

Communicate Hope to Motivate Action Against Highly Infectious SARS-CoV-2 Variants

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The world is facing a race between controlling new and more infectious variants of coronavirus and implementing vaccinations: How can health authorities and governments most effectively communicate the need to engage more strongly in protective behavior to avoid a collapse of the healthcare system until vaccination programs are effective? In the first wave of the pandemic, citizens became engaged in ‘flattening the curve’ via powerful visualizations. Here, we use epidemiological modelling to develop a new visual communication aid, ‘buying time with hope’, which reflects the pandemic trade-offs currently facing governments, authorities and citizens. Using a population-based experiment conducted in United States ($N = 3,022$), we demonstrate that this hope-oriented visual communication aid, depicting the competing effects on the epidemic curve of (1) more infectious variants and (2) vaccinations, motivates public action and communicates more effectively than fear-oriented visual communication, focusing exclusively on the threat of the new variants. Finally, using cross-national representative surveys from eight countries ($N = 3,995$), we document the urgent need to motivate public action to halt the spread of the new, more infectious variants. These findings not only provide public health authorities globally with a validated blueprint for health communication in a critical period of the pandemic but also provide general psychological insights into the importance of hope as a health communication strategy.

INTRODUCTION

After 10 months of the SARS-CoV-2 pandemic, the arrival of highly effective vaccines raised global expectations that a return to normal was within reach. As vaccines are rolled out, however, countries across the globe experienced the emergence of new, more infectious variants of the coronavirus. The most wide-spread of these new variants, the B.1.1.7. variant, is now a global presence and is expected to be the dominant strain in the countries where it was first discovered within weeks [9]. These more infectious variants present a significant and new challenge. Because of higher infectiousness, new variants strongly increase the risk of large outbreaks (witnessed,

e.g. in the United Kingdom and Ireland [8]), intensifying the need for citizens to engage in protective behavior [3], at a time where populations across the globe are strained with pandemic fatigue [4].

This manuscript addresses the question of how health authorities and governments can most effectively communicate this new challenge to their citizens.

In the spring of 2020, when the first wave of SARS-CoV-2 spread across the globe, a figure illustrating the epidemiological credo ‘flatten the curve’ became a global rallying point. This illustration communicated the need for individual and collective action within a conceptual framework of epidemic modelling [1], in a way that resonated with a large number of people. However, the ‘flatten the curve’ illustration, does not fit the current situation. Epidemiologically, the current goal is no longer to ‘flatten the curve’ in the sense of constantly keeping the number of hospitalized below the capacity of the health care system by moving infections from the present to the future. Instead, there is a race between a variant-driven accelerated rate of infection versus vaccination-driven depletion of the pool of susceptibles. The goal of engaging in protective behavior is, therefore, to decrease outbreak size (and associated hospitalizations and deaths) by buying time until vaccines can take effect. Psychologically, research on health behavior prior to the pandemic has provided increasing evidence that fear (e.g., fear of a collapse of a hospital system) is not in itself enough for the generation of protective motivations [2]. Also, during the pandemic, evidence has emerged that positive feelings such as empathy [5], shared identities [7] and optimism [6] play a significant role, perhaps especially in the face of increasing fatigue.

The challenges posed by more infectious variants call for intensified communication with the public, utilizing a visual communications aid that clearly expresses the present rationale for engaging in protective behavior. To sustain both public trust and public motivation, this visual communication aid should be anchored in available epidemiological knowledge and sensitive to the full spectrum of psychological motivations, including the human capacity for hope.

TESTING THE MOTIVATING EFFECTS HOPE-INDUCING VISUAL COMMUNICATION

To create a visual aid for a hope-oriented communication strategy, we built realistic epidemiological models reflecting possible trajectories of the epidemic in one of the first countries where B.1.1.7.

