

Future Self-Continuity Is Associated With Improved Health and Increases Exercise Behavior

Abraham M. Rutchick
California State University, Northridge

Michael L. Slepian
Columbia University

Monica O. Reyes and Lindsay N. Pleskus
California State University, Northridge

Hal E. Hershfield
University of California, Los Angeles

To the extent that people feel more continuity between their present and future selves, they are more likely to make decisions with the future self in mind. The current studies examined future self-continuity in the context of health. In Study 1, people reported the extent to which they felt similar and connected to their future self; people with more present-future continuity reported having better subjective health across a variety of measures. In Study 2, people were randomly assigned to write a letter to themselves either three months or 20 years into the future; people for whom continuity with the distant future self was enhanced exercised more in the days following the writing task. These findings suggest that future self-continuity promotes adaptive long-term health behavior, suggesting the promise of interventions enhancing future self-continuity.

Keywords: future self-continuity, exercise, health

People often make decisions with consequences that are pleasant in the present but harmful in the future. They eat fast food rather than vegetables, watch TV rather than exercise, spend rather than save, and otherwise choose immediate gratification over long-term benefit. Many public health challenges can be construed in this way, as problems of prioritizing present over future benefits (i.e., temporal discounting). In domains such as diet and exercise, there are obvious tradeoffs between enjoyment in the present and well-being in the future. Theoretically, one potentially fruitful way to encourage adaptive health behavior may be through temporal perspective shifts; that is, by helping people understand how their actions today impact their lives in the future. Indeed, prior research has measured participants' tendency to consider how their present actions will affect their future selves. For example, an increased focus on the future has been related to less risk-taking and more protective behaviors in various domains, such as safe sex (Rothspan & Read, 1996), substance use (Wills, Sandy, & Yaeger, 2001), binge-drinking (Henson, Carey, Carey, & Maisto, 2006), smoking (Adams & Nettle, 2009), and healthy dieting and exercise (Gellert, Ziegelmann, Lippke, & Schwarzer, 2012).

Much of this prior work has remained at the level of investigating intriguing correlations between future focus and present behavior. One experimental study in the health domain, however, has sought to combat temporal discounting by orienting people's attention to the beneficial future effects of present sacrifices. Namely, Hall and Fong (2003) successfully promoted increased physical activity by having undergraduates undergo a series of learning sessions and activities meant to help them better understand the long-term consequences of their present actions. And, in an exploratory study, Fritz, Wider, Hardin, and Horrocks (2008) measured the effectiveness of an intervention meant to teach adolescents about the future consequences of smoking, finding that such information increased the desire to quit smoking. It may be fruitful, then, to encourage adaptive health behavior by inducing people to think about how their actions now will impact their lives in the future.

Although having people focus on how present actions might influence their future has had some success, it is easy to see where this approach might fail. Would going out for a drink instead of for a run this upcoming Friday night really have long-term health consequences? Many people simultaneously recognize that an isolated act (e.g., having a few drinks on one Friday night) is unlikely itself to have far-ranging consequences in the future while being aware that such behaviors, repeated over time, have far-ranging consequences. Given that a single isolated unhealthy choice will likely have a negligible impact on long-term health, it is easy to yield to a temptation to carry out that single isolated act (and perhaps tell oneself that the healthy choice will be taken next time).

An important question, then, is how does future focus, or highlighting tradeoffs between the present and future, actually influence behavior on a given day or at a particular moment? We

Abraham M. Rutchick, Department of Psychology, California State University, Northridge; Michael L. Slepian, Management Division, Columbia Business School, Columbia University; Monica O. Reyes and Lindsay N. Pleskus, Department of Psychology, California State University, Northridge; Hal E. Hershfield, Anderson School of Management, University of California, Los Angeles.

