JAMA Network Open

Original Investigation | Public Health

Association of a Public Health Campaign About Coronavirus Disease 2019 Promoted by News Media and a Social Influencer With Self-reported Personal Hygiene and Physical Distancing in the Netherlands

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Abstract

IMPORTANCE In the absence of a vaccine and therapeutic agent, personal hygiene and physical distancing are essential measures to contain the coronavirus disease 2019 pandemic.

OBJECTIVE To determine whether a social media campaign, targeted at the gaps in behavior on personal hygiene and physical distancing and distributed nationwide via digital news media, may be an effective method to improve behavior and help to inhibit person-to-person transmission of severe acute respiratory syndrome coronavirus 2.

DESIGN, SETTING, AND PARTICIPANTS This survey study was designed to uncover self-reported gaps in behavior regarding personal hygiene and physical distancing in the Netherlands. A diagnostic survey was distributed by a large national newspaper (*De Telegraaf*) and a popular social influencer (Govert Sweep) on March 17, 2020, and was completed by 16 072 participants. Analysis of these outcomes showed that coughing and sneezing in the elbow was done well, but that handwashing, face touching, and physical distancing showed serious gaps compared with advised behavior. This diagnostic information was used to design infographics and a video targeted at repairing these gaps in behavior. The video and infographics were distributed on a national level on March 21, 2020, followed by a postcampaign survey to measure the results on March 24, 2020. Data analysis was performed from March to April 2020.

EXPOSURE Exposed participants were those who viewed the infographics and/or video.

MAIN OUTCOMES AND MEASURES Improvement on the extent of handwashing in all areas, handwashing duration of 20 seconds or longer, awareness on face touching, and physical distancing were measured according to responses on the postcampaign survey.

RESULTS A total of 17 189 participants (mean [SD] age, 47.61 [13.57] years; 9100 women [52.9%]) responded to the postcampaign survey. The news article in *De Telegraaf* was read more than 2 million times, and the influencer video was watched more than 80 000 times. Cross-sectional analysis of the postcampaign survey using logistic regression correcting for age, gender, and educational level showed that exposure to the video plus infographics (827 participants) (adjusted odds ratio [OR], 2.14; 95% CI, 1.83-2.50; $P < .001$) and to the infographics alone (11 348 participants) (adjusted OR, 1.31; 95% CI, 1.22-1.40; $P < .001$) were positively associated with washing hands in all areas compared with the unexposed group (4751 participants). In addition, exposure to the video plus infographics (adjusted OR, 1.86; 95% CI, 1.59-2.16; $P < .001$) and to the infographics alone (adjusted OR, 1.27; 95% CI, 1.19-1.36; $P < .001$) were positively associated with washing hands long enough compared with the unexposed group. Exposure to the video alone was not associated with improved handwashing.

(continued)

Key Points

Question Are evidence-based public health campaigns, aiming to contain the coronavirus disease 2019 pandemic and using digital news media and social media, associated with improvements in personal hygiene?

Findings In this survey study of hygiene awareness and behavior in the context of the coronavirus disease 2019 pandemic, exposure to a targeted campaign video and news article was associated with an approximately 2-fold increase in the odds of washing of all required hand areas and longer duration of handwashing.

Meaning These findings suggest that evidence-based campaigns using existing digital news and social media platforms may be an effective means to help combat critical health issues, such as the coronavirus disease 2019 pandemic.

+ Supplemental content

Author affiliations and article information are listed at the end of this article.

Abstract (continued)

Compared with the unexposed group, exposure to the infographics alone and video plus infographics were associated with improvements in physical distancing when the participant had COVID-19 syptoms (infographics alone, adjusted OR, 1.10; 95% CI, 1.03-1.17; *P* = .006; video plus infographics, adjusted OR, 0.79; 95% CI, 0.69-0.91; *P* = .001) and face touching (infographics alone, adjusted OR, 1.29; 95% CI, 1.22-1.38; *P* < .001; infographics and video, adjusted OR, 1.49, 95% CI, 1.30-1.71; *P* < .001).

CONCLUSIONS AND RELEVANCE These findings suggest that a targeted behavioral change campaign, promoted by a news platform and social media, was associated with self-reported improvement in personal hygiene with the aim to prevent person-to-person transmission of severe acute respiratory syndrome coronavirus 2. This method of evidence-based campaigning may be an effective way to improve critical public health issues, such as the coronavirus disease 2019 pandemic.