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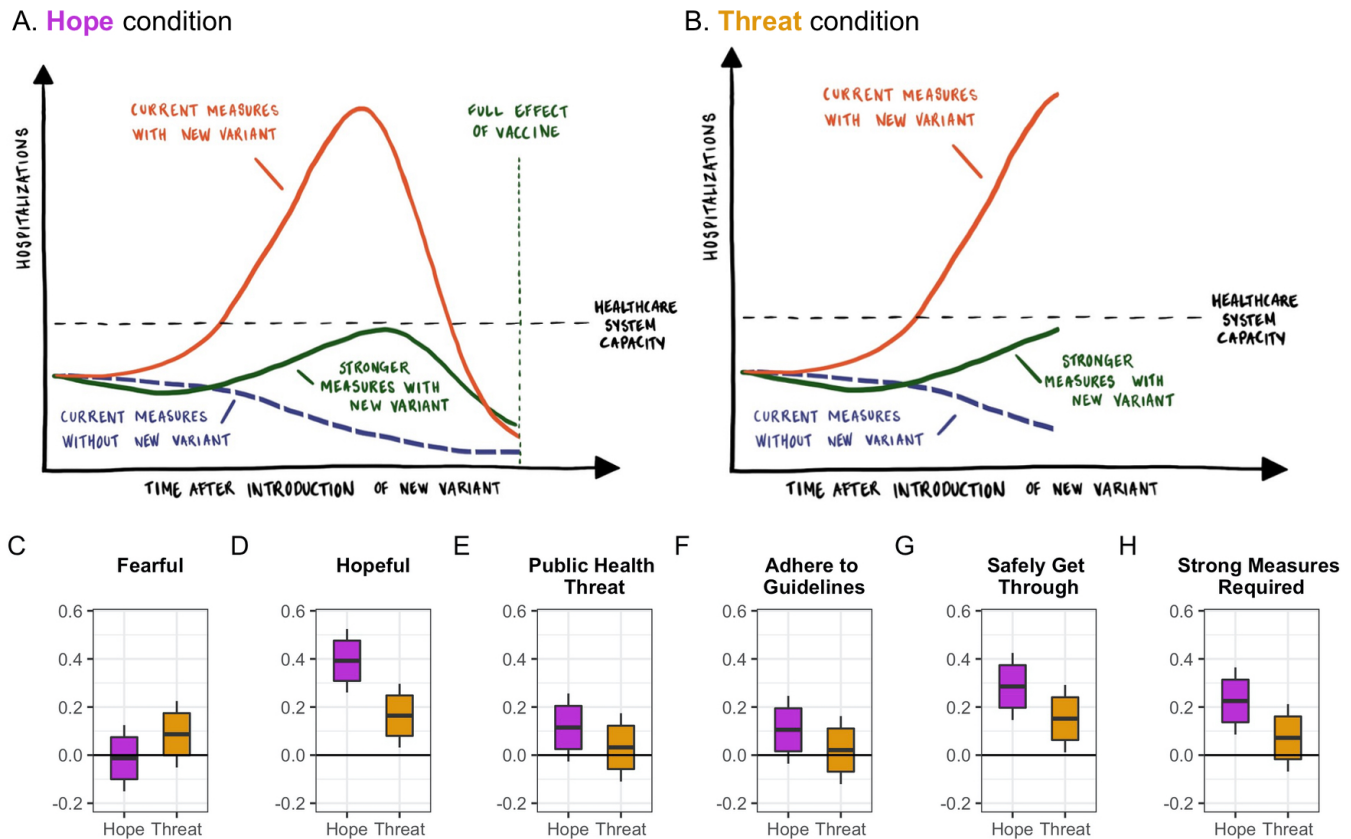


Fig. 1. The effectiveness of public health communication with (Panel A) and without (Panel B) the hope associated with vaccines. Panels C-D report unstandardized coefficients of marginal effects from OLS regressions that compare responses in the Hope Condition (Panel A) and Threat Condition (Panel B) to a control condition, respectively. Hinges denote 95% confidence intervals and whiskers denote 99% confidence intervals.

was identified (Denmark). We modelled three scenarios (Fig 1A): (1) A scenario without B.1.1.7. and without the implementation of stronger epidemic control measures. In this scenario the epidemic is effectively controlled until vaccines take full effect (blue dashed curve). (2) A scenario with B.1.1.7. but without the implementation of stronger epidemic control measures (the red curve). Here hospitalizations exceed capacity as B.1.1.7. becomes dominant until the vaccines take full effect. (3) A scenario with B.1.1.7. but where stronger epidemic measures are implemented (the green curve). This reduces the infection rate and manages to keep hospitalizations below capacity until the vaccines take full effect. The models were generated from realistic assumptions about infection and vaccination rates and hospital capacity (see discussion below).

