

Low voice pitch in orally delivered recommendations can increase compliance with hand sanitizer use among young adults

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abstract

Oral communications delivered in a low voice pitch are more persuasive and perceived as more pleasant and truthful than are communications delivered in a high pitch. The research reported in this article explored whether young adults' compliance with an orally delivered recommendation to use hand sanitizer, an action thought to limit the spread of COVID-19 and other infectious diseases, would increase when the message was delivered in a low versus a high voice pitch. In an experiment involving 478 university students in Australia, a public health announcement delivered in a low voice pitch, compared with one delivered in a high voice pitch, increased participants' sense of power, which increased their perceived behavioral control over their physical health and, in turn, increased their likelihood of using hand sanitizer. Because voice pitch is an aspect of health communications that can be modified easily at a low cost, the findings suggest a simple approach that public health and policy officials can adopt to improve hand hygiene in a population of people who spend a lot of time in close proximity and who should therefore practice hand hygiene routinely to protect themselves and others from infection.

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Handwashing with soap and water is an excellent way to prevent the spread of infection via hand contact, but people often neglect it or find themselves without the needed materials (such as soap, water, or a sink).^{1,2} Hand sanitizers such as alcohol gels offer an easy and effective alternative to handwashing. Young adults, particularly those on college campuses, are less likely than adults to follow handwashing and hand sanitizer recommendations, and this low compliance contributes to the spread of upper respiratory illnesses, strep throat, and other infectious diseases.³⁻⁶ Finding ways to improve hand hygiene among young adults is therefore an important public health objective. Increased hand hygiene is also one of the main ways to fight the SARS-CoV-2 virus during the COVID-19 pandemic.

Through the research I describe in this article, I explored the possibility that opting for low rather than high voice pitch in orally delivered recommendations could enhance the ability of such communications to induce young adults to use hand sanitizer. Pitch is one dimension of voice that can differ among speakers, along with speed, intonation, and volume.⁷⁻¹² Voice pitch is the frequency of the sound wave produced by the opening and closing of the vocal cords and is measured in hertz (Hz), or cycles per second. Although a speaker can adjust pitch to some degree, whether pitch is high or low depends to a great extent on characteristics of the vocal cords—with thicker cords, less tension, and a lower frequency of opening and closing resulting in lower pitch.¹³ Some individuals naturally have a lower or higher voice pitch.

Low voice pitch has been associated with greater pleasantness, persuasiveness, and truthfulness than high pitch,^{14,15} which explains why low pitch can be quite persuasive and is popular in spoken messages delivered by male or female voices.¹⁶ Yet whether low pitch will be more effective than high pitch for orally delivered public health recommendations remains unclear, in part because people sometimes act in opposition to health authorities^{17,18}—a response that could conceivably counteract any benefit conferred by low voice pitch.

In the experiment described in this article, I tested the hypothesis that using a low voice pitch in oral recommendations to use hand sanitizer could increase the use of hand sanitizer among young adults, and I proposed that the increase would occur as a result of their strengthened perception of having behavioral control over their health. Some social scientists might initially be dubious of this proposed mechanism because past work on voice pitch suggests that people associate low voice pitch with power in the speaker,^{7,8,10,12} a phenomenon that social comparison theories might suggest would lead people who hear a low-pitched message to feel less powerful relative to the apparently powerful speaker and thus feel less in control. However, social comparisons primarily arise when people have a lot on their minds (that is, when they are experiencing cognitive load).¹⁹ When mental resources are not taxed, people correct for mistaken impressions prompted by comparative effects.²⁰ Thus, in the absence of cognitive load, listening to a person speak in a low-pitched voice could potentially elicit feelings of power in the listener, which, in turn, would facilitate the listener's perception of behavioral control over his or her own health. This last sequence is predicted by the finding that people who feel powerful perceive that they have control even when they do not (that is, when their sense of control is illusory) and tend to perceive that their abilities are greater than they actually are.²¹⁻²³

In the case of the hand sanitizer experiment, I predicted that greater perceived behavioral control over one's health would increase a person's compliance with public health recommendations, because perceived behavioral control over health has been shown to strongly predict health-related behaviors. When people do not follow public health guidelines, one common cause of this disregard is that they do not perceive their physical well-being to be under their control and do not view the recommended actions to be of demonstrable use.^{24,25} In contrast, people who see luck as having little influence on their health are more likely to exercise, reduce red meat intake, and perform self-examinations for cancer.²⁶⁻²⁹ These individuals see their health, good or bad, as a result of

their own actions and so are more likely to act in their best interest.