JAMA Network Open. 2020;3(7):e2014323. doi:10.1001/jamanetworkopen.2020.14323

Introduction

As coronavirus disease 2019 (COVID-19) spreads around the globe, with more than 5 304 772 confirmed cases and 342 029 deaths as of May 21, 2020, it has become the first pandemic of the digital age.[1] In the absence of a vaccine or effective treatment, improved personal hygiene and physical distancing, together with comprehensive contact tracing and quarantining, are critical measures to prevent further person-to-person transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).[2]

In past pandemics, such as the influenza outbreak in 1918, information exchange was relatively slow; in contrast, in the current information age, 3.7 billion people worldwide (approximately 49.7% of the world's population) are using the internet.[3] It is now possible for individuals to create their own content and easily share information with a large targeted audience, because even a single piece of content (eg, a video) has the potential to reach millions of people at a low cost. Online communities create a shared sense of identity, and many such communities revolve around highly trusted, influential individuals.[4,5] The use of digital technology to present news has also been embraced by traditional media. In the COVID-19 pandemic, an "infodemic" has evolved, resulting in a widespread dissemination of both trusted information and, unfortunately, misinformation.[6] However, the digital interconnectedness creates opportunities for large-scale public health interventions. Harnessing social media to prevent the spread of COVID-19 has the potential to help flatten the curve. It has previously been shown that entertainment media and social media have a tremendous reach to the individual and have the potential to influence awareness and behavior.[7,8]

A recent analysis[9] of multifaceted public health measures in Wuhan, China, including social distancing and traffic restriction, found that such measures were associated with a reduction in the transmission rate of the SARS-CoV-2. The use of the latest insights in behavioral science may further help to harness the use of social media to change human behavior. For instance, a recent meta-analysis[10] on the effectiveness of nudging to promote healthy eating showed that behaviorally oriented nudging was more effective than cognitively or affectively oriented nudging. Another improvement to increase the effectiveness of public health campaigns may be a strategy that first determines the biggest gaps in behavior and subsequently designs a targeted intervention, as was successfully demonstrated in the design of an intervention conducted after face-to-face interviews that was associated with increased consumption of fluoride-free water in Ethiopia.[11] In the survey study presented here, we investigated the effectiveness of an evidence-based public health campaign strategy, distributed by national digital media and designed with behavioral insights, to improve self-reported personal hygiene and physical distancing in the Netherlands in the midst of the first wave of the COVID-19 crisis.

Methods

This study was reviewed and waived for official approval on March 17, 2020, by the medical ethics review committee of VU University Medical Center. Before partaking in the digital surveys, participants were required to give informed consent for participation and collection and analysis of their data by ticking the "Yes, I agree, and I give permission to collect and analyze my data for scientific research" box, and not the "No, I do not agree and hereby end my participation" box on the survey website.

Diagnostic Survey Development

For the purpose of improving hygiene behavior, on March 14 and 15, 2020, we developed a survey in Dutch (eAppendix in the Supplement), based on the National Institute for Public Health and the Environment of the Netherlands guidelines surrounding COVID-19 hygiene.[12] With our survey, we assessed the following personal hygiene components: (1) handwashing, (2) face touching, and (3) physical distancing, in the past 48 hours. The diagnostic survey aimed to identify gaps in appropriate hygiene behavior and consisted of 11 questions total: 2 on handwashing, 1 on face touching, 5 on physical distancing, and 3 on demographic information. The postcampaign survey consisted of the same questions as the diagnostic survey and an additional 2 questions to determine to which part(s) of the campaign the participant was exposed (eAppendix in the Supplement). Both surveys were designed and presented to the participants in Qualtrics^{XM} survey software version update March 2020 (Qualtrics).

The survey was reviewed and tested by a small group of individuals from the target groups of both the influencer and the news outlet *De Telegraaf*. Because of the compressed timelines, there was insufficient time to validate the survey. The AAPOR Standard Definitions Report does not include a study type that fits in our study and mentions that, for surveys comprising nonprobability sampling methods, response rates cannot be calculated.[13]

Dissemination of the Diagnostic Survey

For national distribution of our survey to uncover gaps in hygiene behavior in the Netherlands, we used the reach of a Dutch social influencer, Govert Sweep (one of the authors of this study), who has more than 500 000 combined followers through YouTube and Instagram, and the national newspaper *De Telegraaf*, which is the most read newspaper in the Netherlands and has the largest national circulation in both print and digital platforms. Nationwide distribution of the diagnostic survey was done on March 17, 2020.

Evidence-Based Campaign Design

On March 19, 2020, the results of the diagnostic survey were used to design a social media campaign with the aim to repair the biggest gaps in behavior and, thus, prevent the spread of COVID-19. The campaign was launched on March 21, 2020. The context for this study was ideal for an approach informed by social norm theory.[14] Social norms are what individuals believe is typical behavior (ie, how people around them typically behave), as well as what they believe others perceive as appropriate behavior (ie, how one should behave). We leveraged the power of social norms by having an influencer and a newspaper model appropriate behavior to their audiences.[15] By exposing individuals from the target group to our public health campaign through personalized messaging about their gaps in behavior, we aimed to bridge their intention-behavior gap, which usually results in greater behavioral change.

