



RESEARCH REPORT

Simple Requests Help Desk-Based Workers Stand Up More: A Meta-Analytic Summary

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Table of Contents

Executive Summary	3
Key Takeaways:	3
Theoretical Background	4
Research Questions	6
Intervention Design and Methodology	7
Intervention Design	7
Experimental Conditions	7
Procedure	8
Outcome Measures	9
Data and Sample	10
Hypotheses	10
Analytical Strategy	12
Mini Meta-Analyses	12
Results	14
Primary Outcome Measure: Self-reported Standing	14
Secondary Outcome Measures	17
Additional Results: Friction & Timing	24
Takeaways	27
Appendix	29
Appendix A: Experimental Conditions	29
Appendix B: Bayesian Analyses	30
Appendix C: Strategy Interest	32

Executive Summary

In a series of eight studies, spanning laboratory and field experiments, we examined the effect of messages describing the present and/or future consequences of prolonged sitting on standing behavior among desk-based workers. Providing a meta-analytic summary of our findings, we show that the exact phrasing of the message to encourage standing doesn't produce differing results, but simply asking participants to invest in their health results in a standing rate of roughly 71% across studies and a range of demographics. In addition, our studies highlight the significance of friction; not only does the proportion of participants who chose to stand up decrease as the behavior of standing up becomes more burdensome, but also as the required time commitment increases. Lastly, we present insights on the impressions given by the message content, highlighting that while the effect of the messaging on standing may be indistinguishable, how the messages are perceived matters and should be taken into account.

Key Takeaways:

- Simple requests to get up and move during the workday can be effective in getting employees up from their desks.
- Information about the present vs. future consequences of prolonged sitting during the workday does not seem to yield differences in standing rates. They also did not differ from a control that simply told people to try standing at least once every 30-60 minutes per day.
- Information about the present consequences is perceived as more helpful in understanding the relationship between prolonged sitting and health, and less frightening compared to information about potential future consequences.
- Even small amounts of friction (e.g., requiring people to stand for longer periods of time) can reduce compliance.

Theoretical Background

Present Bias: Doing the “right” thing — be that studying, exercising, or eating healthy — is easier said than done. Whereas our future-self would like to ace that test or be able to run that 10K race, our present-self is less interested in studying or hitting the gym, but much more interested in immediately gratifying activities, such as hanging out with friends or binge-watching TV. This inconsistency is referred to as “present-biasedness”, commonly known as “procrastination”.

This tendency is not only confined to our private lives. A study looking into the association between employee’s present-biasedness and physical activity found that more present-biasedness (a.k.a. being more impatient and less concerned with one’s future self) was associated with lower levels of physical activity.¹ Concerningly, over the last two years, adults have become less physically active and have spent more time sitting each day.² Combined with the fact that employees in the United States spend approximately one-fifth of their time each year working³, employers are in a unique position to influence employee health.

Knowing that physical activity is a preventative health behavior geared toward decreasing the chance of developing ill health in the future (e.g., type 2 diabetes or cardiovascular disease⁴), combined with the fact that most people exhibit some degree of present-biasedness, research is likely to benefit by framing health messages in terms of *present* benefits and/or costs.

Construal Level Theory: According to construal level theory⁵, individuals represent information in memory at varying levels of abstractness or concreteness. For example, one can describe standing up after a prolonged period of sitting as stretching your legs (a concrete, or low construal) versus keeping your body healthy (an abstract, or high construal). Furthermore, information that is temporally distant (e.g., lowering long term health risks) tends to elicit higher construals compared to information that is temporally near (e.g., avoiding immediate bodily discomfort). In other words,

¹ Hunter, R.F., Tang, J., Hutchinson, G. et al. Association between time preference, present-bias and physical activity: implications for designing behavior change interventions. BMC Public Health 18, 1388 (2018). <https://doi.org/10.1186/s12889-018-6305-9>

² Ammar, A., Brach, M., Trabelsi, K., Chtourou, H., Boukhris, O., Masmoudi, L., . . . others (2020). Effects of covid-19 home confinement on eating behaviour and physical activity: results of the eclb-covid19 international online survey. Nutrients, 12(6), 1583.

³ OECD (2021), Hours worked (indicator). <https://doi.org/10.1787/47be1c78-en> (Accessed on December 17, 2021)

⁴ Katzmarzyk, P.T., Powell, K.E., Jakicic, J.M., Troiano, R.P., Piercy, K., & Tennant, B., 2019. Sedentary behavior and health: update from the 2018 physical activity guidelines advisory committee. Med. Sci. Sports Exerc. 51 (6), 1227–1241. <https://doi.org/10.1249/MSS.0000000000001935>.

⁵ Trope, Y., & Liberman, N. (2010). Construal-level theory of psychological distance. Psychological Review. 117 (2), 440–463. doi:10.1037/a0018963

information that feels more psychologically distant elicits higher construals compared to information that feels more psychologically near.

Prior work suggests that eliciting low (i.e., psychologically near) construals may encourage greater perceptions of risk and higher behavioral intentions to engage in healthy behaviors.⁶ For example, participants who received messages that focused on the dangers of heart disease found messages that noted that every day people succumb to heart disease as more persuasive in changing their behavior than messages that focused on yearly heart disease from eating unhealthily.

⁶ Chandran, S., & Menon, G. (2004). When a day means more than a year: Effects of temporal framing on judgments of health risk. *Journal of consumer research*, 31(2), 375-389. doi: 10.1086/422116

Research Questions

Both present bias and construal level theory suggest that to encourage healthy behaviors, one should focus individuals on the present moment. Therefore, in a series of experiments, we manipulated messaging to either focus on the present and/or future consequences of prolonged sitting in order to motivate individuals to stand up.

RQ1: *Will messaging that focuses on the present and/or future consequences of prolonged sitting lead to higher rates of standing compared to a control message?*

Another issue for motivating physical activity at the workplace is the fact that it can be inconvenient. Something as simple as raising a standing desk at work can feel like a burden when one is focused on work.⁷ To examine the role of even small amounts of friction on individuals' likelihood to stand up, we either varied how inconvenient it is to stand-up or the time required to complete the physical activity across four out of our eight studies.

RQ2: *Will the rate of standing decline when standing becomes either more inconvenient or the time required to perform the physical activity increases?*

⁷ Venema, T. A., Kroese, F. M., & De Ridder, D. T. (2018). I'm still standing: A longitudinal study on the effect of a default nudge. *Psychology & Health*, 33(5), 669-681. doi: 10.1080/08870446.2017.1385786

Intervention Design and Methodology

Intervention Design

Between December 2019 and March 2021, we ran a series of eight studies in which participants were presented with one of four messages⁸ about the harmful health consequences of prolonged sitting. Prior to launch, all materials and procedures received ethical approval from the Institutional Review Board at Duke University [2019-0490]. For pre-registration see:

<https://doi.org/10.17605/OSF.IO/9GFXS>.⁹

In total, over 4,500 participants spanning online survey takers, college students, employees, and social media users took part in our research. Upon reading the message, participants were given the opportunity to stand up. Our primary variable of interest is the proportion of participants who reported standing after reading the message.

Experimental Conditions

Following a 2x2 design, we created four messages in which we brought attention to the present and/or future consequences of sitting in order to persuade participants to stand up (see Table 1 in appendix A for exact messages).

The control message, which was shown to all participants, provided information as to how many hours office workers spend sitting down each week, and how often one should break up their sedentary behavior. In studies 1-4, the “Present” message described the physiological effects that occur in the moment while sitting for too long (which are associated with the long-term health consequences), whereas the “Future” message described the health consequences of sitting for too long. In studies 5-8, the messages were slightly altered to either inform participants of the immediate consequences (“Present” message) or the future consequences of prolonged sitting (“Future” message). In addition, the messages were presented to participants in flyer form, while the previous studies utilized simple text. The combined message simply combined the “Present” and “Future” messages in each study.

⁸ Participants in Study 8 were presented with one of the first three messages.

⁹ For three more pre-registrations concerning the various studies, please visit: <https://doi.org/10.17605/OSF.IO/KJRUP>; <https://doi.org/10.17605/OSF.IO/4KYQR>; and <https://doi.org/10.17605/OSF.IO/G8XJR>

Procedure

The studies were designed and implemented using Qualtrics. Studies 1-4 & 8 were run using online survey takers on Prolific, while studies 5-7¹⁰ were embedded in non-related research studies that spanned across a variety of other demographics, such as college students, employees, and social media users.