Method

I designed the study to test the hypothesis that low voice pitch would be more effective than high voice pitch in increasing young adults' compliance with orally delivered recommendations to use hand sanitizer. I conducted it in early 2019 and used an experimental methodology to determine causality. I analyzed actual behavior (use of hand sanitizer) instead of self-reported intentions to increase external validity (that is, applicability to life outside the lab).

Participants were 478 undergraduates at a university in Australia. Their average age was 23.82 years; 178 were men and 300 were women. The students participated in groups of 10 to 15 in the university's behavioral laboratory and received course credit at the end.

Participants were randomly assigned to listen to either a low-pitch or a high-pitch version of an orally delivered two-minute public health message encouraging the use of hand sanitizer; to avoid biased responses, my research assistant told the participants they were taking part in market research for the headphones they were using to hear the message. All participants heard the same message, just at different pitches: 236 heard the low-pitch version, and 242 heard the high-pitch version. (See the Supplemental Material for the script and the recordings.) According to an analysis by Praat software,³⁰ the pitch of the message was either 37 Hz or 110 Hz, and the average volume was kept within the range of 50 to 70 decibels for both versions—readily audible but not painfully loud. The students sat in individual cubicles, put on their provided headphones, and listened to the audio clip. The same speaker, a woman, had been enlisted to record the message in both the low and the high pitches, and she kept the length of the audio the same. (A woman was chosen because prior research had indicated that female voices are used more often than male voices in orally delivered health communications).³¹

Immediately after listening to the audio, in accordance with the study's cover story, participants answered three questions about the headphones: "How comfortable was the headset?" "How clear was the audio?" and "How likely would you [*sic*] recommend the headset to a friend?" Responses were given on a scale of 1 = *Not at All* to 9 = *Very Much*.

The participants then completed a battery of personality questionnaires that were mostly irrelevant but had embedded in them two items designed to measure the students' perceived behavioral control over their physical health: "I am personally responsible for my physical health" and "I have control over my physical well-being." These items were answered on a scale of 1 = *Strongly Disagree* to 9 = *Strongly Agree*. These questions were adapted from past research by Mauri A. Ziff and her colleagues.²⁵ The question set also included one item meant to assess how powerful the participants felt, "I feel powerful," which was answered on a scale of 1 = *Strongly Disagree* to 9 = *Strongly Agree*.

The battery further included a question to measure the perceived authority of the speaker in the audio, "I felt that the speaker was authoritative," which was answered on a scale of 1 = *Strongly Disagree* to 9 = *Strongly Agree*. I included this question to rule out the possibility that listening to the low-pitched voice facilitated compliance with the hand sanitizer recommendation by making the participant feel more obligated to obey someone in authority than listening to a high-pitched voice did.

Participants then ostensibly completed the study by answering demographic questions, including ones asking about their gender, age, and English proficiency. (I assessed proficiency because about 30% of the sample were international students; those with poor proficiency might have not understood the audio message and would need to be eliminated from consideration.) At this point, the participants proceeded to the experimenter's table, where they signed a form to receive course credit. On this table was a bottle of hand sanitizer. My research assistant noted whether the participant used the hand sanitizer before leaving the laboratory.

This action was the key outcome measure (the dependent variable) and was indicated with a binary *yes* or *no*.

listened to the high-pitch one, with an average score of 5.74 ($SD = 1.92$) versus 5.23 ($SD = 2.00$, $p = .005$).

