (Downing et al., 2023). Moreover, results show that people with chronic diseases predicted preventive and maladaptive measures. However, the previous study showed that chronic diseases predicted preventive measures (Vally, 2020). Still, in South Africa, the study revealed that chronic diseases were not a significant predictor of preventive measures (Burger et al., 2022).

Also, results show that increased age was associated with increased preventive measures and decreased maladaptive behaviour. This could be driven by an individual's understanding of the risk that may be associated with the practice of maladaptive behaviour and adherence to preventive measures. This contradicts the previous study's results, which revealed the lower practice of preventive measures (Burger et al., 2022), higher practices for young people (Long & Liu, 2021; Wright & Fancourt, 2021), and age as not a predictor of the practices (Downing et al., 2023). Moreover, results show that an increase in trust in institutions and healthcare predicts increased practices of maladaptive behaviour. This is contrary to the expectations that trust in institutions and healthcare would predict increased practices of preventive measures or lower maladaptive practices. However, the study conducted in East Africa revealed that a lack of trust in government acts as a barrier to handwashing (Muchangi et al., 2024).

Policy and Economic Implications

The finding suggests several important economic and policy implications. First, it highlights the need for targeted public health investment, as differences in age, education, and place of residence influence behavior. This means governments should allocate resources more efficiently by designing tailored communication strategies for specific groups, rather than relying on uniform approaches, thereby improving the cost-effectiveness of interventions. Second, addressing maladaptive behaviors has significant economic benefits, since such behaviors can increase infection rates, place a heavier burden on healthcare systems, and reduce labor productivity through illness and absenteeism. Promoting preventive practices through education and trust-building can therefore help lower public health expenditures and minimize economic disruptions. Third, the findings emphasize the importance of trust and equitable access to accurate information. Policies that ensure all population groups, regardless of background, receive reliable and understandable information can improve compliance with preventive measures, reduce the spread of misinformation, and ultimately support more stable economic activity during a pandemic.

Strengths and limitations

This study's strength is based on the four repeated cross-section data collected with a representative sample of the Republic of Kazakhstan, as opposed to previous studies. However, the study had limitations. The use of online data collection limits the participation of certain important population groups, such as older people (a risk group for COVID-19), migrants, refugees, young people who are under 18 years old, homeless people, and other vulnerable groups. Thus, the results of the research should be interpreted in this context. The findings that are related to the general population may not apply to specific disadvantaged groups, and this affects the generalizability of the study results. In addition, this study used a cross-sectional design, which may lead to recall bias, and the results are drawn from self-reported data. Comparison with objective data, such as direct observation of people wearing masks in a certain context, would be necessary to increase the external validity of the study. Future studies should employ longitudinal designs to track changes in behaviour over time and include objective measures of preventive behaviours to validate self-reported data.

Conclusion

The results conclude that people's behaviour during a pandemic like COVID-19 is affected by different factors. Participants' age, education, place of residence, health condition, and knowledge of COVID-19 predict their practices of preventive and maladaptive behaviours. The existence of different predictors in favour of maladaptive behaviour calls for policy intervention aimed at increasing the uptake of preventive behaviour rather than maladaptive behaviour. Therefore, consideration of all people regardless of their place of residence, level of education, and health status is needed through increased exposure to the right information and undertaking measures that will increase the trust in the disseminated information. Public health authorities in

Kazakhstan should develop tailored communication strategies to improve adherence to preventive measures, particularly among younger and less educated populations. Future research should explore the impact of targeted educational interventions on reducing maladaptive behaviours in high-risk groups.

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Declarations

Ethical approval and consent to participate

The study was approved by the Local Committee on Bioethics of the National Center for Public Health of the Republic of Kazakhstan (№ 2 dated 11 May 2020). All respondents provided informed consent for both survey methods (online and CATI). Confidentiality of information and protection of personal data were strictly ensured. The study was conducted following the relevant ethical standards and adhered to the principles outlined in the Declaration of Helsinki.

Consent for publication

Not applicable.

Competing interest

The authors declare no competing interests.

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