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Intervention made possible by *WhatsApp*® to promote adherence to preventive measures in the COVID-19 pandemic: a pilot study

Intervenção viabilizada por WhatsApp® para promoção da adesão às medidas preventivas na pandemia da COVID-19: um estudo piloto

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ABSTRACT
To analyze the potential efficacy of sending validated messages (text and images) via WhatsApp® in promoting adherence to the use of masks and social distancing and to evaluate its association with the sociodemographic variables. This is a study with a quasi-experimental design, of the pre and post test type. 132 participants were enrolled and followed up for 60 days. Validated messages were sent weekly along with the forms referring to adherence. At the end of the intervention, they answered the survey satisfaction questionnaire. Descriptive analyzes and tests were carried out to compare measures of adherence to mask use and social distancing. The findings of this study demonstrated the positive impact of the intervention in sending validated messages via WhatsApp® on adherence to the use of masks and social distancing during the COVID-19 pandemic. The intervention proposed in this study has potential efficacy for adherence to preventive measures against the SARS-CoV-2 virus and constitutes a valuable tool for health professionals to act in the fight against the COVID-19 pandemic.

Keywords: Coronavirus infections. COVID-19. Prevention of Diseases. Protective factors. SARS-CoV-2.

RESUMO
Analisar o potencial de eficácia do envio de mensagens validadas (texto e imagens), via WhatsApp®, na promoção da adesão ao uso de máscaras, distanciamento social e associar às variáveis sociodemográficas. Trata-se de um estudo com desenho quase-experimental, do tipo pré e pós-teste com 132 participantes, acompanhados por 60 dias. As mensagens foram enviadas semanalmente junto com os formulários de adesão. Ao final da intervenção os participantes responderam ao questionário de satisfação da pesquisa. Foram realizados testes de comparação e análises descritivas. Os achados deste estudo demonstraram impacto positivo da intervenção no envio de mensagens validadas, via WhatsApp®, na adesão ao uso de máscaras e distanciamento social durante a pandemia da COVID-19. A intervenção proposta neste estudo apresenta potencial de eficácia para adesão às medidas preventivas contra o vírus do SARS-CoV-2 e constitui uma ferramenta valiosa para profissionais de saúde atuarem no combate à pandemia.

Palavras-chave: COVID-19. Fatores de proteção. Infecções por coronavírus, Prevenção de doenças. SARS-CoV-2.

INTRODUCTION

Due to the alarming number of people infected and the number of deaths on a global scale caused by the SARS-CoV-2 virus, starting in 2019, the World Health Organization (WHO), on March 11, 2020, drew attention from around the world to the onset of a pandemic. On that date, the virus was present in at least 100 countries, with more than 100,000 confirmed cases and the clear need to develop disease prevention and biosafety strategies.[1]

The spread of SARS-CoV-2 and other respiratory viruses occurs from person to person through respiratory droplets, or also by unprotected contact with an infected individual or by touching surfaces, objects, and/or other items that have been contaminated.[2] Given the potential infectivity and transmissibility of the virus, the effectiveness of any isolated intervention is limited; however, multiple strategies should be combined to have a substantial impact on reducing contagion.[2]

In this way, strategies such as the use of masks, social distancing, proper hand hygiene, early identification of the disease, and isolation of confirmed cases are essential for controlling the pandemic.[1] The combination of isolation of confirmed cases, quarantine of contacts, and distancing measures, especially those that reduce social contacts by at least 60%, can significantly reduce the transmission of the disease and, consequently, contribute to the decline in hospitalizations, deaths, overload and costs generated to the health system.[2]

However, proving the effectiveness of such strategies is not enough, a broad effort is also needed for compliance and adherence by the population and, for this, technology has been a crucial tool in combating the 2019 coronavirus disease (COVID-19) pandemic. It is an instrument that makes it possible to carry out online consultations through applications, telephones, chat, and services that provide health guidance to citizens, in addition to allowing free calls, video calls, or messages via WhatsApp®.[3] Therefore, this technology can be considered a tool for assistance policies, as well as for health education.