After consenting to participate in the study (all studies) and acknowledging to be physically able to stand and move (all studies, except 5-6), participants were asked whether they currently are in a space that allows them to stand up (all studies, except 7). Online survey takers were also asked about the number of hours they spend working on Amazon Mechanical Turk (MTurk)¹¹ each week, how they would categorize their job on MTurk, and how long it has been since they last stood up. Next, participants were randomly assigned to one of the four¹² messaging conditions (see Table 1 in appendix A for details).

To reinforce the manipulation, all online survey participants completed four (two for those in the control condition) understanding questions and were prompted to take 30 seconds to write a few sentences reflecting on the health message. All online survey takers were also asked to:

- Rate the message on a multitude of dimensions on a 7-point scale, such as fear and disgust,
- State their intentions to stand up more often in the future,
- Rate the psychological distance on a slider from 0 (near) to 100 (far), and
- Rate their agreement to three health statements about the benefits of standing up on a 7-point Likert scale (studies 1 and 2 only).

Next, we assessed our main outcome variable of interest - standing rate - in the following ways:

1. **Required/30-seconds/Compensated:** Participants in Study 1 were given the opportunity to stand up during a 30 second visualization task or to remain seated. If a participant said 'yes', the next screen prompted them to stand up. All participants, regardless of choosing to stand or sit, were then prompted to engage in the 30-second workplace visualization task. The screen did not allow participants to continue until the time elapsed.

¹⁰ Study 7 was translated into Dutch as it was run with employees of a large Dutch health insurance company.

¹¹ MTurk workers are individuals who do online tasks (like research studies or consumer surveys) in exchange for money from their personal computers.

¹² Participants in Study 8 were presented with one of the first three messages.

2. **Voluntary/Open Timing/Implied No Compensation:** Participants in Study 2 were given the opportunity to stand up before moving on to the next section. If a participant said 'yes', the next screen prompted them with the following: "Please stand up now for as long as you feel that you need to! Click the Next button when you are ready to sit back down and begin the next task."
3. **Voluntary/30 seconds/Explicit No Compensation:** Participants in studies 3-7 were given the opportunity to stand up for 30 seconds before moving on to the next section. Participants were made aware that this was voluntary, and the 30 seconds spent standing were not compensated. If a participant said 'yes', the next screen prompted them to stand and did not allow them to continue for 30 seconds. Those who stood were asked what they did during those 30 seconds.
4. **Voluntary/Variable Timing/Explicit No Compensation:** Participants in Study 8 were given the opportunity to stand up for one of 7 randomly assigned lengths of time – [15 / 30 / 60 / 90 / 120 / 180 / 240]-seconds – before moving on to the next section. Participants were made aware that this was voluntary, and the time spent standing was not compensated. If a participant said 'yes', the next screen prompted them to stand and did not allow them to continue for [15 / 30 / 60 / 90 / 120 / 180 / 240]-seconds. Those who stood were asked what they did during those [15 / 30 / 60 / 90 / 120 / 180 / 240]-seconds.

Then, all participants answered questions about their work environment, their current location, the number of hours they spend sitting down on a typical day while working, and in case they indicated standing up during the 30-second stand-up opportunity, whether they had actually stood up during that time. Participants in studies 5-8, also rated the psychological distance on a slider from 0 (near) to 100 (far). Lastly, we collected demographic information, such as age and gender.

Outcome Measures

Primary outcome measure

The primary outcome measure was self-reported standing [Yes/No].

Secondary outcome measures

Our secondary outcome measures included:

- Rating of psychological distance. Participants were asked to answer the following question: How much do you feel like the consequences of sitting are something you should be worrying about right now, as compared to in the future? (0 (Near) -100 (Far))
- Rating of the health message on a multitude of dimensions, such as fear, fright, and disgust (on a 7-point Likert scale)
- Rating of intentions to stand up more often in the future (on a 7-point Likert scale)
- Self-reported interest in learning about a strategy that can help participants stand up more frequently [Yes/No] (see Appendix C)

Data and Sample

Our final sample included 4,548 participants. We excluded participants based on the following culling rules: participants who didn't complete the entire study, who indicated not having space to stand up and those who were already standing before reading the message, as well as participants who indicated not being physically able to stand. In addition, all participants that said they were dishonest about standing up were re-coded to reflect that they did not actually stand. Lastly, participants who didn't complete the attention check question in Study 4 (in a rating task at the end of the study, one item saying "...please select strongly agree") were excluded. Data was anonymous and stored in a secure location.

Hypotheses

Our pre-registered hypotheses were as follows:

Primary outcome measures

1. We would see a higher proportion of participants standing up when the "Present" message is shown as compared to when it is absent.
2. We would see a lower proportion of participants standing up when the "Future" message is shown as compared to when it is absent.
3. We would see a lower proportion of participants standing up when the "Future" message is shown as compared to when the "Present" message is shown (Study 8).

Secondary outcome measures

1. Participants receiving the “Present” and “Future” message, and the “Future” only message will rate the message as the most frightening, followed by the “Present” message alone, then the control message.
2. Greater frightened ratings will be associated with a greater proportion standing.
3. Fewer participants will stand as the amount of time they are asked to stand for increases (Study 8).
4. All messages will be perceived as less psychologically distant than the control message (no “Present” and no “Future”).
5. Smaller psychological distance will be associated with a greater proportion standing.¹³

¹³ This is the same as saying that a greater psychological distance will be associated with a smaller proportion standing.

Analytical Strategy

In the following section we describe one analytical strategy deployed throughout our research report: a mini meta-analysis. As this strategy is less familiar to many readers, we would like to dedicate some time to get everyone up to speed. Other analytical strategies, such as linear regressions or correlations, will be discussed in combination with the results.

Mini Meta-Analyses¹⁴

As all eight studies explored the same research question with nearly identical designs, we decided to conduct several internal meta-analyses — or mini meta-analyses — of those eight studies to redirect attention towards effect sizes and away from individual studies' p-values, thus being able to better understand the big picture. In addition, an internal meta-analysis increases the precision of our estimates despite the low number of (small) studies involved, and thus not only provides stronger evidence, but also greater transparency. Overall, our mini meta-analyses were conducted using the steps outlined in Goh et al. (2016)¹⁵, and by using the Excel spreadsheet published by Goh (2019).¹⁶

Primary Outcome Measure: Self-reported Standing

By running an additive, factorial logistic regression for each study, ignoring the interaction effect¹⁷, we have two effect sizes — two odds-ratios — for each study: one for each message type (present consequences of sitting and future consequences of sitting). Thus, each effect size provides us with the odds of standing-up when the participant is exposed to the message as compared to without exposure to the message. Given the nature of the factorial experimental design in studies 1-7, absence of exposure to the “Present” message (“Future” message) doesn't necessarily mean that participants were exposed to the control message as they could have still been exposed to the “Future” message (“Present” message).

Given the two effect sizes for each study, we performed a separate mini meta-analysis for each message type. To account for multiple ways in which sample characteristics can be weighted, we

¹⁴ In addition to the described analytical strategy, we followed our pre-registration and ran separate Bayesian models for each experiment, relying on the posterior distribution for the previous experiment to inform the priors for the experiment that followed. See appendix B for details.

¹⁵ Goh, J. X., Hall, J. A., Rosenthal, R. (2016). Mini Meta-Analysis of Your Own Studies: Some Arguments on Why and a Primer on How. *Social & Personality Psychology Compass*, 10, 535–549. <https://doi.org/10.1111/spc3.12267>

¹⁶ Goh, J. X. (2019, May 3). Mini Meta-Analysis of Your Own Studies. Retrieved from osf.io/6tfh5

¹⁷ We opted for an additive, factorial logistic regression as the interaction effect in the full factorial logistic regression was insignificant.

meta-analyzed our eight studies using two fixed effects and two random effects approaches. All odds-ratios were log-transformed for analyses and converted back to odds-ratios for presentation.

Fixed effects approaches

Following Hedges and Olkin's method, the mean effect size (e.g., the mean odds-ratio) was weighted by the inverse variance. In a second fixed effects approach, the mean effect size was weighted by sample size.

Random effects approaches

In the fully random effects approach all eight studies received equal weight, meaning that the overall effect is simply the arithmetic average of all the effect sizes. Given that the random effects model assumes that variability between effect sizes is due to sampling error and variability in the population of effects (instead of all variability between effect sizes being due to sampling error), in our second random effects approach, weights were assigned as a function of sampling error and study level variability.