News Article With Infographics in *De Telegraaf*

The newspaper *De Telegraaf* created a news article with infographics showing gaps in behavior based on the results of our diagnostic survey (**Figure**). At the bottom of the news article, a link to our evidence-based campaign video with Govert Sweep was included.[16]

Evidence-Based Campaign Video

On the basis of the findings of the diagnostic survey, the social influencer designed a video containing a thorough instruction of how to wash hands properly. In addition, in the video he interviewed a well-known virologist on the importance of physical distancing and avoiding face touching (Figure). The total duration of the video was 11 minutes and 33 seconds.[17]

Postcampaign Survey

The results of the exposure to the public health campaign were measured in individuals from the same target group with a cross-sectional survey on March 24, 2020. The postcampaign survey was disseminated through *De Telegraaf* and by Govert Sweep, as previously described for the diagnostic survey.

Formulation of Groups

Adding questions that assessed the exposure of participants of the postcampaign survey allowed us to split the participants in the following 4 groups: group 1 was not exposed to the campaign (unexposed group), group 2 only saw the evidence-based video, group 3 had read the article in *De Telegraaf* containing infographics, and group 4 was exposed to both the news article plus infographics and the evidence-based video.

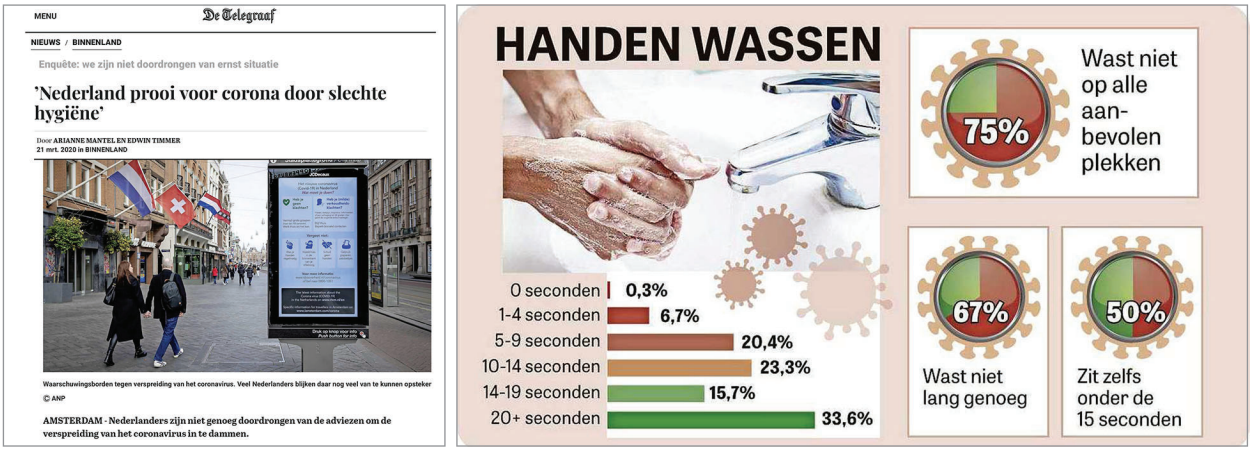
Statistical Analysis

Ordinal data collected with the Likert-scale answers (eg, never, rarely, sometimes, often, and always) for questions 6, 7, and 8 in the surveys (eAppendix in the Supplement) were transformed into

Figure. Screenshots From Evidence-Based Campaign Video and News Article With Infographics

A Screenshots from evidence-based campaign video with social influencer

B Screenshots from news article with infographics in *De Telegraaf*



A, Govert Sweep designed a video containing a thorough instruction of how to wash hands properly, and he interviewed a well-known virologist on the importance of physical distancing and avoiding face touching. B, On the basis of the results of our diagnostic survey, the newspaper *De Telegraaf* created a news article with infographics showing gaps in behavior. The news article included a link to our evidence-based campaign video with the social influencer Govert Sweep.

numerical values (1, 2, 3, 4, and 5, respectively). All outcomes per question are available in eAppendix in the Supplement. Outcomes on handwashing (questions 4 and 5 eAppendix in the Supplement) were transformed into binary outcomes regarding washing all required areas (yes or no) and washing long enough (yes or no).

Binary outcomes were analyzed with the Pearson χ^2 test between all groups. When the latter was found to be statistically significant (ie, 2-sided $P < .05$), a binary logistic regression was performed.

Ordinal outcomes were assessed using a χ^2 test. When this was found to be statistically significant, in the case of an transformed ordinal outcome, an ordered logistic regression was performed. We adjusted for the following demographic characteristics in our regression models: age, gender, and education.

Results are reported as mean outcomes of the behavior with 95% CIs, adjusted odds ratios (ORs) with 95% CIs, and *P* values for each group. Analysis was conducted in R statistical software version 3.6.1 (R Project for Statistical Computing). Data analysis was performed from March to April 2020.

Results

The online news article with the infographics in *De Telegraaf* was read more than 2 million times in the Netherlands.[16] The exposure of the paper version of the article, with a circulation of 600 000, could not be measured. The video was watched more than 80 000 times on YouTube.[17] A total of 16 072 participants (mean [SD] age, 48.03 [13.68] years; 8546 women [53.2%]) responded to the diagnostic survey, and 17 189 participants (mean [SD] age, 47.61 [13.57] years; 9100 women [52.9%]) responded to the postcampaign survey.