WhatsApp® has been widely used in health care and has shown promising results in the integration between theory, clinical practice, and self-management in health.[4-6] In the health follow-up of people with human immunodeficiency virus (HIV), messages were sent every two weeks addressing the importance of adherence to antiretroviral therapy and this monitoring by the application made it possible to clarify doubts, with positive repercussions in achieving greater adherence to medications.[7]

The use of this technology is believed to promote greater patient access to safe information in order to overcome their difficulties with treatment, share achievements, and

adhere to health behaviors.[8-9] Therefore, WhatsApp® is a powerful tool to expand access to health care, reducing geographic barriers and the costs involved in the treatment of various diseases, in addition to strengthening the health system and improving the quality of care, especially when combined with usual care measures.[10]

Given the above and considering the pandemic context caused by SARS-CoV-2 and the need for effective strategies to promote awareness, individual and collective adherence to health protection measures to control disease transmission, the use of validated messages with information related to the use of masks and social distancing constitutes a possibility of low-cost intervention with potential for expansion.

This study is part of a broader, multicenter, quasi-experimental research, whose main objective was to analyze the potential effectiveness of validated messages (text and images), and forwarded via WhatsApp® in promoting adherence to the use of masks and social distancing, in addition to evaluating the association between adherence to protective measures and sociodemographic variables.

METHODOLOGY

DESIGN

This was a study with a quasi-experimental design, pre- and post-test, designed according to the recommendation of the Transparent Reporting of Evaluations with Nonrandomized Design.[11]

STUDY SCENARIO

As part of a multicenter study across the entire Brazilian territory, this research focused on the metropolitan region of Campinas, in the interior of the state of São Paulo, and was developed from December 2020 to July 2021.

SAMPLING

Sampling was non-probabilistic, using the snowball technique, and the subjects were invited through a message sent via WhatsApp® by the responsible researchers. To avoid harassment of potential participants, the researchers were the only ones who made the

invitation, ensuring that all individuals received the message only once.

PARTICIPANTS

This study included individuals aged 18 years or over, who had a mobile phone and internet access to use the WhatsApp® application; literate, with the ability to understand Portuguese and without visual and/or cognitive impairment, and who resided in cities surrounding the metropolitan region of Campinas.

Individuals who expressed the desire to no longer participate in the study were excluded; those who lost or changed their phone number and those who discontinued responding to the adherence forms.

A total of 850 subjects met the inclusion criteria and were invited to participate in the study; 205 people responded positively and signed the IC and, among these, 73 discontinued the study. Therefore, the final sample of this study consisted of 132 participants (Figure 1).

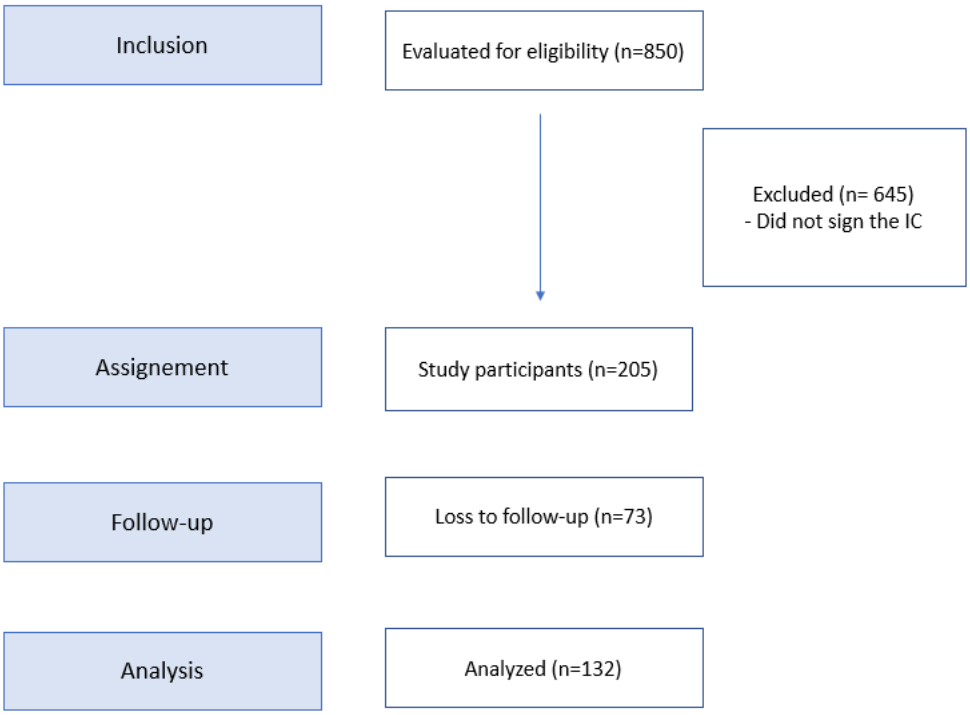

Figure 1. Flowchart adapted according to the recommendations of the Transparent Reporting of Evaluations with Nonrandomized Design –TREND.