To assess the communicative efficacy of this visual aid and associated text, we conducted an online population-based experiment with a sample reflective of the US population in the beginning of February 2021 ($N = 3022$) (for details on all data and models, see code repository¹). Participants were randomly assigned to one of three conditions: (1) A **control** condition, which simply informed

the participants that more infectious variants of the coronavirus were spreading in the US and that authorities may urge citizens to more strongly adhere to the health guidelines. (2) A **hope** condition that displayed the graph from Fig 1A to the participants and described the displayed epidemic scenarios, emphasizing how the 'goal is to buy time until vaccines against COVID-19 take effect'. (3) A **threat** condition that displayed and described only the initial half of the graph, focusing exclusively on the threat from the infectious variants without mentioning vaccines and associated hopes (see Fig 1B). After exposure, respondents were asked to rate whether they found that the information conveyed 'a fearful message' and 'a hopeful message'. Subsequently, respondents completed four 3-item batteries that measured whether the information 'clearly explained', helped 'others understand' and helped 'me understand': (1) 'why new coronavirus variants are a public health threat', (2) 'why [people/they/I] need to adhere more strongly to the health authorities' guidelines because of new coronavirus variants', (3) 'how we as a society can get safely through this pandemic' and (4) 'why strong measures are required until vaccines take full effect and drive down infections'. We averaged answers within each battery and z-scored

¹https://github.com/SocialComplexityLab/pandemic_hope

the scales using the control group's mean and standard deviation. For the analyses, we report unstandardized OLS regression coefficients (*bs*) and associated *p*-values.

Fig 1C-H display the marginal effects of the Hope and Threat Conditions relative to the Control Condition. The Threat Condition ($b = .094, p = .05$) but not the Hope Condition ($b = -.01, p = .78$) is perceived as marginally more fearful, whereas the Hope Condition is perceived as substantially more hopeful ($b = .39, p < .001$). Furthermore, the Hope Condition significantly increases the perception of infectious variants as a health threat ($b = .11, p < .05$), the motivation to adhere to the guidelines of the health authorities ($b = .11, p < .05$), the understanding of how to get safely through the pandemic ($b = .29, p < .001$) and why stronger measures are needed ($b = .23, p < .001$). The effects of the Threat Condition are for the most part insignificant (beyond effects in Fig 1D and 1G) and for Fig 1D, 1G and 1H the marginal effects are significantly stronger for the Hope than the Threat Condition (all $ps < .05$).

These findings demonstrate that in the current phase of the pandemic, including the hope promised by the advent of vaccines into the communication of future scenarios is effective in motivating stronger adherence to health guidelines and may facilitate a better public understanding of the pandemic situation that an exclusive focus on the threat from new, more infectious variants.

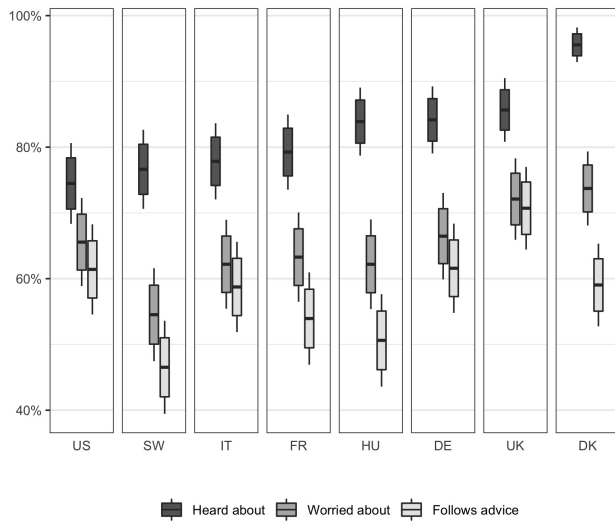


Fig. 2. Knowledge, fear and behavior change because of new, more infectious variants. Proportions with associated 95% confidence intervals within each country (Denmark, Sweden, United Kingdom, United States, Italy, France, Germany & Hungary), that agree 'completely' or 'somewhat' with the statements: (1) 'I have heard about new variants of the corona-virus that are more infectious', (2) 'I am worried about the new, more infectious variants of the corona-virus', (3) 'I follow the health authorities' advice to a greater extent because of new, more infectious variants of the corona-virus'. Total $N = 3,995$.

ASSESSING THE NEED FOR PUBLIC HEALTH MOTIVATION

To assess the need for intensified and effective public health communication about the new variants, we ran online surveys in eight Western democracies that have already identified these variants within their borders: The US, UK, Sweden, France, Italy, Hungary, Germany, France and Denmark. In each country, we surveyed about 500 respondents during January 2021. Respondents were sampled to match the population margins on age, gender, and geographic location for each country and imbalances were addressed via post-stratification. Respondents were asked whether they had heard about the new more infectious variants, whether they were worried about this and whether they as a result adhered more to the authorities' advice (Fig 2).