Among the 17 189 participants who completed the postcampaign survey, 4751 reported not having seen either the video or infographics (unexposed group), 263 participants reported having seen the video only (video-only group), 11 348 participants reported having seen the infographics only (infographics-only group), and 827 participants reported having seen both the video and infographics (video and infographics group). Only small differences in demographic characteristics were observed among the postcampaign survey groups in terms of age (mean [SD] age, 45.62 [13.8] years for the unexposed group, 40.79 [21.63] years for the video-only group, 48.26 [12.89] years for the infographic-only group, and 52.25 [15.61] years for the video and infographic group) and gender (2258 women [47.5%] in the unexposed group, 151 women [57.4%] in the video-only group, 6225 women [54.9%] in the infographic-only group, and 466 women [56.3%] in the infographic and video group) (**Table 1**).

The diagnostic survey revealed serious gaps in personal hygiene behavior. With regard to handwashing, only 4610 respondents (29%) washed all required areas, and 5346 respondents (33%) washed long enough (ie, ≥20 seconds). Refraining from touching one's face was reported only sometimes (mean [SD] score, 3.10 [1.04]), and physical distancing was reported sometimes when a household member had symptoms (mean [SD] score, 3.48 [1.43]) or often when the survey participant had symptoms (mean [SD] score, 3.87 [1.32]) (**Table 2**).

Overall, the unexposed group participants of the postcampaign survey had better personal hygiene than the participants in the diagnostic survey (Table 2). However, between the unexposed group and exposure groups in the postcampaign survey, we observed improvement in self-reported personal hygiene in the infographics-only and the video and infographics group. Detailed data are shown in the following subsections.

Postcampaign Survey Results for Handwashing

Handwashing: Washing All Required Areas

Compared with the unexposed group (mean proportion, 40% [95% CI, 38%-41%]), exposure to infographics alone (mean proportion, 48% [95% CI, 47%-49%]; adjusted OR, 1.31 [95% CI,

1.22-1.40]; $P < .001$) and infographics plus video (mean proportion, 62% [95% CI, 58%-65%]; adjusted OR, 2.14 [95% CI, 1.83-2.50]; $P < .001$) were associated with a higher proportion of washing all areas (ORs are adjusted for age, gender, and education levels and are presented only if differences between the groups are statistically significant). Exposure to the video alone (mean proportion, 40% [95% CI, 34%-46%]; adjusted OR, 1.07 [95% CI, 0.82-1.38]; $P = .63$) was not associated with a higher proportion of participants reporting washing all hand areas. Age (adjusted OR, 1.02 [95% CI,

Table 1. Demographic Characteristics

Characteristic	Survey respondents, No. (%)			Postcampaign survey group, respondents, No. (%)				
	Diagnostic (n = 16 072)	Postcampaign (n = 17 189)	*P* value	Unexposed (n = 4751)	Video only (n = 263)	Infographic only (n = 11 348)	Infographic and video (n = 827)	*P* value
Age, mean (SD) [range], y	48.03 (13.68) [47.82-48.24]	47.61 (13.57) [47.40-47.81]	.004	45.62 (13.8) [45.22-46.01]	40.79 (21.63) [38.16-43.41]	48.26 (12.89) [48.02-48.5]	52.25 (15.61) [51.17-53.30]	<.001
Gender								
Male	7494 (46.6)	8058 (46.9)	<.001	2480 (52.2)	112 (42.6)	5108 (45.0)	358 (43.3)	<.001
Female	8546 (53.2)	9100 (52.9)	<.001	2258 (47.5)	151 (57.4)	6225 (54.9)	466 (56.3)	<.001
Other	32 (0.2)	31 (0.2)	.90	13 (0.3)	0	15 (0.1)	3 (0.4)	
Education								
Elementary school	216 (1.3)	236 (1.4)	.35	63 (1.3)	17 (6.5)	109 (1.0)	47 (5.7)	<.001
High school								
Prevocational secondary education	1448 (9.0)	1573 (9.2)	.02	384 (8.1)	47 (17.9)	978 (8.6)	164 (19.8)	<.001
Senior general secondary education	1165 (7.2)	1281 (7.5)	.02	336 (7.1)	33 (12.5)	840 (7.4)	72 (8.7)	<.001
Preuniversity education	457 (2.8)	515 (3.0)	.06	130 (2.7)	15 (5.7)	345 (3.0)	25 (3.0)	<.001
Secondary vocational education	5157 (32.1)	5474 (31.8)	.002	1453 (30.6)	93 (35.4)	3634 (32.0)	294 (35.6)	<.001
Higher professional education	5409 (33.7)	5689 (33.1)	.008	1575 (33.2)	37 (14.1)	3904 (34.4)	173 (20.9)	<.001
University education	2220 (13.8)	2421 (14.1)	.003	810 (17.0)	21 (8.0)	1538 (13.6)	52 (6.3)	<.001