STUDY VARIABLES

The main variable evaluated was adherence to protective measures, which refers to the frequency of mask use and social distancing, analyzed through responses to forms over the weeks. The factors investigated as independent variables were:

sociodemographic variables: age, sex, education, marital status, employment relationship, total number of people residing in the house, family/individual income and origin; clinical variables: self-reported practice of physical activity (frequency and location), previous comorbidities (hypertension, diabetes mellitus, heart disease, neurological disease, vascular disease, cancer), respiratory problems (asthma, rhinitis, bronchitis, sinusitis, bronchiectasis, self-reported use of alcohol (frequency), smoking and medication;

variables related to knowledge: transmission of SARS-CoV-2, means of obtaining information about the coronavirus, and the need to use a mask.

For the sociodemographic characterization and assessment of the knowledge, questionnaires built on the Google platform were used, forms with questions about the participant's profile and closed questions (yes and no answers) about knowledge.

To assess adherence and frequency of participants' actions each week of the research, Google forms were also created with questions about how often they left home in the last week; used the mask when leaving the house; washed the mask after arriving home; removed the mask when talking on the phone outside the home; removed the mask when going to the bathroom outside the house; used the mask on public transport; replaced the mask when damp; removed the mask to talk to someone outside the house; used the mask covering the mouth and nose; took at least one spare mask when leaving home; stayed at least 1 meter away from other people when leaving home; removed the mask using the loops; performed hand hygiene with soap and water or 70% alcohol and how often they touched the mask or objects outside the home. All responses used the Likert scale: 1- Never; 2 - Rarely; 3 - Sometimes; 4-Almost always; 5 - Always.

DATA COLLECTION

Data were collected from each participant for a period of two months and messages were sent every two days, whose content and appearance were validated by a focus group of specialists composed of three nurses and three physicians with a minimum of four years of experience in the area of infectiology or direct action in a pandemic situation, in addition to an expert in media with experience in the preparation of educational manuals and/or text messages. This group was responsible for evaluating the theoretical relevance, clarity, pertinence, and

vocabulary of the messages. Each week a questionnaire was sent to assess the adherence of the participants (total of 08 questionnaires). In the end, a satisfaction questionnaire regarding the messages was also sent.

All those who agreed to participate in the study received the Informed Consent (IC) via WhatsApp® and after signing it, they received the form with sociodemographic information, knowledge, and the first questionnaire on adherence to mask use and social distancing.

VALIDATION AND CONTENT OF THE MESSAGES

The content of the messages consisted of short information, composed of texts and figures constructed from a literature review. The content analysis allowed to evaluate the concepts, in addition to the adequacy of items and texts. The appearance validation verified the aesthetics of the messages, that is, if the images were harmonized with the content of the information.

Virtual focus groups were carried out to assess theoretical relevance (whether the messages reached the subjects they intended to reach), clarity (whether the messages designed for mobile phones were written in such a way that the concepts were understandable and adequately expressed what was expected to be measured), practical relevance (whether the messages reflected the concepts involved, whether they were relevant and suitable for sending as a text message to the target population). In addition, the coherence of the figures, the size, and the font of the texts were evaluated. There was 100% agreement between the parties regarding the contents of the messages (texts and images).

The messages contained information regarding the transmission routes of SARS-CoV-2, guidelines on how to use a face mask, differences between faces and care for each type, the importance of maintaining social distancing, proper hand hygiene, and the moments in which they must be carried out.

DATA ANALYSIS AND TREATMENT

The collected data were entered into an electronic spreadsheet (Software Excel, 2003) and subsequently transferred to the Statistical Package for Social Sciences (SPSS®) software, version 23.0. Descriptive analyses of variables related to sociodemographic, clinical, and knowledge data were performed. Subsequently, an analysis of the feasibility of the intervention was carried out according to the participation rate and the participants' satisfaction. And finally,

tests to compare measures of adherence to mask use and social distancing over the follow-up weeks and tests of association between adherence measures, sociodemographic and clinical variables, and the moment of the pandemic. For comparisons of adherence variables between times, modified Poisson regression models were used, with robust variance, via GEE modeling - Generalized Estimating Equations. To check the associations between the adherence variables and the other qualitative variables, the Chi-square and Fisher's exact tests were applied. A significance level of 5% was considered.