Results

Behavioral Compliance

More participants who listened to the low-pitch version of the public health advisory than the high-pitch version used the hand sanitizer on the table (83.1% versus 71.9%)—a difference that was statistically significant ($p = .004$). (See note A for a discussion of the statistical notation used in this article, and see the Supplemental Material for more statistics relating to the results reported in this section.)

Perceived Behavioral Control

Those who listened to the low-pitch version of the public health advisory scored higher than did those who listened to the high-pitch version on perceived behavioral control over their physical health—an average of 5.59 ($SD = 1.87$) versus 4.99 ($SD = 1.91$). Low pitch was highly correlated with perceived control ($r = .89$, $p = .001$).

Felt Power

Those who listened to the low-pitch version of the public health advisory scored significantly higher on felt power than did those who

Mediation Effects

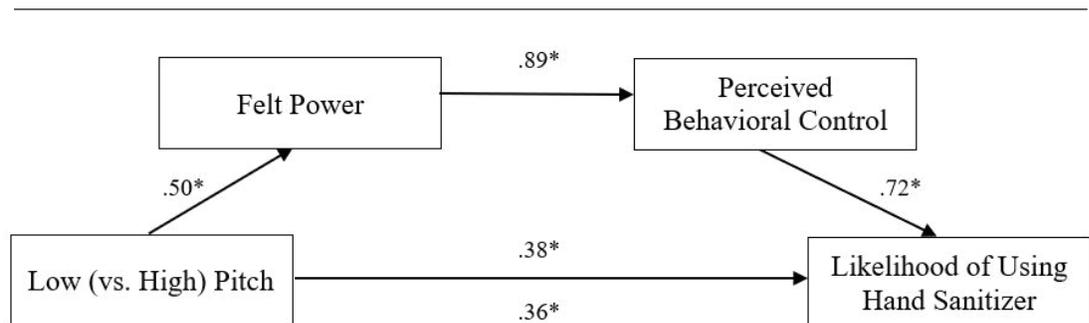
A mediation analysis that used procedures outlined by Kristopher J. Preacher and Andrew F. Hayes (Model 6 of their bootstrapping protocol)³² found that felt power and perceived behavioral control mediated the influence of pitch on the likelihood of using hand sanitizer, with felt power leading to the perception of control, which led to increased compliance. See Figure 1 for the individual pathways and statistics. I also examined other pathways of influence, but none were significant.

Perceived Authority

Those who listened to the low-pitch and high-pitch versions of the public health advisory rated the perceived authority of the speaker in the audio clip similarly—an average of 5.22 ($SD = 2.06$) versus 5.00 ($SD = 2.08$), respectively, which was not a statistically significant difference. In other words, the difference in pitch did not cause a meaningful difference in the tendency to obey the health message ($p = .24$).

Find additional analyses in the Supplemental Materials.

Figure 1. The effect of vocal pitch on the behavioral response to an oral health message



Note. Mediation analysis confirmed that an oral message encouraging young adults to use hand sanitizer was more effective in increasing compliance when delivered in a low pitch than in a high pitch because it increased the listener's felt power, which then increased the listener's perceived behavioral control over his or her health. The numbers shown are B values, which indicate how much a change in one variable accounts for a change in another variable. $B = .38$ is a measure of the direct effect of pitch on use of hand sanitizer when the mediating factors are not taken into account. $B = .36$ is the indirect effect as mediated by felt power and perceived behavioral control. The standard error is .11, and the 95% confidence interval is [.16, .62]. $*p < .05$.

Discussion

This experiment demonstrated that using a low voice pitch to deliver a public health message urging greater use of hand sanitizer increased young adults' compliance with the recommendation more than using a high voice pitch did. The mediation analysis confirmed that greater compliance occurred because the low pitch more effectively led the participants to feel powerful, which in turn increased their perceived behavioral control over their health; this greater perceived control facilitated compliance with the recommendation to use hand sanitizer.