Table 2. Overview of Results for All Outcomes

Outcome	Diagnostic survey group vs postcampaign survey unexposed group				Postcampaign survey exposed groups			
	Score, mean (SD) [95% CI]				Score, mean (SD) [95% CI]			
	Diagnostic survey (n = 16 072)	Unexposed postcampaign (n = 4751)	Difference between groups	*P* value	Infographic only (n = 11 348)	Video only (n = 263)	Infographic and video (n = 827)	*P* value
Handwashing, mean (95% CI), % of respondents								
All required areas	29 (28-29)	40 (38-41)	11	<.001	48 (47-49)	40 (34-46)	62 (58-65)	<.001
Duration ≥20 s	33 (33-33)	45 (43-46)	12	<.001	52 (51-53)	49 (43-55)	60 (57-62)	<.001
Try not to touch face[a]	3.10 (1.04) [3.08-3.12]	3.16 (1.05) [3.13-3.19]	0.06	<.001	3.33 (0.94) [3.17-3.35]	3.10 (1.01) [2.98-3.22]	3.42 (0.91) [3.36-3.48]	<.001
Spent time with people outside one's household[b]								
With 1-5 people outside household	2.19 (1.29) [2.17-2.21]	1.85 (1.18) [1.81-1.88]	−0.34	<.001	1.72 (1.09) [1.70-1.74]	1.86 (1.21) [1.72-2.01]	1.67 (1.09) [1.59-1.74]	<.001
With ≥5 people outside household	1.46 (1.02) [1.45-1.48]	1.24 (0.80) [1.22-1.27]	−0.22	<.001	1.17 (0.66) [1.16-1.19]	1.21 (0.64) [1.13-1.29]	1.23 (0.78) [1.18-1.29]	<.001
Was at public place with ≥20 people present	1.73 (0.96) [1.71-1.75]	1.52 (0.84) [1.49-1.54]	−0.21	<.001	1.44 (0.77) [1.43-1.46]	1.45 (0.76) [1.36-1.54]	1.41 (0.80) [1.36-1.47]	<.001
Physical distance[c]								
When household member had symptoms	3.48 (1.43) [3.46-3.50]	3.63 (1.46) [3.59-3.67]	0.15	<.001	3.79 (1.41) [3.76-3.81]	3.58 (1.42) [3.41-3.75]	3.80 (1.41) [3.7-3.89]	<.001
When the respondent had symptoms	3.87 (1.32) [3.85-3.90]	4.01 (1.34) [3.97-4.05]	0.13	<.001	4.10 (1.31) [4.07-4.12]	3.57 (1.49) [3.39-3.7]	3.86 (1.46) [3.76-3.96]	<.001

[a] Face touching was scored as 1 (never), 2 (rarely), 3 (sometimes), 4 (often), and 5 (always).

[b] Spending time with people outside of one's own household was scored as 1 (never), 2 (1 time), 3 (2-3 times), 4 (4-5 times), and 5 (> 5 times).

[c] Physical distancing when symptoms were present was scored as 1 (never), 2 (rarely), 3 (sometimes), 4 (often), and 5 (always).

1.02-1.02]; *P* < .001) and gender (adjusted OR, 0.60 [95% CI, 0.56-0.64]; *P* < .001) were independently associated with washing all hand areas (Table 2 and **Table 3**).

Handwashing: Duration

Compared with the unexposed group (mean proportion, 45% [95% CI, 43%-46%]), exposure to the infographics alone (mean proportion, 52% [95% CI, 51%-53%]; adjusted OR, 1.27 [95% CI, 1.19-1.36]; *P* < .001) and infographics and video (mean proportion, 60% [95% CI, 57%-62%); adjusted OR, 1.86 [95% CI, 1.59-2.16]; *P* < .001) were associated with a higher proportion of washing hands long enough. Exposure to the video alone (mean proportion, 49% [95% CI, 43%-55%); adjusted OR, 1.23 [95% CI, 0.96-1.59]; *P* = .10) was not associated with a higher proportion of participants reporting washing their hands long enough. Age (adjusted OR, 1.01 [95% CI, 1.01-1.01]; *P* < .001), gender (adjusted OR, 0.75 [95% CI, 0.70-0.79]; *P* < .001), and educational level (adjusted OR, 1.09 [95% CI, 1.01-1.17]; *P* = .03) were independently associated with handwashing duration (Table 2 and Table 3).

Postcampaign Survey Results for Face Touching

The scale for face touching included scores of 1 (never), 2 (rarely), 3 (sometimes), 4 (often), and 5 (always). Compared with the unexposed group (mean score, 3.16 [95% CI, 3.13-3.19]), exposure to the infographics alone (mean score, 3.33 [95% CI, 3.17-3.35]; adjusted OR, 1.29 [95% CI, 1.22-1.38]); *P* < .001) and infographics and video (mean score, 3.42 [95% CI, 3.36-3.48]; adjusted OR, 1.49 [95% CI, 1.30-1.71]; *P* < .001) were associated with a higher reported awareness on face touching. Exposure to the video alone (mean score, 3.10 [95% CI, 2.98-3.22]; adjusted OR, 0.87 [95% CI, 0.69-1.09]; *P* = .21) was not associated with a higher reported awareness on face touching. Age (adjusted OR, 1.01 [95% CI, 1.00-1.01]; *P* < .001), gender (adjusted OR, 0.63 [95% CI, 0.60-0.67]; *P* < .001), and educational level (adjusted OR, 1.16 [95% CI, 1.08-1.24]; *P* < .001) were independently associated with awareness of face touching (Table 2 and Table 3)