ETHICAL ASPECTS

The multicenter research project was approved by the Unifesp Research Ethics Committee (Opinion 4077371) and by the Research Ethics Committee of the School of Medical Sciences of the State University of Campinas (Opinion 4389386). All patients enrolled in this study signed the informed consent.

RESULTS

A total of 132 individuals residing in municipalities in the region participated in this study: 97 participants from Campinas, two from Arthur Nogueira, two from Jaguariúna, three from Paulínia, three from Indaiatuba, four from Santa Bárbara, three from Hortolândia, two from Sumaré and two from Valinhos, as shown in the sociodemographic and clinical characteristics listed in Table 1.

Among the professions, 32 were nurses, 25 were students, three housewives, eight teachers, two music producers, two freelancers, 13 physical therapists, two retirees, two nutritionists, 14 nursing technicians, three civil servants, two administration technicians, two pharmacists and 22 from other professions.

Data on physical activity, smoking, and drinking alcohol are listed in Table 1. Most participants (44; 33.3% of the sample) were not performing any type of physical activity during the data collection period, five (3.79%) indicated a frequency of once a week; 20 (15.15%) twice a week; 21 (15.91%) three times; nine (6.82%) four times; 19 (14.39%) five times; five (3.79%) six times; seven (5.30%) seven times, and two (1.52%) stated the practice more than seven times. Among the participants who practiced physical activities, 34 (25.76%) performed outdoors such as parks and walks, 20 (15.15%) practiced at home; 16 (12.12%) in closed places such as gyms, 18 (13.64%) practiced physical activities in both types of environments.

About the use of alcoholic beverages, 57 (43.18%) of the participants denied it and 15 (11.36%) consumed it once a month, 13 (9.85%) twice a month, 26 (19, 70%) once a week, and 21 (15.91%) indicated consumption more than twice a week. In the evaluated sample, 127 (96.21%) of the participants denied tobacco use and among the smokers, four (3.03%) consumed less than one pack a day and one (0.70%) reported using a pack per day.

Table 1. Socioeconomic and clinical variables of participants who completed the entire survey. Campinas, state of São Paulo, Brazil, 2020 – 2021

Variable	n	%
Age		
18 to 28	53	40.15
29 to 39	47	35.61
40 to 49	16	12.12
>= 50	16	12.12
Gender		
Female	100	75.76
Male	32	24.24
Income		
Less than 1 minimum wage	6	4.55
From 1 to 3 minimum wages	34	25.76
From 4 to 6 minimum wages	49	37.12
Over 7 minimum wages	43	32.58
Number of children		
0	78	59.09
1	22	16.67
2	22	16.67
More than 3	10	7.57
Number of people living in the same house		
0	9	6.82
1	39	29.55
2	29	21.97
3 or more	55	41.67
Education		
Incomplete elementary school	1	0.76
Complete elementary school	1	0.76
Incomplete high school	1	0.76
Complete high school	21	15.91
Incomplete higher education	25	18.94
Complete higher education	25	18.94
Graduate studies	58	43.94
Diseases		
None	114	86.36
Hypertension	8	6.06
Heart disease	6	4.55
DM and hypertension	2	1.52
Diabetes Mellitus	1	0.76
Respiratory disease		
No	103	78.03
Yes	29	21.97

Alcoholic beverage		
No	57	43.18
Yes	54	56.82
Smoking		
No	127	96.21
Yes	5	3.79
Physical activity		
No	44	33.33
Yes	88	66.67

Descriptive analysis is presented in absolute frequency (n) and relative frequency (%).

Regarding the knowledge of the participants, only 68 (51.52%) recognized the correct way of transmitting SARS-CoV-2, that is, through the air, coughing, sneezing, and touching contaminated surfaces. Regarding knowledge of mask use, 121 (91.67%) demonstrated recognition of the need, 129 (97.93%) stated that it was easy to acquire, and 85 (64.39%) reported discomfort during use, as shown in Table 2.