Correspondence concerning this article should be addressed to Abraham M. Rutchick, Department of Psychology, California State University, Northridge, 18111 Nordhoff Street, Northridge, CA, 91330-8255. E-mail: rutchick@csun.edu

propose an underlying mechanism (absent from prior work on health behavior) that enables one to go from focusing on the future to acting today: *future self-continuity*. Namely, we suggest that future self-continuity, or the sense of similarity and connection that is felt between one's current and future selves, may be one explanation for the success of temporal perspective interventions. That is, by explicitly linking the current self to the future self (through future self-continuity), the benefits of an extended time perspective may be more clearly seen and acted upon. Feeling connected to one's future self may lead to isolated health-improving acts today, tomorrow, next week, and so on that cumulatively yield health benefits.

In the current work, we sought to examine whether the effect of future self-continuity (i.e., the connection one feels to one's future self), which has been shown to benefit financial decision-making, would extend to decision-making in the health domain. Unlike putting away money into savings, which immediately yields a benefit (i.e., more savings), a healthy behavior one day may not have a readily apparent effect the next day. We thus suggest that the success of shifting time perspective in the health domain should depend on how connected one feels to one's future self. By highlighting the continuity between the current and future self, we propose that people should be better able to appreciate how actions taken today can improve health at a later point, as reflected by engaging in increased healthy behaviors.

Conceptual Background

Future Self-Continuity

The notion of identity across time has long been a subject of psychological and philosophical inquiry. Plutarch (Clough, 1864/1920) posed the paradox of Theseus's ship, a vessel whose parts had, over time, all been replaced, yet whose identity had been preserved. Despite containing none of the original physical elements, the craft remained Theseus's ship. The analogy to human experience is clear: although almost none of the atoms that make up our bodies are the same as those we were born with, we feel as though we should fundamentally be the same person over time, that our identity is preserved even as the parts of our body are replaced. The philosopher Derek Parfit (1984) directly questions what specific features must be maintained for a future person to be considered the "same" as a current person. His provocative claim is that with a reduction in psychological connection from one self to the next (i.e., more felt distance), it may be rational to reduce the concern one has for one's future self. Thus, when deciding whether to allocate resources to some future version of ourselves, what should matter is the sense of connection or continuity that exists between selves: only with enough overlap should we be willing to make sacrifices today to reward a distant self.

Importantly, the psychological link between the present and future self may be tenuous. Evidence from research on attributional thinking (Pronin & Ross, 2006; Wakslak, Nussbaum, Liberman, & Trope, 2008) suggests that the future self may at times be perceived as if it is more like another person than like the self (i.e., there is a bias toward making dispositional attributions for the future self's actions). Neurological evidence further supports this possibility; neural activity produced when thinking about the future self more closely resembles that produced when thinking

about another person than that produced when thinking about the self (Ersner-Hershfield, Wimmer, & Knutson, 2009; Mitchell, Schirmer, Ames, & Gilbert, 2011). Yet, there is variability in the extent to which people feel a sense of continuity over time, and to the extent that someone does feel such a connection, it is likely that they make decisions with the future self in mind.

Indeed, prior work has found a relationship between future self-continuity and temporal discounting in the financial domain. Ersner-Hershfield, Garton, Ballard, Samanez-Larkin, and Knutson (2009) used a pictorial scale (i.e., overlapping circles) as a representation of continuity between selves, and found a correlation between these ratings and patience on a temporal discounting task (cf., Frederick, 2003). Further, perceived continuity with the future self (as measured using the overlapping-circles task (Ersner-Hershfield et al., 2009; Bartels & Rips, 2010) has been linked to a lower likelihood to give to others now (and instead save for the future self; Bartels, Kvaran, & Nichols, 2013), a tendency to forego immediately rewarding but ethically dubious courses of action (Hershfield, Cohen, & Thompson, 2012), and more positive evaluations of products, brands, and charitable causes meant to be consumed by future selves (Zhang & Aggarwal, 2015). In this past work, researchers have used various definitions of future self-continuity, but most revolve around the idea that a sense of overlap in personality, beliefs, ideals, preferences, values, and so forth is maintained between one's current and future selves.