Postcampaign Survey Results for Physical Distancing Outside of the Household

The scale for physical distancing outside of one's own household was scored as 1 (never), 2 (1 time), 3 (2-3 times), 4 (4-5 times), and 5 (> 5 times). Participants were also asked about the size of the groups with whom they spent time outside their household (ie, 1-5 people, ≥5 people, or being in public places with ≥20 people).

Time Spent With 1 to 5 People Outside of the Household

Compared with the unexposed group (mean score, 1.85 [95% CI, 1.81-1.88]), exposure to the infographics alone (mean score, 1.72 [95% CI, 1.70-1.74]; adjusted OR, 0.87 [95% CI, 0.81-0.93]; *P* < .001) and infographics and video (mean score, 1.67 [95% CI, 1.59-1.74]; adjusted OR, 0.81 [95% CI, 0.70-0.95]; *P* < .001) were associated with less time spent with 1 to 5 people outside of the household. Exposure to the video alone (mean score, 1.86 [95% CI, 1.72-2.01]; adjusted OR, 0.91 [95% CI, 0.71-1.16]; *P* = .45) was not associated with less time spent with 1 to 5 people outside of the household. Age (adjusted OR, 0.98 [95% CI, 0.98-0.98]; *P* < .001) and gender (adjusted OR, 1.13 [95% CI, 1.07-1.20]; *P* < .001) were independently associated with the frequency of time spent with 1 to 5 people outside of the household (Table 2 and Table 3).

Time Spent With 5 or More People Outside of the Household

Being exposed to infographics alone was associated with spending less time with 5 or more people outside of the household (adjusted OR, 0.85 [95% CI, 0.76-0.96]; *P* = .006). Age (adjusted OR, 0.97 [95% CI, 0.97-0.98]; *P* < .001), gender (adjusted OR, 1.39 [95% CI, 1.25-1.54]; *P* < .001), and educational level (adjusted OR, 0.81 [95% CI, 0.72-0.92]; *P* < .001) were independently associated with spending less time with 5 or more people outside of the household (Table 3).

Table 3. Overview of Regression Analysis Results

Variable and exposure	R^2	Adjusted R^2[a]	OR (95% CI)	Adjusted OR (95% CI)[a]	*P* value
Handwashing: all required areas					
Video only	0.008	0.027	1.02 (0.80-1.32)	1.07 (0.82-1.38)	.63
Infographics only			1.41 (1.32-1.51)	1.31 (1.22-1.40)	<.001
Infographics and video			2.45 (2.11-2.86)	2.14 (1.83-2.50)	<.001
Age			NA	1.02 (1.02-1.02)	<.001
Gender			NA	0.60 (0.56-0.64)	<.001
Educational level			NA	1.03 (0.96-1.11)	.43
Handwashing: duration					
Video only	0.005	0.012	1.18 (0.92-1.51)	1.23 (0.96-1.59)	.10
Infographics only			1.33 (1.24-1.43)	1.27 (1.19-1.36)	<.001
Infographics and video			2.01 (1.73-2.34)	1.86 (1.59-2.16)	<.001
Age			NA	1.01 (1.01-1.01)	<.001
Gender			NA	0.75 (0.70-0.79)	<.001
Educational level			NA	1.09 (1.01-1.17)	.03
Try not to touch face					
Video only	0.002	0.009	0.85 (0.68-1.06)	0.87 (0.69-1.09)	.21
Infographics only			1.35 (1.27-1.44)	1.29 (1.22-1.38)	<.001
Infographics and video			1.57 (1.37-1.80)	1.49 (1.30-1.71)	<.001
Age			NA	1.01 (1.00-1.01)	<.001
Gender			NA	0.63 (0.60-0.67)	<.001
Educational level			NA	1.16 (1.08-1.24)	<.001
Spent time with 1-5 people outside household					
Video only	0.001	0.01	1.01 (0.80-1.28)	0.91 (0.71-1.16)	.45
Infographics only			0.81 (0.76-0.87)	0.87 (0.81-0.93)	<.001
Infographics and video			0.71 (0.61-0.82)	0.81 (0.70-0.95)	<.001
Age			NA	0.98 (0.98-0.98)	<.001
Gender			NA	1.13 (1.07-1.20)	<.001
Educational level			NA	1.02 (0.94-1.09)	.67
Spent time with ≥5 people outside household					
Video only	0.002	0.02	1.11 (0.75-1.60)	0.87 (0.58-1.25)	.46
Infographics only			0.77 (0.69-0.86)	0.85 (0.76-0.96)	.006
Infographics and video			1.02 (0.80-1.28)	1.19 (0.93-1.50)	.16
Age			NA	0.97 (0.97-0.98)	<.001
Gender			NA	1.39 (1.25-1.54)	<.001
Educational level			NA	0.81 (0.72-0.92)	<.001
Was at public place with ≥20 people present					
Video only	0.001	0.1	0.87 (0.67-1.12)	0.78 (0.59-1.01)	.06
Infographics only			0.83 (0.77-0.89)	0.88 (0.82-0.94)	<.001
Infographics and video			0.70 (0.60-0.82)	0.80 (0.68-0.94)	.008
Age			NA	0.98 (0.98-0.98)	<.001
Gender			NA	1.00 (0.94-1.07)	.94
Educational level			NA	1.03 (0.96-1.12)	.41
Physical distance when household member had symptoms					
Video only	0.001	0.008	0.90 (0.73-1.12)	1.00 (0.80-1.25)	>.99
Infographics only			1.23 (1.15-1.31)	1.15 (1.09-1.23)	<.001
Infographics and video			1.24 (1.09-1.43)	1.10 (0.96-1.26)	.18
Age			NA	1.02 (1.02-1.02)	<.001
Gender			NA	0.85 (0.80-0.89)	<.001
Educational level			NA	1.04 (0.97-1.11)	.31