Table 2. Variables related to knowledge of SARS-CoV-2 transmission, means of obtaining information about the coronavírus, and the need to use a mask. Campinas, state of São Paulo, Brazil, 2020 – 2021

Variables		**n**	**%**
How do you get information about the coronavirus?			
Only by television, newspaper, and internet		41	31.06
Only at work, school, or college		2	1.52
Only by television, newspaper, internet, friends and/or family		65	49.24
Only internet		20	15.15
Only television, newspaper, internet, and college		1	0.76
Only internet and at work		1	0.76
Only tv		1	0.76
Only newspaper		1	0.76
How is the coronavirus transmitted?			
Only by air, coughing, and sneezing		6	4.55
Only by air, coughing, sneezing, and touching contaminated surfaces		68	51.52
Only by coughing and sneezing		2	1.52
Only by touching contaminated surfaces, coughing, sneezing, and feces		3	2.27
Only by air, touching contaminated surfaces, coughing, sneezing, and contaminated food		18	13.64
Only by touching contaminated surfaces, coughing, and sneezing		24	18.18
Only by touching contaminated surfaces, and sneezing		1	0.76
Only by air		5	3.79
All alternatives except by air		2	1.52
Only by air, and contaminated surfaces		1	0.76
Only by air, touching contaminated surfaces, and coughing		1	0.76
Only by air, coughing, sneezing, and feces		1	0.76
Have you ever had contact with someone with covid?	No	57	43.18
	Yes	75	56.82
Have you ever had covid?	No	108	81.82
	Yes	24	18.18

Are you afraid of getting covid?	No	19	14.39
	Yes	113	85.61
Do you feel discomfort when wearing a mask?	No	47	35.61
	Yes	85	64.39
Do you think you don't need to wear a mask?	No	121	91.67
	Yes	11	8.33
Do you have difficulty acquiring a mask?	No	129	97.73
	Yes	3	2.27

Descriptive analysis is presented in absolute frequency (n) and relative frequency (%).

Most participants (49.24%) used more than one source of information (television, internet, newspaper, friends, and family), 113 (85.61%) reported fear of contamination with the coronavirus, and a total of 75 (56.82%) sample subjects had already had contact with someone with Covid-19 (Tab 2).

To assess adherence to protective measures, different questions were asked and analyzed over the weeks (Table 3). The descriptive analysis of the responses over time showed no significant variation regarding P1 (frequency the participant left home in the last week), that is, most people left home more than five times in a single week during the data collection period.

Table 3. Description of the questions and answers asked to the participants. Campinas, state of São Paulo, Brazil, 2020 – 2021

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P1 – In the last week, how often did you leave home?
P2 – In the last week, how often did you use the mask when you left home?
P3 – In the last week, how often did you wash your mask with soap and water when you got home?
P4 – In the last week, how often did you take off your mask to talk on the phone when you were away from home?
P5 – In the last week, how often did you take off your mask to go to the bathroom when you were away from home?
P6 – In the last week, how often did you wear a mask in the car, subway, bus, or train?
P7 – In the last week, how often did you replace the mask when damp?
P8 – In the last week, how often did you take off your mask to talk to someone when you were away from home?
P9 – In the last week, how often did you wear a mask covering your mouth and nose when you were away from home?
P10 – In the last week, how often did you take another mask with you to replace it, if necessary?
P11 - In the last week, how often did you keep a distance of 1 meter from another person when you left home?
P12 – In the last week, how often did you take off the mask using the loops after use?
P13 – In the last week, how often did you wash your hands or apply 70% alcohol when you touched the front of the mask?
P14 – In the last week, how often did you wash your hands or apply 70% alcohol when you touched an object outside the home?

Questions P2 to P10 and P12 are related to the use of a mask and more than 75% participants took the recommended protective measures in all periods. P11 concerns the distance of 1 meter from one person to another and in the same way, most of the participants in

the sample (75%) demonstrated adherence. As for hand hygiene and the use of 70% alcohol, there was greater adherence when participants touched objects outside the home.

Comparative analysis of adherence responses to protective measures over the weeks (Tab 4) could not group the answers related to P1 because they presented many categories of answers and we considered that some participants were from the health area, therefore, leaving home was a need for the participant and not a matter of adherence to the recommendations.

Table 4. Comparison of participants' responses according to the week of the beginning, middle, and end of the study. Campinas, state of São Paulo, Brazil, 2020 – 2021