Secondary Outcome Measures: Intentions to Stand Up More and Psychological Distance

For each outcome variable — participants' intentions to stand up more in the future and ratings of how psychologically distanced the message was perceived — we conducted two separate mini meta-analyses examining (1) exposure vs. absence of exposure to the “Present” message, and (2) exposure vs. absence of exposure to the “Future” message. We used Cohen's d as our measure of effect size for these comparisons. We included the condition in which both “Present” and “Future” messages were read by the participant in both analyses. A fixed-effects meta-analysis was calculated following Hedges and Olkin's method of weighing the mean effect size (Cohen's d) by the inverse variance.

An additional mini meta-analysis examined the correlation between standing and psychological distance across all eight studies. All Pearson correlations were Fisher z transformed for analysis and converted back to Pearson correlations for presentation.

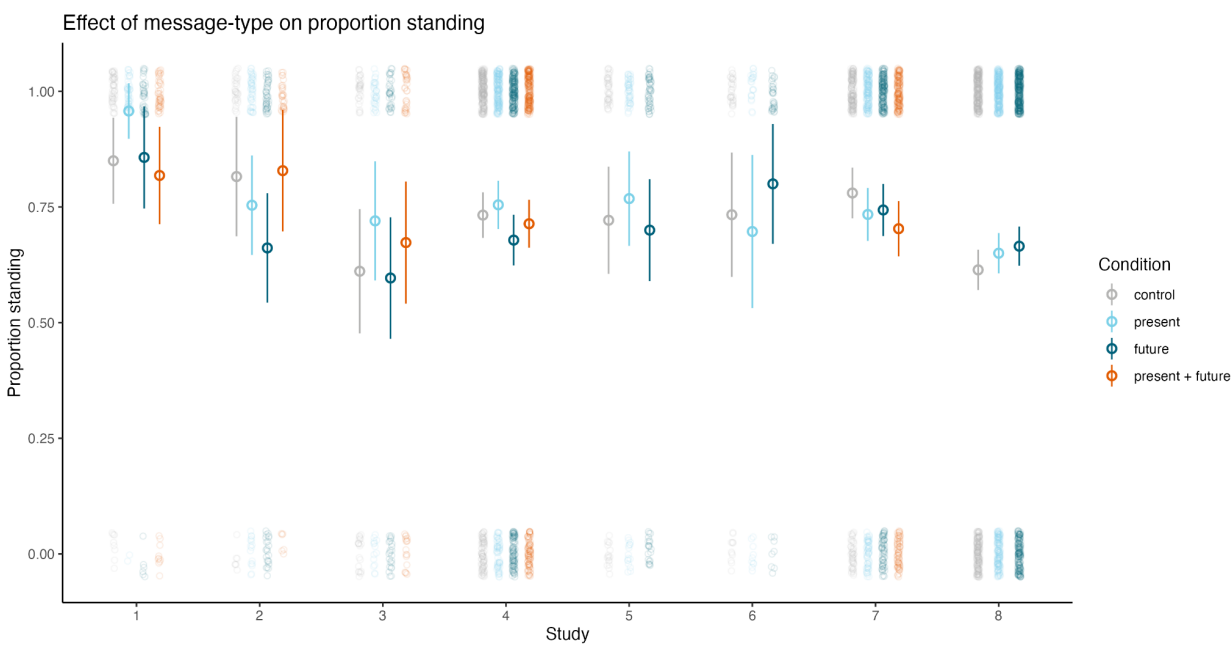
Results

Overall, we found very high rates of standing – between 64.3% and 86.8% – when given the opportunity to do so. However, we found no statistically significant effect of either our “Present” or “Future” messages relative to the absence of that message (see Mini Meta-Analysis in the Primary Outcome Measure section). Further analyses provide insights into secondary outcome measures with important implications to increase participation in physical activity, such as reducing friction and making sure people are not scared when highlighting future health threats.

Primary Outcome Measure: Self-reported Standing

Before providing the mini meta-analytic results, Figure 1 presents the underlying raw data of the proportion of participants standing up, split by condition and study. In addition to the scatterplot, Figure 1 also displays the average standing rate as well as 95% confidence intervals.

Figure 1.

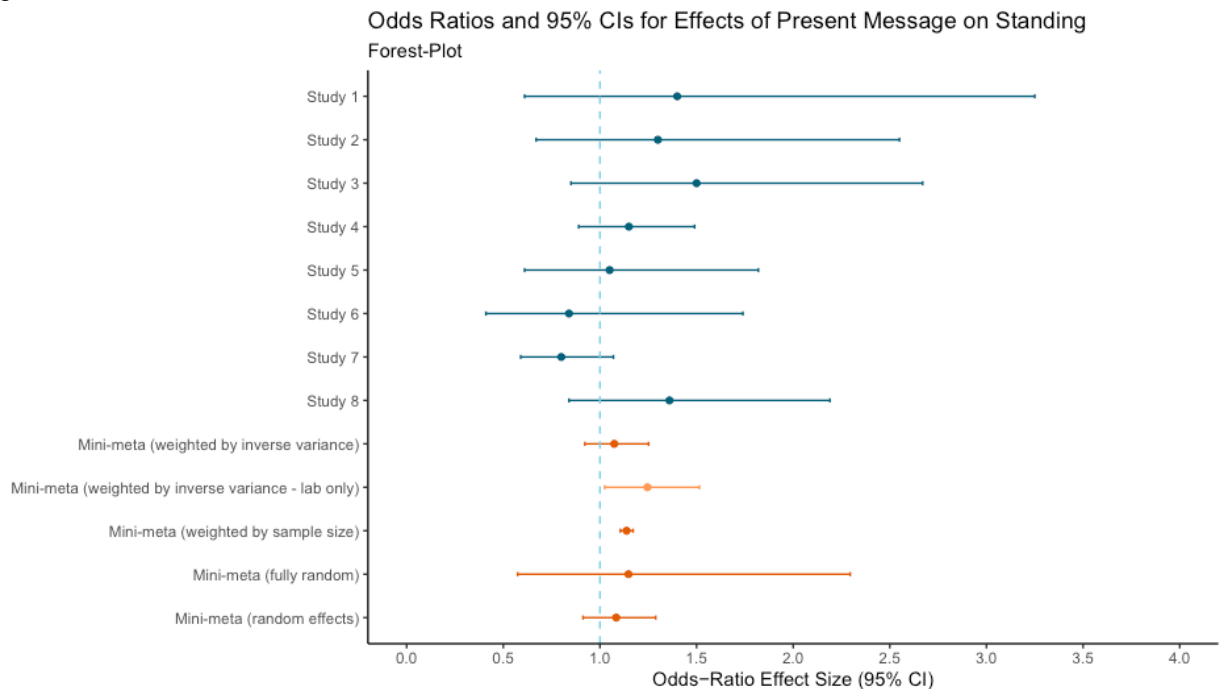


Mini Meta-Analysis

Present Consequences of Sitting: Overall, the effect — following Hedges and Olkin’s method as well as either random effects approach — was insignificant ($OR_{HO}=1.074$, 95% CI [0.922, 1.252], $p > .05$; $OR_{RD}=1.085$, 95% CI [0.913, 1.289], $p > .05$; $OR_{RD-full}=1.148$, 95% CI [0.574, 2.295], $p > .05$), such that those participants with exposure to the “Present” message and those without the “Present” message exposure, had an equal chance of standing up (see Figure 2).

Only the fixed effects approach in which the mean effect size was weighted by sample size produced a significant effect of “Present” message exposure on the odds of standing up, $OR=1.138$, 95% CI [1.106, 1.172], $p < .001$. However, the effect was very small. Compared to a coin-toss — a 50-50 percent chance of standing up or remaining seated — exposure to the “Present” message increased the chance of standing up by less than 5%. Thus, it is questionable whether such an effect is meaningful in practice, and we are rejecting our hypothesis (H1) that we see a higher proportion of participants standing up when the “Present” message is shown as compared to when it is absent.

Figure 2.