(continued)

Table 3. Overview of Regression Analysis Results (continued)

Variable and exposure	R^2	Adjusted R^2[a]	OR (95% CI)	Adjusted OR (95% CI)[a]	*P* value
Physical distance when participants had symptoms					
Video only	0.002	0.007	0.56 (0.45-0.71)	0.62 (0.50-0.78)	<.001
Infographics only			1.16 (1.09-1.24)	1.10 (1.03-1.17)	.006
Infographics and video			0.87 (0.76-1.01)	0.79 (0.69-0.91)	.001
Age			NA	1.02 (1.01-1.02)	<.001
Gender			NA	0.83 (0.78-0.88)	<.001
Educational level			NA	1.17 (1.09-1.25	<.001

Abbreviations: NA, not applicable; OR, odd ratio.

[a] Adjusted for age, educational level, and gender.

Time Spent in a Public Place With 20 or More People Present

Being exposed to infographics alone (adjusted OR, 0.88 [95% CI, 0.82-0.94]; *P* < .001) and to the infographics and video (adjusted OR, 0.80 [95% CI, 0.68-0.94]; *P* = .008) were associated with being at public places with 20 or more people less often. Age was independently associated with being in public places with large groups less often (adjusted OR, 0.98 [95% CI, 0.98-0.98]; *P* < .001) (Table 3).

Physical Distancing When Symptoms Were Present

The scales for physical distancing when COVID-19 symptoms were present were scored as 1 (never), 2 (rarely), 3 (sometimes), 4 (often), and 5 (always). Participants were asked whether they or a household member had symptoms of COVID-19.

Physical Distancing When a Household Member Had Symptoms

Being exposed to infographics alone was associated with keeping physical distance when someone in the household showed symptoms such as sneezing, runny nose, coughing, or fever (adjusted OR, 1.15 [95% CI, 1.09-1.23]; *P* < .001). Age (adjusted OR, 1.02 [95% CI, 1.02-1.02]; *P* < .001) and gender (adjusted OR, 0.85 [95% CI, 0.80-0.89]; *P* < .001) were independently associated with maintaining physical distance when a household member had COVID-19 symptoms (Table 3).

Physical Distancing When the Participant Had Symptoms

Being exposed to infographics alone was associated with maintaining physical distancing when the participant had symptoms such as sneezing, runny nose, coughing, or fever (adjusted OR, 1.10 [95% CI, 1.03-1.17]; *P* = .006). Being exposed to infographics and video (adjusted OR, 0.79 [95% CI, 0.69-0.91]; *P* = .001) and video alone (adjusted OR, 0.62 [95% CI, 0.50-0.78]; *P* < .001) were associated with keeping more distance when the participant had symptoms such as sneezing, runny nose, coughing, or fever. Age was independently associated with maintaining physical distancing when the participant had symptoms (adjusted OR, 1.02 [95% CI, 1.01-1.02]; *P* < .001) (Table 3).

Discussion

These findings suggest that an evidence-based, large-scale public health campaign, distributed by a news media platform and social influencer, was associated with better personal hygiene in the participants exposed to infographics and the infographics plus video. Exposure to the infographics only and to the infographics plus the video were associated with a larger proportion of participants washing hands long enough and in all areas. Participants exposed to the video alone did not show these improvements, which may be associated with the small sample size of this particular group. Exposure to the infographics plus the video showed significant but small improvements in awareness on face touching and physical distancing.

To correct for possible confounding factors, we used logistic regression analysis and found that age, gender, and education level were significantly associated with the outcomes. Increasing age, a

higher education level, and being female were all significantly associated with a better personal hygiene outcome. The basic conclusions of the study did not change after correction for the confounding factors.