Dependent variable	Comparison	Relative risk	Confidence interval (95%)		p-value
			Lower limit	Upper limit	
P2*	T4 - T0	1.02	0.99	1.05	0.3173
	T8 - T0	1.00	0.96	1.04	1.0000
	T8 - T4	0.98	0.96	1.01	0.1573
P3*	T4 - T0	1.11	1.02	1.22	0.0219
	T8 - T0	1.11	1.01	1.23	0.0412
	T8 - T4	1.00	0.93	1.07	1.0000
P4**	T4 - T0	0.98	0.93	1.02	0.3173
	T8 - T0	1.00	0.95	1.05	1.0000
	T8 - T4	1.02	0.97	1.08	0.4054
P5**	T4 - T0	1.02	0.97	1.08	0.3657
	T8 - T0	1.06	1.01	1.11	0.0196
	T8 - T4	1.03	0.99	1.07	0.1025
P6*	T4 - T0	1.09	0.99	1.21	0.0834
	T8 - T0	1.11	1.00	1.24	0.0483
	T8 - T4	1.02	0.94	1.11	0.6547
P7*	T4 - T0	1.03	0.94	1.13	0.5316
	T8 - T0	1.10	0.99	1.23	0.0772
	T8 - T4	1.07	0.99	1.15	0.0708
P8**	T4 - T0	0.99	0.96	1.03	0.6547
	T8 - T0	0.98	0.95	1.02	0.4142
	T8 - T4	0.99	0.96	1.03	0.6547
P9*	T4 - T0	1.02	1.00	1.05	0.0833
	T8 - T0	1.02	0.98	1.07	0.2569
	T8 - T4	1.00	0.97	1.03	1.0000
P10*	T4 - T0	1.12	1.01	1.24	0.0344
	T8 - T0	1.10	0.98	1.23	0.1173
	T8 - T4	0.98	0.91	1.05	0.5930
P11*	T4 - T0	1.07	0.96	1.19	0.2231
	T8 - T0	0.99	0.88	1.11	0.8658
	T8 - T4	0.93	0.85	1.02	0.1026
P12*	T4 - T0	1.07	1.00	1.15	0.0594
	T8 - T0	1.10	1.02	1.18	0.0116
	T8 - T4	1.02	0.98	1.08	0.3173
P13*	T4 - T0	1.14	1.02	1.27	0.0219
	T8 - T0	1.12	1.01	1.24	0.0442
	T8 - T4	0.98	0.90	1.07	0.6698
P14*	T4 - T0	1.03	0.96	1.10	0.4669

T8 - T0	1.05	0.99	1.12	0.1088
T8 - T4	1.03	0.98	1.08	0.3173

*The risk of presenting the result "4 to 5" was estimated. **The risk of presenting the result "1 to 3" was estimated. Statistics used - modified Poisson regression models, with robust variance, via Generalized estimating equations (GEE).

When comparing the participants' responses using the research moment (1st week - T0; 4th week - T4; 8th week - T8), some questions obtained a significant difference in comparison to the evaluated week, as listed in Table 4. For all questions with statistical significance, there was a difference compared to T0, that is, the beginning of the research.

Regarding the comparison of times, the questions that had the greatest impact on adherence to preventive measures by participants in times T0-T4 and T0-T8 were P3, P6, P10, P12, and P13. P5 was also considered to have a relevant impact. All cited responses reached a 95% confidence interval and p-value < 0.05. This analysis showed that 42.85% of the informative messages about preventive measures for the disease were considered relevant and had positive effects on adherence to protective and preventive measures against Covid-19, with a p-value <0.05 and a 95% confidence interval.

In addition to these analyses, comparison tests (Chi-square test* and Fisher's exact test**) between the answers and the socioeconomic and clinical variables of the participants in T8. For questions P3 (p=0.0064*), P7 (p< 0.0001*), P13 (p=0.0110*), and P14 (p= 0.0086**) there was a statistically significant association between gender and adherence to the questioned measures. There was also a significant association between the number of people living in the same house in P6 (p=0.0416*), and P14 (p=0.0493**).

The fear of getting the coronavirus had a significant association only for P6 (p=0.0470**), for the other questions there was no statistically significant difference.

As for the degree of satisfaction of the participants, the results in Table 5 suggest that 58 (59.09%) participants indicated that they were "always satisfied" with receiving messages over the weeks, 25 (18.94%) evaluated as "almost always", and only 6 (4.55%) answered "rarely" or "never" 3 (2.27%). Likewise, 23 (93.18%) considered the images easy to understand, and 79 (59.09%) classified them as interesting. With regard to conducting the research, most participants reported that the time interval for sending messages was adequate (77.27%), as well as the duration of the intervention (76.52%).