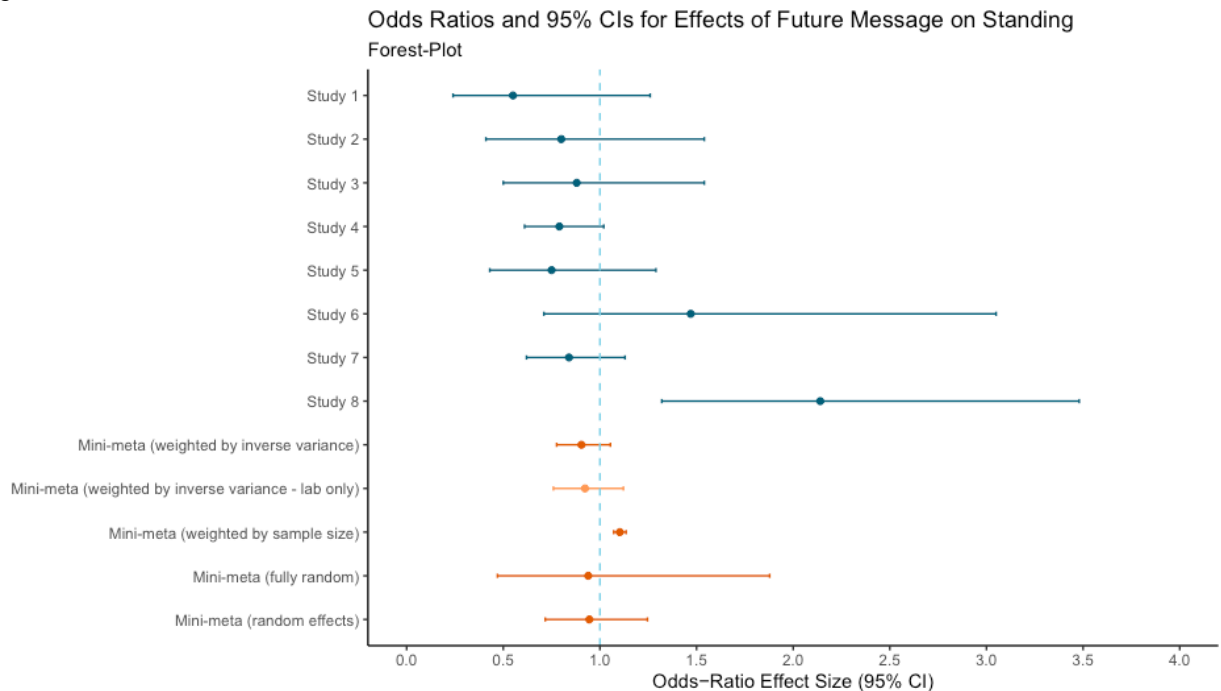


Studies 1-4 and 8 were carried out in a laboratory setting (online respondents were paid to participate in our survey), while the other three studies were field studies ('real' people completed an unrelated survey in which our study happened to be embedded in). Interestingly, we found an overall significant, positive effect in those studies carried out in the lab ($OR_{HO}=1.246$, 95% CI [1.025, 1.515], $p = .027$). What can explain this discrepancy? On the one hand this shows how sensitive findings can be to context, and how careful one needs to be when translating findings across contexts. On the other hand, another key difference besides population might be responsible for the discrepancy, namely engagement. While participants in the laboratory setting were asked to engage in a 30-second writing task about the message they had just read, field participants were not asked to do so. It could be that the additional engagement is key for the message's effectiveness.

Future Consequences of Sitting: As with the "Present" message, the overall effect of the "Future" message — following Hedges and Olkin's method as well as either random effects approach — was insignificant ($OR_{HO}=0.904$, 95% CI [0.776, 1.054], $p > .05$; $OR_{RD}=0.945$, 95% CI [0.717, 1.246], $p > .05$; $OR_{RD-full}=0.939$, 95% CI [0.470, 1.878], $p > .05$), such that those presented with the "Future" message and those without exposure to it, had an equal chance of standing up (see Figure 3).

Only the fixed effects approach in which the mean effect size was weighted by sample size produced a significant effect of "Future" message exposure on the odds of standing up, $OR=1.103$, 95% CI [1.071, 1.135], $p < .001$. However, the effect was very small. Compared to a coin-toss — a 50-50 percent chance of standing up or remaining seated — exposure to the "Future" message increased the chance of standing up by less than 5%. Thus, it is questionable whether such an effect is meaningful in practice and again, we reject our hypothesis (H2) that we see a lower proportion of participants standing up when the "Future" message is shown as compared to when it is absent.

Figure 3.



While restricting the set of studies to only those carried out in the lab produced an overall significant, positive effect when considering exposure to the “Present” message, we didn’t observe the same when looking at exposure to the “Future” message.

Secondary Outcome Measures

Intentions to Stand Up More Often in the Future

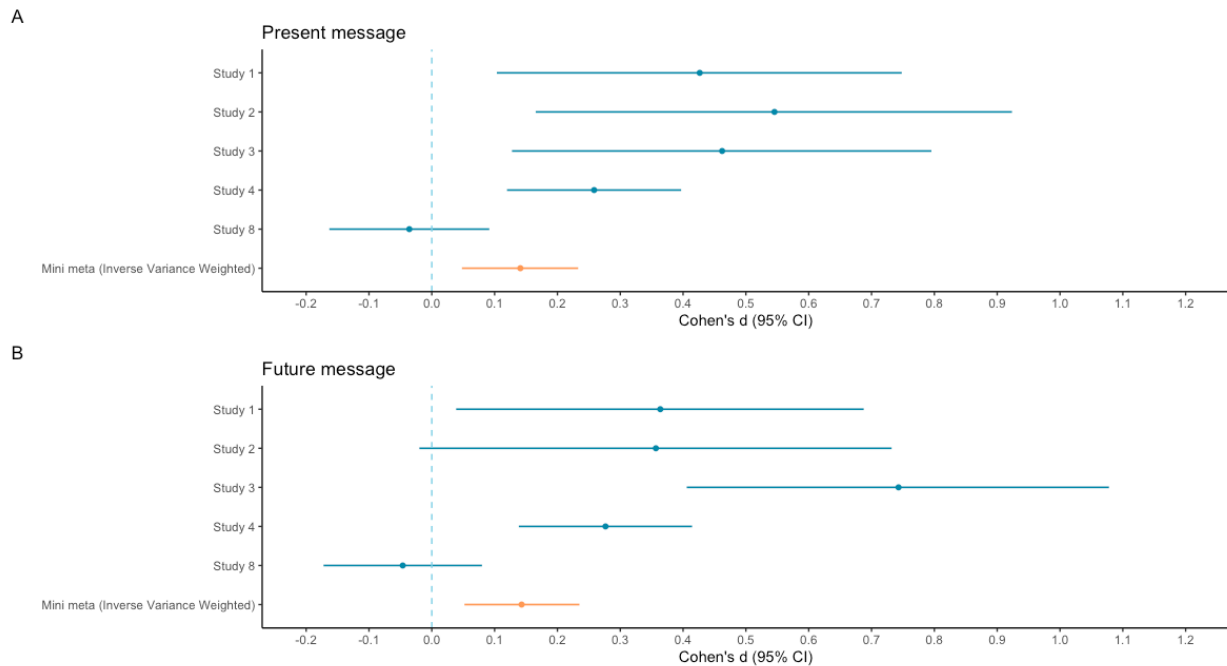
After reading their randomly assigned message about the harmful health consequences of prolonged sitting, all online survey takers (studies 1-4, and 8) were asked to rate their intent to stand up more often in the future.

Results of this mini meta-analysis showed that in four of the five studies, exposure to the “Present” message yielded significantly greater intentions to stand in the future relative to the control condition. Three out of five of the studies found significantly greater intentions relative to control for the “Future” message. Taking all of the studies together, the “Present and Future” messages led to greater intentions relative to control (Cohen’s $d_{\text{(present)}} = 0.14$, 95% CI [0.05, 0.23], $p = .003$; Cohen’s $d_{\text{(future)}} = 0.14$, 95% CI [0.05, 0.24], $p = .002$; see Figure 4). Finally, to examine the relationship between standing intentions and behavior, we combined all five studies and found that those who rated themselves as having greater intentions to stand in the future were also more

likely to stand during the experiments, though the relationship between intentions and behavior was weak ($r = 0.18$, 95% CI [0.15, 0.21], $p < .001$).

Figure 4.

Mini-Meta Analyses for effect of message on standing intentions



Finally, we looked at the relationship between intentions to stand in the future and the Consideration of Future Consequences (CFC) score¹⁸ in Study 8. The CFC scale measures the extent to which one considers the future consequences of their present behaviors ($M = 43.95$, $SD = 8.45$, $Min = 12$, $Max = 60$, $\omega_h = 0.63$). It stands to reason that those who are more likely to consider the long-term consequences of their behaviors would report greater intentions to stand in the future. True to this reasoning, participants who scored higher on CFC rated themselves as more likely to stand in the future ($\rho = 0.20$, 95% CI [0.15, 0.25], $p < .001$). We also ran an ANOVA interacting CFC with messaging condition to see if the relationship between CFC and intentions was stronger when the “Future” message was presented, but found no significant interaction between CFC and message ($p = 0.64$).