The results add to the wider body of research on the possible benefits of lower rather than higher voice pitch in audiovisual messages. This study is the first to suggest that low voice pitch, in addition to enhancing a message's persuasiveness and signaling pleasantness and truthfulness, might promote perceived control over the listener's own physical health and thus encourage the listener to perform the beneficial health behavior highlighted in the message. Unlike some research relating to the influence of low voice pitch on persuasiveness,^{17,18} this experiment did not demonstrate any negative reactivity to the low-pitch voice. The reason may be that a negative reaction requires the listener to perceive that the speaker is more authoritative or has higher status than the listener; in this study, the participants who heard the low-pitch message did not differ from the participants who heard the high-pitch message in their perception of the speaker's authority. I did not measure pleasantness or truthfulness; either of these factors could conceivably explain my findings. My study measured only felt power in the listeners and found that it played a role in the demonstrated effects.

The findings have practical implications. Many public health campaigns are delivered orally—whether on the radio, on television, or through social media.^{33,34} The new results suggest that the people who are encouraging the public to follow recommended guidelines should speak in a relatively low pitch. This is an approach that can be accomplished at no added cost.

Although the experiment delivered its public health communication in a laboratory setting, the outcomes suggest that oral public health campaigns broadcast via social media, podcasts, and other channels that are popular with young adults might be effective at increasing this population's uptake of healthy behaviors. And although this study focused on hand sanitizer use, the results could well apply to efforts to promote other healthy behaviors.

That said, the study had limitations. Further attempts to replicate this experiment with other speakers and with male speakers is warranted. Although Australian culture is largely similar to the cultures of other Western countries such as the United States and United Kingdom, cultural differences could influence the effectiveness of different public health campaign strategies.³⁵ Relatedly, the message was delivered in American English even though the participants were Australian because the American accent is popular in Oceania. But American English is sometimes respected more than the local accent is,³⁶ which may have influenced the perceived power of the speaker. The study also measured participants' perceived behavioral control over their physical health with two items and their felt power with just one, because prior research has shown that single questions relating to those perceptions are as valid as multiple-item measures in health contexts.^{37,38} Further work is warranted to replicate and strengthen the results of this study.

Also, although I measured hand sanitizer use, I did not assess whether participants used the sanitizer properly. Using hand sanitizer correctly is important for deriving its maximum benefit.

Finally, I examined the possible benefit of low voice pitch for health communications within the confines of a laboratory. This choice offered benefits for determining causality. In practice, however, decisionmakers who hear a spoken message might not attend to the message in full or at all or might be multitasking as they listen; all of these circumstances can affect the impact of voice pitch on felt power, perceived behavioral control over physical health, and

compliance.²⁰ Therefore, the results must be considered preliminary. Nevertheless, voice pitch is an integral aspect of oral communication that has been studied in various contexts, and my findings offer insights into the likely role of voice pitch in the effectiveness of public health messaging.

end note

A. Editors' note to nonscientists: For any given data set, the statistical test used—such as the chi-square (χ^2), the t test, or the F test—depends on the number of data points and the kinds of variables being considered, such as proportions or means. An r value represents the correlation between two variables; values can range from -1 to 1 , with 0 indicating no correlation, 1 indicating a perfect positive relationship, and -1 indicating a perfect inverse relationship. The p value of a statistical test is the probability of obtaining a result equal to or more extreme than would be observed merely by chance, assuming there are no true differences between the groups under study (this assumption is referred to as the *null hypothesis*). Researchers traditionally view $p < .05$ as the threshold of statistical significance, with lower values indicating a stronger basis for rejecting the null hypothesis. Standard deviation is a measure of the amount of variation in a set of values. Approximately two-thirds of the observations fall between one standard deviation below the mean and one standard deviation above the mean. Standard error uses standard deviation to determine how precisely one has estimated a true population value from a sample. For instance, if one were to take enough samples from a population, the sample mean ± 1 standard error would contain the true population mean around two-thirds of the time. A 95% confidence interval for a given metric indicates that in 95% of random samples from a given population, the measured value will fall within the stated interval.

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supplemental material

- <http://behavioralpolicy.org/journal>
- Supplemental Text
- Multimedia

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