Table 5. Frequency of responses to questions related to the satisfaction survey. Campinas, state of São Paulo, Brazil, 2020 – 2021

	Always		Almost always		Sometimes		Rarely		Never	
	n	%	n	%	n	%	n	%	n	%
Were the words and images used in the messages easy to understand?	123	93.18%	5	3.79%	3	2.27%	0	0.00%	1	0.76%
Were the messages interesting to you?	79	59.85%	34	25.76%	13	9.85%	3	2.27%	3	2.27%
Did you like receiving the messages?	78	59.09%	25	18.94%	20	15.15%	6	4.55%	3	2.27%
In your opinion, were the messages uncomfortable?	4	3.03%	3	2.27%	20	15.15%	29	21.97%	76	57.58%
Did the duration of sending messages appear suitable for you?	101	76.52%	15	11.36%	10	7.58%	4	3.03%	2	1.52%
Did the time interval between sending one message and another seem adequate for you?	102	77.27%	20	15.15%	7	5.30%	2	1.52%	1	0.76%
Did the messages remind you to wear a mask and maintain social distancing?	88	66.67%	19	14.39%	8	6.06%	8	6.06%	9	6.82%
Did you learn anything new from sending these messages?	38	28.79%	21	15.91%	36	27.27%	25	18.94%	12	9.09%
Did the messages remind you of the pandemic situation we are experiencing?	106	80.30%	12	9.09%	5	3.79%	2	1.52%	7	5.30%
Did the messages provide safety in the face of the measures that we must take at the time of a pandemic?	95	71.97%	14	10.61%	11	8.33%	7	5.30%	5	3.79%

Descriptive analysis is presented in absolute frequency (n) and relative frequency (%).

As for the impact of sending messages in promoting adherence, 88 (66.67%) individuals reported that they always and 19 (14.39%) were almost always reminded to use a mask and practice social distancing, and the vast majority, 106 (80.30%), reported that the messages served as a warning of a pandemic moment. Regarding acquired knowledge, 38 (28.79%) subjects always reported having learned something new, another 21 (15.91%) almost always, and 36 (27.27%) reported only sometimes. Importantly, 95 (71.97%) participants felt safe in the face of the protective measures they should have taken during the Covid-19 pandemic (Table 5).

DISCUSSION

This study evaluated the potential effectiveness of messages sent via WhatsApp® to promote adherence to preventive measures for the spread of SARS-CoV-2 and also verified the association between this adherence and sociodemographic and clinical characteristics.

Our findings showed that 1) the messages sent had potential effectiveness for adherence to protective measures, especially in relation to care with the hygiene of masks and correct use/handling; 2) the intervention obtained satisfaction regarding the content, receipt, and interval of sending messages, in addition to promoting participants' confidence in preventive measures; 3) sending validated messages can be effective in disseminating safe information; 4) there was an association between hand hygiene, the gender variable and the number of people living in the same house.

The construction of the messages that made up the intervention of this study considered previous studies that evaluated the effectiveness of preventive measures against Covid-19 and followed the methodological rigor necessary for content validation. Countless studies presented such evidence, such as the recent systematic review whose main outcome was the reduction in the incidence of Covid-19 through health policy interventions. The authors identified 37 studies with packaged interventions and 35 that evaluated interventions separately. Of these 35 studies, eight were included in a meta-analysis that indicated a reduction in the incidence of Covid-19 associated with handwashing (HR 0.47, 95% CI 0.19 to 1.12, I^2 = 12%), use of masks (0.47, 0.29 to 0.75, I^2 =84%) and physical distancing (0.75, 0.59 to 0.95, I^2=87%).[12] Other evidence indicated that the use of masks can greatly reduce the risk of respiratory virus infection (MERS, SARS, SARS-Cov2) n=2,647; OR 0.15 (0.07 to 0.34); Non-adjusted OR 0.34 (95% CI 0.26 to 0.45) with stronger associations with N95 mask or similar respirators compared to disposable surgical masks or similar.[13]

The literature is emphatic in stating that hand hygiene is extremely important to control the spread of any virus. A case-control study demonstrated that regular hand washing is associated with a lower risk of SARS-CoV-2 (adjusted OR 0.34 (95% CI 0.13 to 0.87)) and reduced odds of infection (adjusted OR 0.30 (95% CI 0.11 to 0.80))[14]. In the present study, the results showed a strong association between sex and adherence to hand and mask hygiene measures, which corroborates a previous study that pointed out that most men in the studied sample did not comply with protective measures.[15] These results call attention to the need for specific interventions with the male population.