18 Strathman, A., Gleicher, F., Boninger, D. S., & Edwards, C. S. (1994). The consideration of future consequences: Weighing immediate and distant outcomes of behavior. *Journal of Personality and Social Psychology*, 66(4), 742-752. doi: 10.1037/0022-3514.66.4.742

Psychological Distance¹⁹

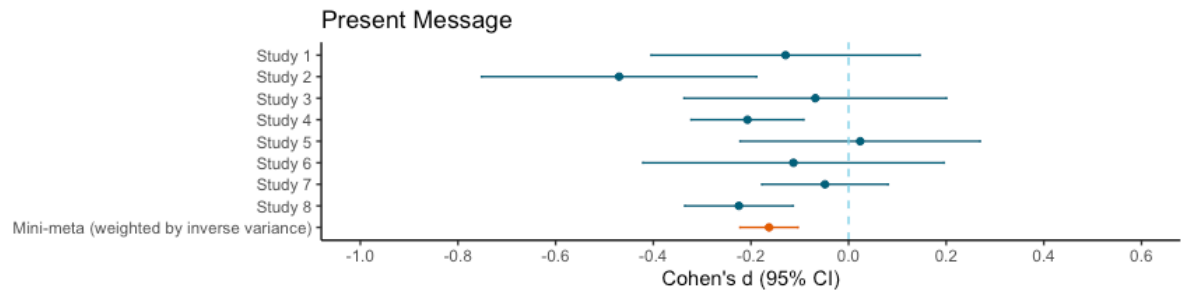
Overall, the effect of the “Present” message as well as the “Future” message — following Hedges and Olkin’s method of weighing the mean effect size (Cohen’s d) by the inverse variance — was significant (Cohen’s $d_{\text{(present)}} = -0.16$, 95% CI $[-0.222, -0.103]$, $p < .00001$; Cohen’s $d_{\text{(future)}} = -0.12$, 95% CI $[-0.176, -0.058]$, $p < .001$), meaning that those participants with exposure to either of the messages had a significantly lower rating of psychological distance compared to those participants without the message exposure, thus feeling like the consequences of sitting are something they should be worrying more about right now, as compared to in the future (see Figure 5).

¹⁹ Note: In studies carried out in a laboratory setting (studies 1-4, 8), psychological distance was assessed before asking participants whether they would like to stand, while in studies 5-7 (field studies) psychological distance was assessed after participants were asked to stand.

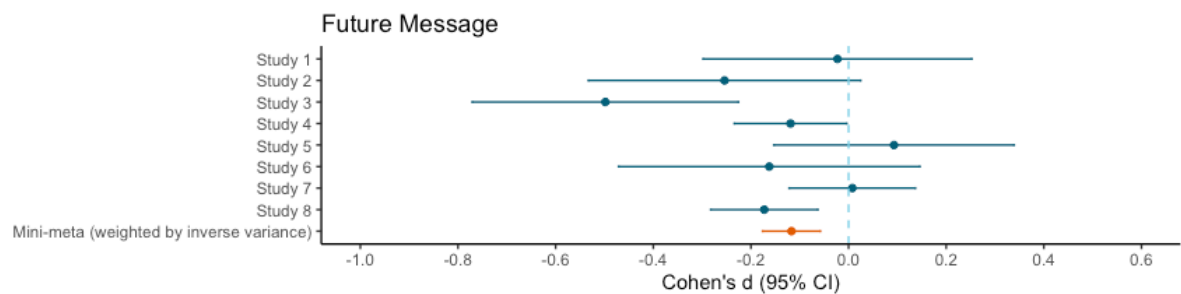
Figure 5.

Mini Meta-Analyses for Effect of Message on Psychological Distance

A



B



In order to directly compare “Present” and “Future” messaging, we combined all study data and ran a linear regression estimating how participants' ratings of how psychologically distanced the message was perceived, changed in each condition. Conditions were combined into a four-level factor: control, present, future, present & future. We then computed the estimated main effect of each condition as well as conducted pairwise comparisons using a Tukey adjustment for multiple comparisons.

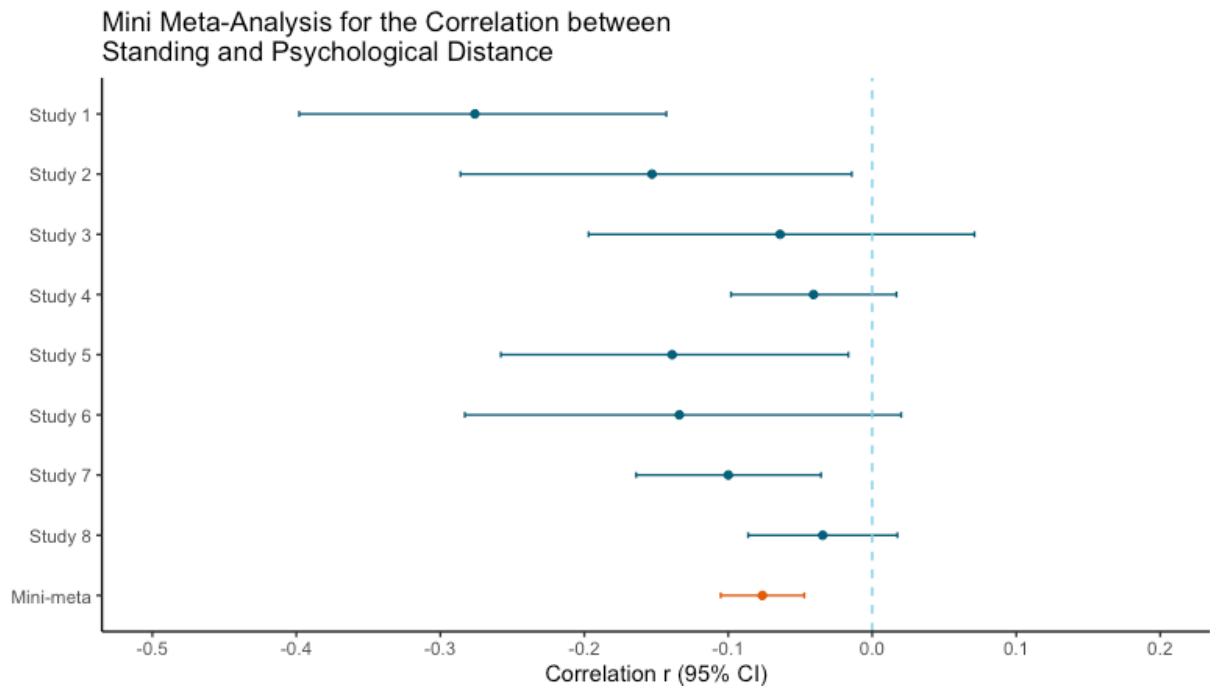
As predicted, the “Present” message was perceived as less psychologically distant than the “Future” message ($p = .033$). This shows that the message manipulation worked. In accordance with hypothesis 7, all messages were perceived as less psychologically distant than the control message, though, only the “Present” message ($p < .0001$) and the present & future combined ($p = .002$) message were significantly less psychologically distant than the control message. This suggests that the “Present” messages did reflect a more concrete (or psychologically closer) construal relative to the other messages.

Psychological Distance and Standing

We also conducted a mini meta-analysis of the correlation between psychological distance and standing across our studies. As hypothesized (H8), we found a significant negative correlation

($r = -0.08$, 95% CI $[-0.105, -0.047]$, $p < .00001$), in that a greater psychological distance is associated with a smaller proportion standing (see Figure 6).

Figure 6.