Moving beyond correlational work, Bartels and Urminsky (2011) found that directly manipulating a person's sense of continuity with a future self increased patience on financial decision-making tasks. Manipulating a sense of connection to one's future self has also been shown to increase the tendency to think ahead and act in more ethical ways (Hershfield et al., 2012; Sheldon & Fishbach, 2015).

Health Behaviors

Although past research has linked future self-continuity to a variety of outcomes, health is a distinct domain that may or may not share similarities with other intertemporal domains. In fact, other research has shown that decision-making processes for health can differ markedly from those in other contexts. For example, Chapman (1996) demonstrated that, within person, the discount rates for health outcomes and monetary outcomes differed. Like financial and moral decision-making, decisions about health behaviors often involve considering how decisions made today can affect outcomes that will be realized in the future. But, unlike these other contexts, health outcomes are often harder to quantify and may take longer to be realized. For example, whereas saving money today can lead to quantifiable benefits at retirement, going to an exercise class today does not necessarily lead directly to a reduction in body mass index in five years.

To the best of our knowledge, no work has directly investigated the link between future self-continuity and long-term decision-making in the health domain. As noted earlier, previous work has examined future time perspective and its relationship to healthy behaviors. However, it is easy to see how a future time perspective may not always induce adaptive behavior. Just as walking to work today may have no real benefits on next year's health, focusing on the coming year may not lead one to readily see the benefit of walking to work today. Different ways of viewing the future (e.g.,

the length of time someone plans into the future or the degree to which the future is perceived as an opportunity; Henson et al., 2006) do not solve this problem of tenuous links between today and the future; people likely recognize that no single healthy act will improve long-term health, and could therefore fail to act today. Of course, the answer is that accumulating healthy behaviors *over time* will improve long-term health. And thus the construct of future self-continuity, the extent to which a sense of connection is felt between selves over time, highlights how even isolated acts today belong to the same self, and thereby represent an avenue by which focus on the future can successfully bring about adaptive behaviors.

Overview of Current Work

The current work examined whether future self-continuity is related to health behaviors, using both correlational and causal approaches. Drawing on work mentioned earlier, we hypothesized that heightened continuity with the future self might relate to an increased likelihood of engaging in healthy behavior today: theoretically, by sensing an overlap between selves at different points in time, the benefits of taking action now will be more clearly seen and subsequently acted upon.

In undertaking this examination, we had two primary goals. First, we sought to make a contribution to the growing literature on future self-continuity, and investigate whether its downstream consequences can be felt in a new applied domain, health, which often operates very differently to other domains such as financial and moral decision-making. Specifically, saving money today or volunteering at a soup kitchen today clearly yields benefits at the moment of action, whereas health behaviors require repeated action across a longer time horizon to yield benefits.

Second, although past work has found beneficial outcomes from shifting time perspectives (i.e., future focus), the relative paucity of research demonstrating future focus improving health outcomes may serve as a signal that this method may not always work, and perhaps indeed it should not always work. Many people are familiar with having forgone a healthy option in favor of unhealthy indulgence “just this time,” recognizing that the impact of any isolated act on the future is small. A pattern of such behavior, however, will cumulatively have an impact.

We propose that by tying the current self to the future self, people will be better able to appreciate how actions today can cause them to benefit (or suffer) at a later point. To this end, we present two studies that examine future self-continuity in the health domain. In Study 1, we assessed the relation between future self-continuity and self-reported health. Here, we formally tested:

Hypothesis 1: Future self-continuity will be positively associated with self-reported health.

In Study 2, we took an experimental approach and implemented an intervention, which manipulated participants’ connection to their distant future self to examine its effects on subsequent exercise behavior, and formally tested:

Hypothesis 2: An intervention aimed at connecting individuals to their distant selves will lead to an increase in the likelihood as well as number of minutes exercised over a subsequent 2–10-day period.