At the time of the campaign, we had almost reached the critical point for hospital admissions and intensive care capacity in the southern part of the Netherlands, as was also observed in certain parts of other countries, such as northern Italy.[18] By using evidence-based health campaigning based on the diagnostic survey, we aimed to bridge the intention-behavior gap to influence a greater behavioral change with the goal of flattening the curve and minimizing the strain on the health care system. To our knowledge, the strategy of first diagnosing the biggest gaps in behavior and awareness and designing the campaign at this scale in such a compressed time frame has not been shown before. We believe that the strategy to use a large-scale, science-based public health intervention can be easily replicated in other countries. A similar strategy could also be of potential use to help with other pressing issues during the crisis, such as support for the elderly, who are mostly isolated given their vulnerability to SARS-CoV-2, as is currently taking place in the Netherlands for 3 million seniors.[19] Furthermore, evidence-based public health campaigning may have the potential to combat chronic pandemics, such as obesity, lack of exercise, and smoking.

Because personal hygiene and physical distancing are important measures to prevent person-to-person transmission of SARS-CoV-2, these findings suggest that significant contributions can be made by public health campaigns to lessen the spread of COVID-19.[2,6] One of the big takeaways of the campaign was the impact of *De Telegraaf*, especially the online news platform. The widespread national public reach of the campaign was reflected by 2 million views of the online version of the *De Telegraaf* news article containing the infographic and the 80 000 views of the campaign video.[16,17] Approximately 15 million individuals have access to the internet in The Netherlands.[3] The reach of the paper version of *De Telegraaf* (600 000 copies) has to be added to the total distribution of the campaign, but is hard to exactly measure.

The fact that the unexposed group of the postcampaign survey reported better results on personal hygiene compared with the participants in the diagnostic survey indicates that public health messages by the government already showed a substantial beneficial effect. Our public health campaign showed significant additional benefit in the exposed groups on top of the undercurrent of improvement present in the Dutch society. This indicates that national public health campaigns using new-media platforms and social influencers should be considered in addition to contact tracing, testing, and lockdown measures as initiated by governments. This additional benefit may help to protect citizens, avoid congested intensive care units, and give scientists the time to develop and test effective vaccines against SARS-CoV-2.

Limitations

One of the limitations of this study was that the participants in the diagnostic survey were not the same as the participants in the postcampaign survey. The reason was that approval of tracking of the participants of the diagnostic survey could not be obtained from the institutional review board given the short timeline. Because of the urgency of the crisis, we decided to execute the campaign in the current format. Comparison of the baseline demographic characteristics between the participants of the diagnostic survey and the postcampaign survey showed significant changes attributable to the large sample sizes of the groups, but they were very small in absolute terms. Therefore, we are convinced that the diagnostic and postcampaign surveys represent comparable samples from Dutch society. The question remains, however, how representative the samples are for the Dutch society as a whole. In general, *De Telegraaf* is read by a large proportion of the Dutch population, representing multiple layers of our society. In addition, the distribution among genders was almost equal. Because of the nationwide online distribution to unnamed persons for recruiting participants, we were unable to calculate exact response rates.

A second limitation may be the possible bias between the exposed and unexposed groups. One possibility, for instance, is that the unexposed group had on average less interest in health or hygiene

in general. From the data, we cannot exclude such a bias. However, the unexposed group had substantially better self-reported personal hygiene compared with the baseline participants, which suggests that there was not a lack of interest. The best strategy would have been a randomized trial, but given the urgency of the crisis, we had no time to obtain approval from the institutional review board and to implement a randomized strategy.

A third limitation is that comparison of the groups in the postcampaign survey revealed some differences. For instance, the participants in the video-only group were much younger than participants in the other groups. To correct for the possible confounding factors in demographic characteristics, we performed logistic regression, which adjusted for these possible confounders and resulted in only slightly changed associated outcomes of the campaign and gave no reason to change the basic conclusions of the study.

Conclusions

In this survey study, we found that an evidence-based public health campaign strategy, distributed by national digital media and designed with behavioral insights, was associated with improved self-reported personal hygiene and physical distancing in the Netherlands during the COVID-19 crisis. This strategy may have the potential to intervene in other health emergencies and ongoing pandemics, such as smoking and obesity.

ARTICLE INFORMATION

Accepted for Publication: June 4, 2020.

Published: July 8, 2020. doi:10.1001/jamanetworkopen.2020.14323

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Obtained funding: Yousuf, van Rossum, Lindemans, L. Hofstra.

Administrative, technical, or material support: Yousuf, Sweep, Scherder, Zhao, van Rossum, Lindemans, L. Hofstra.

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Conflict of Interest Disclosures: Dr Lindemans reported receiving grants from Centene Corporation during the conduct of the study. No other disclosures were reported.

Funding/Support: This study was supported by grants from the Fred Foundation, Noaber Foundation, and HAPPY Foundation.

Role of the Funder/Sponsor: The Fred Foundation, the Noaber Foundation, and HAPPY Foundation approved the design and conduct of the study; the funders had no involvement in the collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

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SUPPLEMENT.

eAppendix. COVID-19 Hygiene Questionnaire