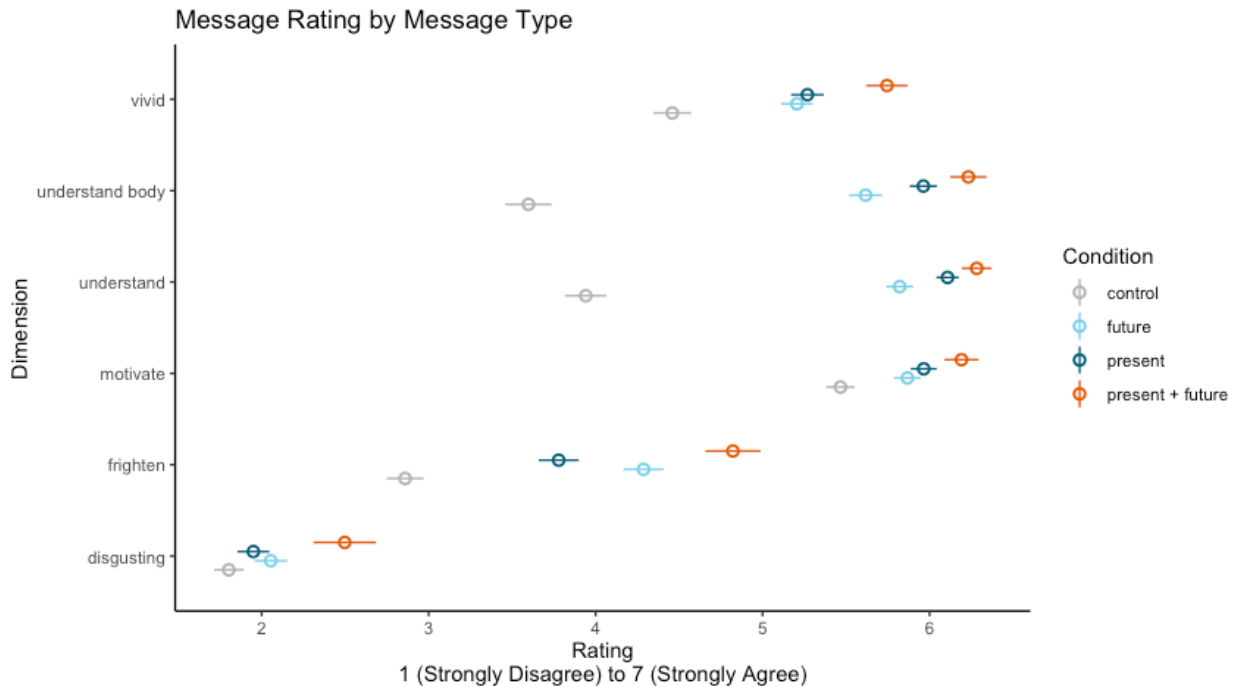
Considering Study 8, we were interested in determining whether individuals' psychological distance ratings might covary with their Consideration of Future Consequences (CFC) scores. There was a small, negative relationship between the two measures, such that individuals who were more likely to consider future consequences rated psychological distance as closer ($r(1,428) = -0.18$, 95% CI $[-0.23, -0.13]$, $p < .001$). In other words, individuals who were more likely to consider the future consequences of their current behaviors were also more likely to worry about the consequences of sitting right now as compared to in the future.

Message Ratings

Overall, we found little to no difference between message ("Present" vs. "Future") effectiveness compared to the absence of these messages when looking at standing rates. Yet, we wanted to understand whether the different messages could possibly evoke different reactions. In particular, did the message content impact how people rated the message?

All online participants rated the message on the following six dimensions on a 7-point scale: understanding the health implications of the message, understanding how sitting for too long affects their body, motivation to stand up more frequently, fright, disgust, and vividness. For each of the six dimensions, we regressed the rating on condition and conducted post hoc comparisons for all combinations of condition (using Tukey adjustment for multiple comparisons). Across all rating dimensions, the control message always had the lowest rating while the message that brought attention to the present and future consequences of sitting always had the highest rating (see Figure 7).

Figure 7.



Whereas both “Present” and “Future” messaging were significantly more helpful in aiding the *understanding* of the health implications of the message (p 's < .0001) as well as the *understanding* of how sitting for too long affects the body compared to the control message (p 's < .0001), the “Present” messaging was significantly more helpful in doing so than the “Future” messaging (p 's < .0001).

Messages that brought attention to the present and/or future consequences of sitting were significantly more *motivating* than the control message (p 's < .0001), though we found no significant difference in the “Future” compared to the “Present” messaging on motivation to stand up more frequently (p = n.s.).

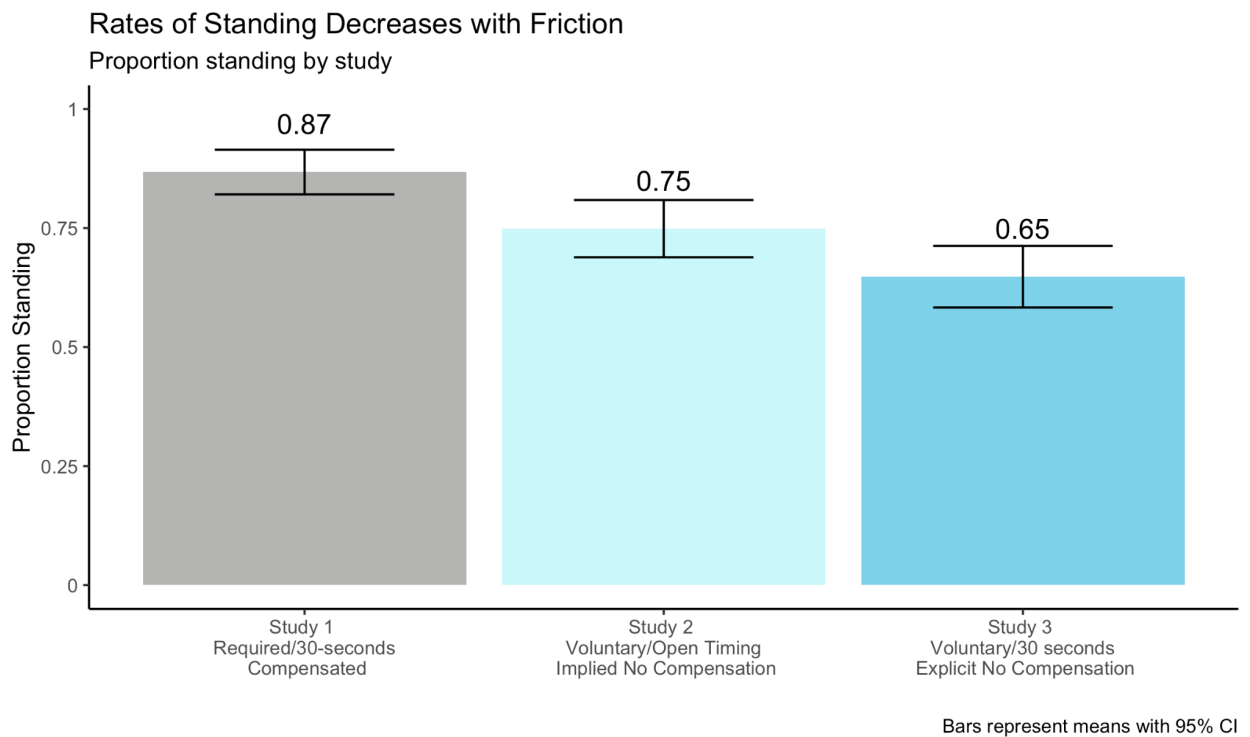
“Future” messaging was significantly more *frightening* than “Present” messaging (p < .0001), with messaging highlighting the present and/or future consequences being significantly more frightening than the control message (p 's < .0001). This finding is in support of hypothesis 4. We also ran a logistic regression estimating the relationship between standing and participants' ratings of how frightening the message was. Indeed, in line with hypothesis 5, we found a significant relationship in that greater frightened ratings were associated with a greater proportion standing (OR = 1.131 95% CI [1.088, 1.177], p < .001).

While the “Future” messaging was rated as significantly more disgusting than the control message ($p = .002$), “Future” and “Present” messaging were not significantly different ($p = \text{n.s.}$). As expected, all messaging was rated as more vivid than the control message (p 's $< .0001$). Though, “Present” messaging was not significantly more vivid than “Future” messaging ($p = \text{n.s.}$).

Additional Results: Friction & Timing

Across the first three studies, friction to stand increased: In Study 1, participants were forced to engage in a 30-second visualization task regardless of whether they sat or stood (this would be akin to an individual continuing to work while standing). In the second and third study, we eliminated the visualization task and made standing optional. These studies were more like stopping work in order to take a standing break. Given the fact that time is literally money for online survey takers (in our case, \$10 per hour), it was more enticing to skip the activity and complete the study more quickly. Whereas participants could stand for however long they desired in Study 2, Study 3 required participants to stand for 30 seconds in the event that they chose to do so. As friction to stand increased across these three studies, the proportion of participants who chose to stand up decreased by 22 percentage points (see Figure 8).

Figure 8.