Study 1

If people who feel more connected to their future selves more often make decisions that benefit their future selves, there should be evidence of a history of such decisions. In the context of health, this means that people with greater future self-continuity should be healthier, having engaged in more adaptive health behaviors in the past. To examine this question in the health domain, participants completed an assessment of future self-continuity and reported their current health. We hypothesized that people who felt more connected to their future selves would show evidence of greater health.

Method

Participants were recruited via Amazon’s Mechanical Turk (Buhrmester, Kwang, & Gosling, 2011) and compensated \$0.25. The original sample consisted of 200 participants; this sample size was chosen to yield power of .80 to detect $r = .20$, per G*Power (Faul, Erdfelder, Lang, & Buchner, 2007). Nine participants were excluded for providing incomplete data, yielding 191 participants (52% female, $M_{\text{age}} = 31.8$) in the final sample.

Participants completed four items assessing future self-continuity (Ersner-Hershfield et al., 2009). The first two items, derived from the Inclusion of Other in Self (Aron, Aron, & Smollan, 1992) measure, assessed how similar and connected participants felt to their future self. The next two items assessed how much participants liked their future self and cared about their future self (from 1 = *not at all* to 7 = *completely*). Next, participants reported their health using the Patient-Reported Outcomes Measurement Information System (PROMIS) Global Health Scale (Cella et al., 2010), which comprises 10 items assessing physical and mental health (e.g., “in general, would you say your quality of life is . . .,” and “in general, how would you rate your satisfaction with your social activities and relationships?”; see the Appendix for the full scale). The PROMIS scale yields a single-item general health score as well as subscales indexing physical health and mental health (the Global Physical Health scale and Global Mental Health scale). Participants then reported demographic information and were debriefed.

Results and Discussion

Both the Global Physical Health (Cronbach’s $\alpha = .74$) and Global Mental Health (Cronbach’s $\alpha = .84$) subscales had adequate reliability. The four items measuring future self-continuity were intercorrelated at moderately high levels (Cronbach’s $\alpha = .65$, a comparable level of reliability to other studies using this measure such as Ersner-Hershfield et al., 2009); removing any individual item did not increase reliability. Thus, for simplicity, the composite of these items (hence “future self-continuity”) was used as the primary predictor in subsequent analyses. Note that the pattern of relations between each individual item and the dependent measures was the same; we present these correlations in Table 1.

Consistent with H_1 , future self-continuity significantly predicted general health, $b = 0.22$, $SE = 0.07$, 95% CI [0.08, 0.35], $t(189) = 3.19$, $p = .002$. Similarly, future self-continuity significantly predicted Global Physical Health, $b = 0.64$, $SE = 0.19$, 95% CI [0.26,

Table 1
Correlations Among Future Self-Continuity and PROMIS Items

PROMIS items	Similar	Connected	Care	Like
General health	.128	.173*	.235**	.218**
Quality of life	.192**	.195**	.226**	.265**
Physical health	.197**	.237**	.282**	.236**
Mental health	.225**	.310**	.244**	.365**
Social discretionary	.222**	.285**	.234**	.317**
Social function	.232**	.341**	.292**	.399**
Physical function	.073	.011	.227**	.203**
Emotional problems	.201**	.190**	.234**	.263**
Fatigue	.131	.109	.088	.097
Pain	.049	.042	.266**	.262**

Note. PROMIS = Patient-Reported Outcomes Measurement Information System.

* Indicates statistical significance at $p < .05$. ** Indicates statistical significance at $p < .01$.

1.01], $t(189) = 3.35$, $p = .001$, and Global Mental Health, $b = 1.41$, $SE = 0.24$, 95% CI [0.94, 1.87], $t(189) = 5.91$, $p < .001$.¹

Study 1, then, demonstrated that future self-continuity was positively associated with self-reported health. Although this is consistent with the idea that a greater sense of connection to the future self leads a person to engage in healthier behavior, the opposite direction of causality cannot be ruled out. It is plausible, for example, that feeling healthier leads a person to feel more connected to their future self (e.g., via increased self-esteem or optimism). Moreover, we suspect that the relationship between future self-continuity and subjective reports of health is based in actual objective healthy behaviors. Thus, to examine the causal impact of connection to the future self and to explore the role of objective healthy behaviors, Study 2 was an intervention study, which manipulated continuity with the future self via a writing task, and measured the effect of doing so on subsequent health behavior (i.e., exercise).