Results from a previous study that included 8,158 participants indicated an increased risk of Covid-19 infection for those who did not wash their hands (2.28% vs 0.65%; HR 3.53, 95% CI 1.53-8.15; P = 0.009), did not practice social distancing (1.52% vs 0.58%; HR 2.63,

95% CI 1.48-4.67; P=.002) and did not wear a mask (7.41 % vs 0.6%; HR 12.38, 95% CI 5.81-26.36; P<0.001).[16] It is understood that the risk of infection can be reduced through strategies such as the one in this study, which showed results of improvement in some prevention behaviors over the period of data collection.

Concerning social distancing, motivations for engagement have to be understood, and interventions to educate the population about a sense of community responsibility and involve the protection of those closest (family and friends) have the be predicted, to generate better results. Participants of a study carried out in North America and Europe were asked about their personal reasons for engaging in preventive measures against Covid-19 and the answers were from an individual and collective perspective, such as "I want to protect others" 1,726 (85.7%), "I want to protect myself" 1,690 (84%) and "I feel a sense of responsibility to protect our community" 1,688 (83.9%).[17] The present study showed no significant relationship between social distancing and the number of people in the house, probably because a large part of the sample was composed of health workers. However, an association was detected between the number of people living in the same house and hand hygiene, reinforcing the sense of protection for others, especially among individuals from the same family.

The same study cited above evaluated the barriers to social distancing which included "There are a lot of people walking on the streets" 624 (31.0%), "I have friends or family who need me to do things for them" 497 (24.7 %), "I don't trust my government's messages about the pandemic" 255 (12.7%) and "I feel stressed when I'm alone or isolated" 268 (13.3%).[17] Many barriers to social distancing are sometimes unavoidable, mainly related to essential services, such as the need for food and health care. In the present study, the results indicated that the participants often left their homes at a time when the recommendation was exactly the opposite, which can be explained by the number of health professionals in the sample who had to go out to work.

Factors such as stress caused by isolation and lack of confidence in information can also compromise adherence to protective measures. In this study, there was no assessment of stress or difficulty in maintaining social distancing, but previous results found an association between the lockdown period, loneliness, and increased levels of salivary cortisol.[18] In addition, qualitative research findings indicated that physical distancing measures can impact loneliness due to limitations imposed on social contact and the perceived insufficiency of digital contact as a substitute[19]. Therefore, psychoeducational interventions, such as the messages used in this study[20], can be an alternative for reducing the symptoms of anxiety, depression, and stress caused by social distancing.

The results of the present study showed that most participants used the internet, television, newspaper, friends, and family as a source of information during the Covid-19 pandemic. A Brazilian study evaluated the veracity of 85 records of information in the format of messages, videos, and audios disseminated on networks and social media and classified 80 (94.1%) of the records as fake news.[21] Likewise, the literature points out that misinformation on Covid-19 has an important effect on health behaviors. Therefore, noise in communication between people seems to be frequent, mainly because that information is transmitted from person to person without prior verification of the veracity, and this has a negative impact on the fight against infectious and contagious diseases, and the strategy for sending validated messages, such as proposed by this study, can be a valuable tool for health professionals and a safe source of access to information.

The intervention proposal of this study demonstrated evidence of applicability and satisfaction of the participants since it was evaluated as an easy-to-understand, reliable information vehicle and most reported that they felt safe to carry out the recommended guidelines. These results corroborate another study that evaluated the effectiveness of sending text messages on cell phones directed by the Korean government for public compliance with preventive measures during the Covid-19 pandemic, likewise, a high degree of adherence was found, and participants reported recognizing the importance of these messages in their daily lives.[22] This strategy was also used to assess the follow-up of university students diagnosed with Covid-19 who expressed interest in receiving text messages with support and encouragement during their time of isolation.[23]

Therefore, this study demonstrated that technology is an ally in the expansion of validated and reliable information to the population. In addition, this strategy is capable of promoting adherence to positive health-related behaviors both for prevention, as demonstrated in this study, and the promotion and monitoring of individuals.

CONCLUSION

The intervention proposed here of sending messages validated via WhatsApp® showed evidence of potential effectiveness in promoting adherence to preventive measures against the SARS-CoV-2 virus, and that sociodemographic factors such as male gender may be associated with poor adherence to hand hygiene.

PRACTICAL APPLICATIONS

The pilot project of this study showed potential effectiveness for carrying out the intervention by sending text messages to promote adherence to prevention and health protective behaviors. It is reliable, low-cost capable of reaching a large audience in a short period, and it can be used as a source of safe dissemination of information by health professionals in the context of different diseases, especially transmissible ones.

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