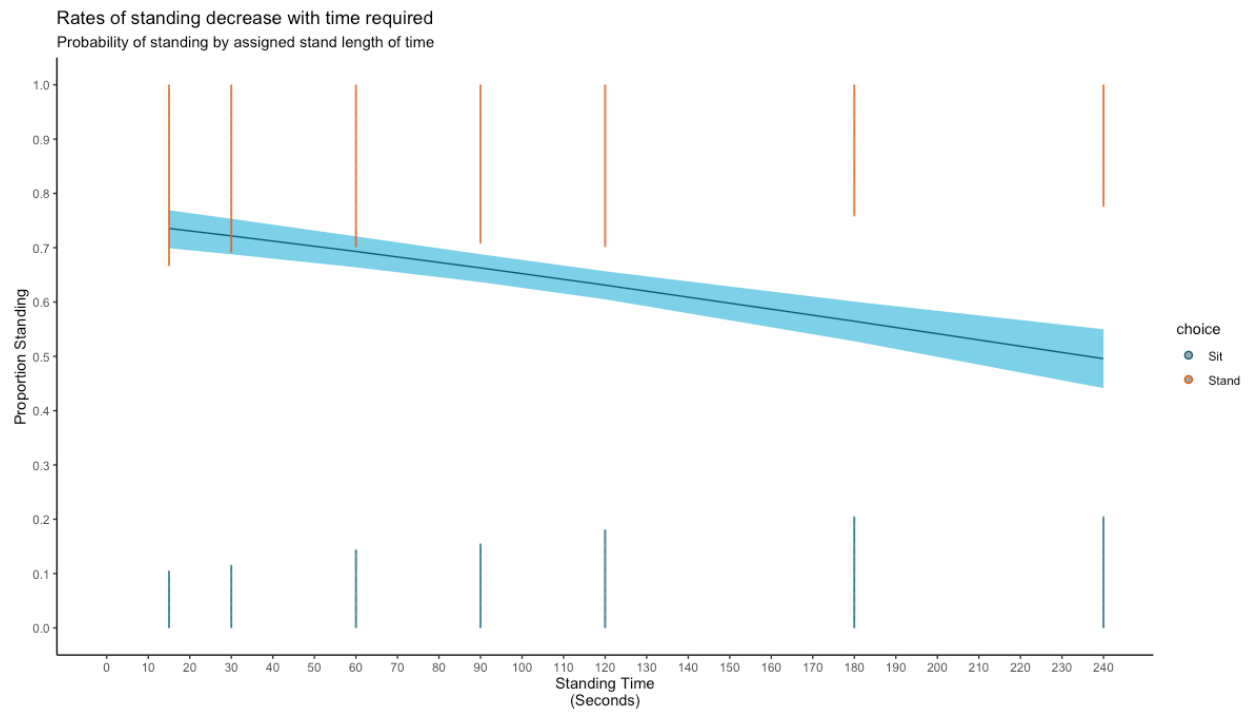


In our final study²⁰, we examined the effect of time on standing with more granularity. Whereas standing up was still optional, participants were asked to stand for intervals ranging from 15 seconds to four minutes. As the amount of time increased, the proportion of people opting to stand decreased (OR = 0.995, 95% CI [0.994, 0.997], $p < .001$)²¹, namely from 76.1% when asked to stand for 15 seconds to 52.3% when asked to stand for four minutes (see Figure 9). This finding supports hypothesis 6, which states that increased time would lead to decreased standing rates.

²⁰ Considering Study 8, we reject the hypothesis of a lower proportion of participants standing up when the "Future" message is shown as compared to when the "Present" message is shown (H3; $p = \text{n.s.}$).

²¹ This reflects the main effect of standing time averaged over the three message conditions.

Figure 9.



Takeaways

In a series of eight studies, we have demonstrated a very real behavior — standing up — in an online context. While the phrasing of the message to encourage standing didn't produce differing results, simply asking participants to stand-up resulted in a standing rate of ~71% across studies and message type as well as across a range of demographics. Thus, our research failed to support hypotheses driven by present bias or construal theory, which would have predicted superiority of the message that emphasized immediate consequences of prolonged sitting.

However, our results do show that to get someone to do something as simple as standing up, it is often sufficient to simply ask. Yet, we significantly underestimate our ability to get others to comply with our direct requests by nearly 50%.²² This effect — coined the underestimation-of-compliance effect — is not only large but has been demonstrated in a variety of studies spanning multiple types of requests. Whereas targets find it awkward to say no to an in-person request, this fact is largely ignored by the requester, thus explaining this large underestimation. Moving away from direct, in-person requests to requests made over email or another online medium — as was the case in our studies — does make it much more likely for a person to decline a request. Yet, as suggested by Bohns (2016) the requesters' relationship to their target may play a large role, such as an employer-employee relationship. Overall, we tend to underestimate the compliance with direct requests for help. Moving the request online, but preserving an employer-employee relationship, however, may not alter the target's feeling of awkwardness in declining a request. Thus, simply asking people to do things may go a long way.

Whereas the message content in a direct request to stand up may not matter for the overall compliance rate (though including more explanatory content did increase intent to stand in the future), it could matter when it comes to how people feel about the message. A message, such as our "Present" message, that emphasizes the immediate issues of joint pain, muscles weakness, and digestive difficulty associated with the undesirable behavior of sitting, was perceived as more helpful in understanding the relationship between prolonged sitting and health, and less frightening compared to a message that contains future threats of cancer or death. Thus, in instances in which messaging is deployed for physical activity, a message that is perceived more positively (e.g., our "Present" messaging) is preferred over a more frightening message (e.g., our "Future" messaging).

²² Bohns, V. K. (2016). (Mis)Understanding Our Influence Over Others: A Review of the Underestimation-of-Compliance Effect. *Current Directions in Psychological Science*, 25(2), 119–123. DOI: 10.1177/0963721415628011

Lastly, we have learned that even a small amount of friction (e.g., a perceived barrier to engaging in a behavior) can make a large difference by reducing participation. In our case, an additional 3 minutes and 45 seconds led to a 31% decrease in compliance. Thus, it is not only important to make physical activity during work breaks easy, but also quickly achievable.

Appendix

Appendix A: Experimental Conditions

Table 1. Standing Messages

Condition	Version 1 Message (Studies 1-4)	Version 2 Message (Studies 5-7)	Version 3 Message (Study 8)
Control (Shown in all conditions)	Research suggests that office workers spend an average of 67 hours per week sitting. Health researchers have found that it is important to avoid sitting for too long. They recommend standing up at least once every 30 to 60 minutes.	Tip of the Day!!! Avoid sitting for too long. Try to stand up and move around at least once every 30 to 60 minutes.	Tip of the Day!!! Avoid sitting for too long. Try to stand up and move around at least once every 30 to 60 minutes.
Control		Office workers spend an average of 67 hours per week sitting. Health researchers have found that it is important to avoid sitting for too long. They recommend standing up at least once every 30 to 60 minutes.	Office workers spend an average of 67 hours per week sitting.
Present	Sitting for too long causes blood to pool in your legs. This puts added pressure on your veins. Sitting for too long can also tighten the hip and leg muscles and stiffen your joints. It causes your abdomen (i.e., stomach) to compress, which means you will digest more slowly. Finally, your leg, abdominal, and shoulder muscles will all become less active. Therefore, they will be less likely to respond to insulin, which is involved in muscles breaking down sugar - which is needed to create the energy needed for movement.	Sitting for too long has many immediate negative effects on your body that you have probably experienced (or may be feeling right now.) It puts pressure on your leg veins, stress on your spine and joints, and weakens your muscles.	Sitting for too long has many immediate negative effects on your body that you have probably experienced (or may be feeling right now.) It puts pressure on your leg veins, stress on your spine and joints, and weakens your muscles.
Future	Sitting for too long increases your chances of having varicose veins (enlarged, swollen, and twisting veins, often appearing blue or dark purple). Sitting for too long can also increase your chances of back and joint pain. It can lead to abdominal discomfort and excess bloating. Finally, it can increase your chance of getting cancer and Type 2 Diabetes.	Sitting for too long is associated with many long-term negative effects on your body that you would rather not experience later in life. These include increased risk of dying from numerous health conditions, including cancer, type 2 diabetes, and heart disease.	Sitting for too long is associated with many long-term negative effects on your body that you would rather not experience later in life. These include increased risk of dying from numerous health conditions, including cancer, type 2 diabetes, and heart disease.
Combined	Sitting for too long causes blood to pool in your legs. This puts added pressure on your veins, increasing your chances of having varicose veins (enlarged, swollen, and twisting veins, often appearing blue or dark purple). Sitting for too long can also tighten the hip and leg muscles and stiffen your joints, increasing your chances of back and joint pain. It causes your abdomen to compress, which means you will digest more slowly and can lead to abdominal discomfort and excess bloating. Finally, your leg, abdominal, and shoulder muscles will all become less active. Therefore, they will be less likely to respond to insulin which is involved in muscles breaking down sugar - which is needed to create the energy needed for movement. This can increase your chance of getting cancer and Type 2 Diabetes.	Sitting for too long has many immediate negative effects on your body that you have probably experienced (or may be feeling right now.) It puts pressure on your leg veins, stress on your spine and joints, and weakens your muscles. Sitting for too long is also associated with many long-term negative effects on your body that you would rather not experience later in life. These include increased risk of dying from numerous health conditions, including cancer, type 2 diabetes, and heart disease.	N/A