Across all countries, 83% report that they have heard about new variants. A significantly smaller group (65%, $t(3994) = 23.07, p < .001$), are worried about them and an even smaller fraction (58%, $t(3994) = 9.63, p < .001$) report to adhere more strongly to health advice as a consequence. These results show that knowledge about the new variants does not in itself fuel fear, which again does not in itself motivate behavior change and, hence, highlight the need for rethinking public communication in the current phase of the pandemic.

ASSESSING REQUIRED LEVELS OF PUBLIC ACTION

While 58% across countries report changed behavior (Fig 2), this may not be enough for epidemic control, as the needed level of behavior change is highly sensitive to the values of the specific parameters that underlie the three scenarios displayed in the Hope Condition. The graph was produced with an effective reproduction number of $R_t = 1.0$ for the existing variants, a relative R_t of the new variants of 1.6, the assumption that stronger measures would reduce R_t to 0.9, and a daily vaccine rate of 500 per million population for the first 60 days and then increased to 5 000 (assuming that vaccines are 95% effective and that 90% of the population wants to be vaccinated). As a baseline, this graph is reproduced in Fig 3A.

Fig 3B, 3C and 3D display the trajectory of the epidemic if the current measures are 10% less effective (Fig 3B), if the relative R_t for the new variant is 0.1 higher (Fig 3C) or if the vaccinations are rolled out more quickly in the first 60 days (Fig 3D). The figures are based on a population of 1 million and a hospital capacity of 200 COVID-19-related hospitalizations (the planned peak capacity in December 2020 and coinciding with B.1.1.7 becoming a matter of public concern).

Fig 3 demonstrates that if the current measures are less effective or the new variant is more infectious, the epidemic will very quickly escalate out of control. If the vaccines can be rolled out more quickly, epidemic control is much easier to achieve.

CONCLUSION

The current pandemic situation is a race between controlling emerging infectious variants and implementing vaccinations. In this situation, motivating the public to engage in protective behavior to buy time is crucial. As we have demonstrated in this manuscript, a dual communication strategy that uses a graphical aid to emphasize

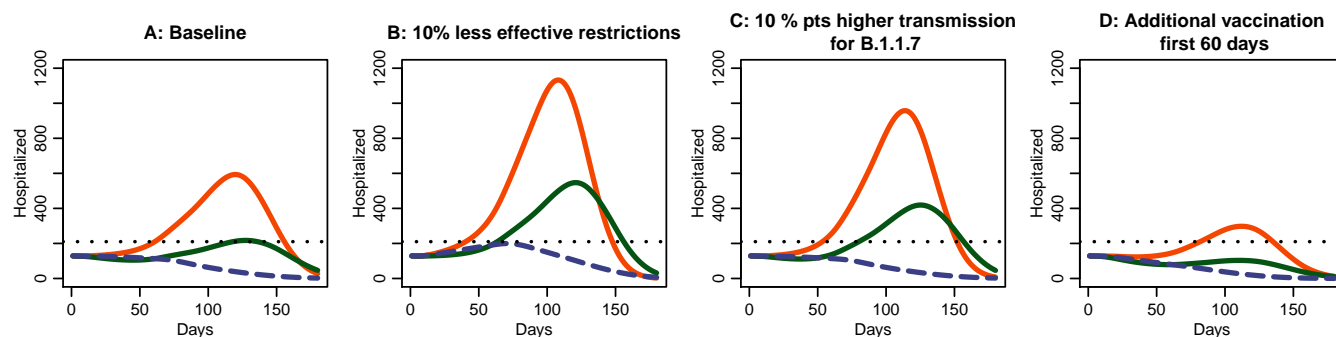


Fig. 3. **Impact of restrictions, relative transmission and additional vaccination.** Each display contains a baseline scenario with B.1.1.7 (red) and without B.1.1.7 (dashed blue) as well as a scenario with B.1.1.7 and 10% more effective restrictions (green). A) reference $R_t = 1.0$ and a vaccination rate of 500 persons per day for 60 days and then 5000 per day. B) As A) but with reference $R_t = 1.1$. C) as A) but with relative R_t for B.1.1.7 equal to 1.7 instead of 1.6. D) as A) but with a vaccination rate of 2500 persons per day for the first 60 days. The hospital capacity is 200 beds related to covid-19 (dotted line). All displays are normalized to a population of 1 million.

both the threat from the new variants and the hope induced by the vaccines is an effective means to this end. The present findings provide public health authorities globally with a validated blueprint for health communication in a critical period of the pandemic and emphasize the general importance of using hope in public health communication.

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