Appendix B: Bayesian Analyses

In addition to the mini meta-analysis, we ran separate Bayesian models for each experiment, relying on the posterior distribution for the previous experiment to inform the priors for the experiment that followed. Results from this analysis yield even less support for the effect of any of the messages, with an OR = 1.01 95% CI [0.86, 1.19] for the “Present” condition (see Figure A1) and an OR = 1.03 95% CI [0.88, 1.2] for the “Future” condition (see Figure A2).

Figure A1.

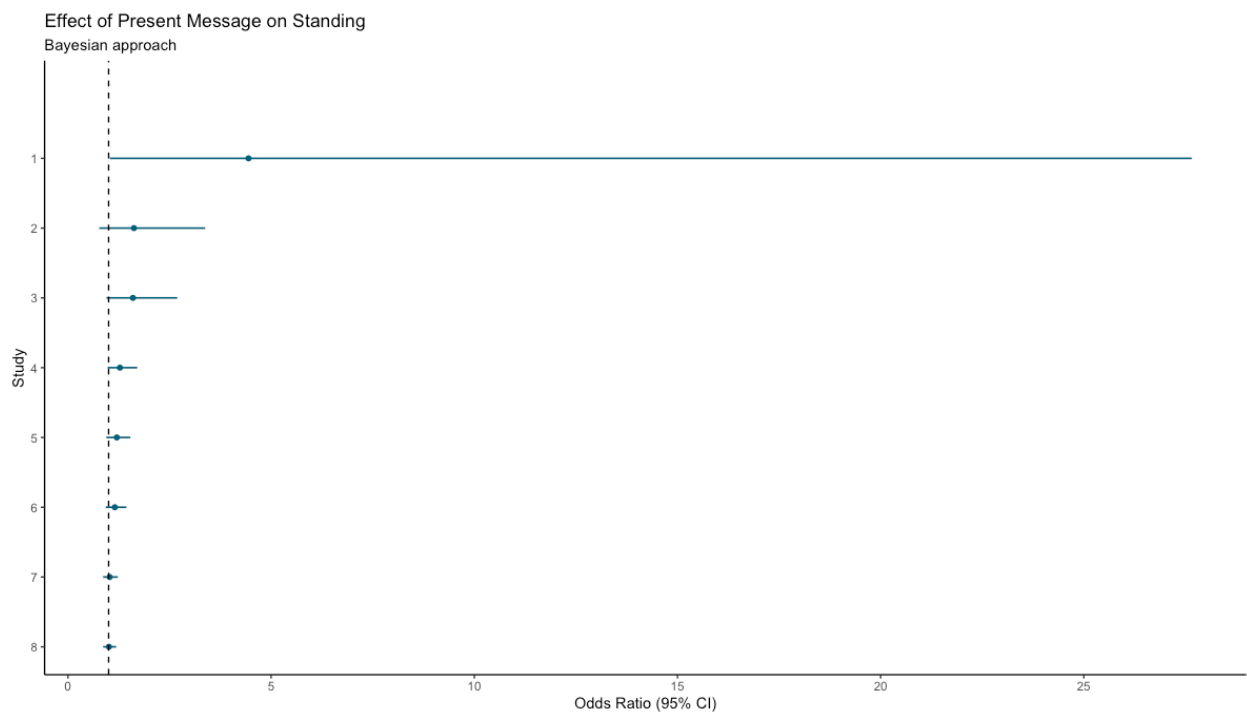
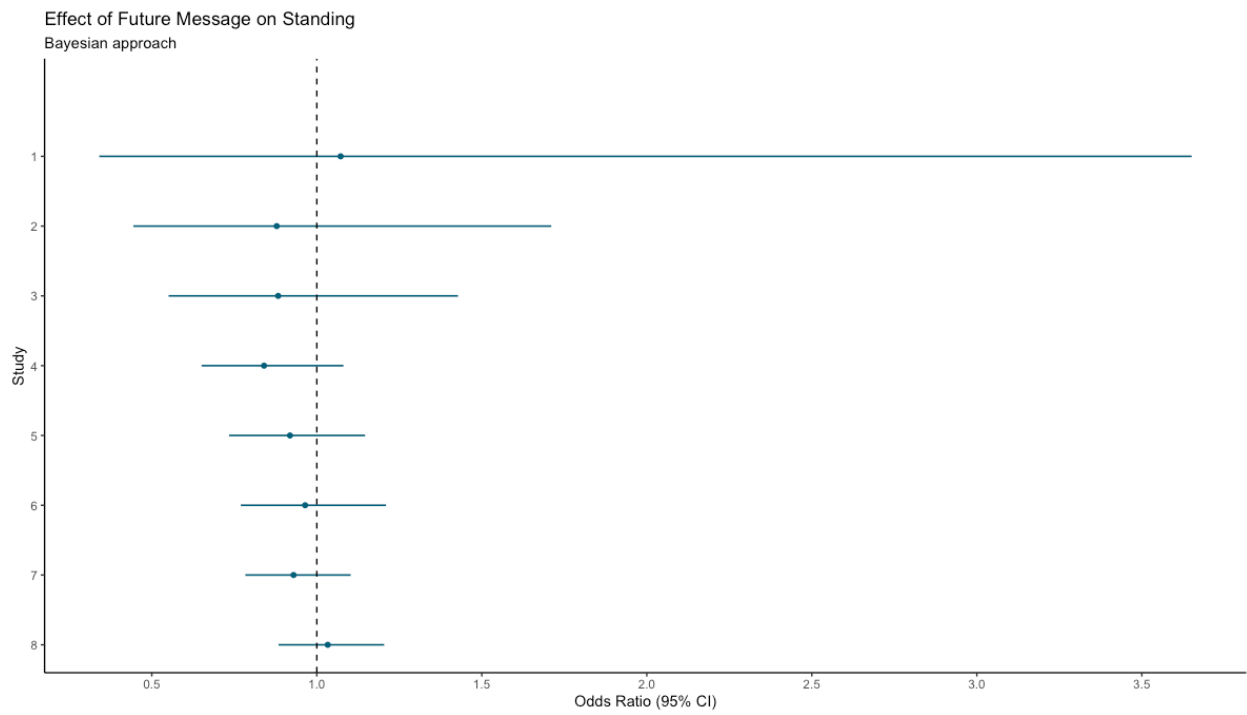


Figure A2.



Appendix C: Strategy Interest

In three studies (studies 5-7), after asking participants to stand up, participants were shown the following message: "OPTIONAL: If you are interested in a strategy that can help you stand up more frequently, please say 'yes' below, and we will give you a very brief exercise. If not, click 'no' and you will move on to the rest of the survey."

Those who clicked 'yes' were then taken to an implementation intentions task in which they were told that creating concrete if-then statements could help them follow-through on their standing intentions. Overall, 28%, 49%, and 46% of participants opted to learn about the strategy in Studies 5, 6, and 7, respectively. The lower rate in Study 5 may be due to the fact that these were paid online workers, whereas Studies 6 and 7 were online field studies. We ran logistic regressions for each of the three studies to determine whether the messaging affected rates of opting in but found no significant differences between messages. Finally, we examined the relationship between psychological distance and opting in for each of the three studies and found that ratings of psychological distance were negatively correlated with opting in for all three studies, meaning that the closer in time to the present that people rated themselves as having to worry about the consequences of sitting, the more likely they were to opt in (Study 5: $r(252) = -.16, p = .01$; Study 6: $r(160) = -.19, p = .02$, Study 7: $r(680) = -.16, p < .001$).