Study 2

Previous research has found that one way of increasing continuity between selves is to make the future self more salient, via a variety of tasks such as writing a letter to that future self or presenting vivid visual depictions of the future self (e.g., Hershfield et al., 2011; van Gelder, Hershfield, & Nordgren, 2013). Accordingly, to examine whether increasing continuity with the future self indeed causes people to engage in healthier behaviors, Study 2 used a writing task in which participants wrote a letter to their distant future selves (the self in 20 years), and completed a series of daily diaries. In a control condition, participants wrote about a self that was only three months away.² Accordingly, participants in both conditions were directed to think about selves that exist at another, future, point in time. Although health decisions made in the present can have effects on the self at multiple points in time, we contend that the 20-year time horizon offers a more substantial temporal window in which to realize the benefits (or drawbacks) of choices made in the present.

In sum, in both conditions, participants were directed to think about future selves that could be concretely represented as being affected by today's decisions, but only in the experimental condition did participants consider a much more distant future self. Given that this method

has successfully shifted future self-continuity in other work (e.g., Hershfield et al., 2011; van Gelder et al., 2013), we chose to not include a manipulation check that would call further attention to this manipulation. Hence, any results of this manipulation would not be contingent on asking participants to explicitly indicate how connected they feel to their future self (as Study 1 did). We hypothesized that, relative to those in the control condition, participants for whom the distant future self was made salient would engage in healthier behavior in the ensuing days.

Method

Undergraduate participants were recruited during "open season" of the subject pool during two semesters. Thus, sample sizes were not specified in advance, but reflect the number of students seeking to obtain partial course credit at that time (total $N = 535$, 69% female, $M_{\text{age}} = 19.76$). Each evening, for 10 (Wave 1) or 2 (Wave 2) days, they used an online questionnaire to report the key dependent measure for the current study, how many minutes they exercised that day (asking first whether they exercised, and if so for how many minutes), in addition to several other measures for unrelated studies.³

In addition, upon registering for the study (which took place one or two days before the diary began), participants completed a preliminary battery of measures related to brand attitudes (for the other, unrelated study). At the end of this battery, participants completed a writing task (van Gelder et al., 2013) that served as the manipulation of the independent variable for the present work. Half of the participants were randomly assigned to write a letter to themselves in 20 years' time ("Think about who you will be 20 years from now, and write about the person you are now, which topics are important and dear to you, and how you see your life."); this constituted the "distant-self" condition. Half of the participants wrote a letter to themselves in three months' time; this constituted the "near-self" condition. Importantly, using the "near-self" condition as a control (rather than a "current self" condition) eliminates a potential confound—that thinking about the future per se drives differences in the dependent variable. The benefits of exercise could well manifest within either timeframe, and thus any observed differences can be attributed to participants thinking specifically of a long-term future self.

¹ Controlling for age, future self-continuity significantly predicted general health, $b = 0.24$, $SE = 0.07$, 95% CI [0.11, 0.38], $t(188) = 3.53$, $p = .0005$, Global Physical Health, $b = 0.67$, $SE = 0.20$, 95% CI [0.29, 1.06], $t(188) = 3.44$, $p = .0007$, and Global Mental Health, $b = 1.39$, $SE = 0.25$, 95% CI [0.91, 1.88], $t(188) = 5.68$, $p < .0001$ (no significant effects of age on general health $b = -0.01$, $SE = 0.01$, 95% CI [-0.03, 0.002], $t(188) = -1.73$, $p = .085$; Global Physical Health $b = -0.02$, $SE = 0.02$, 95% CI [-0.06, 0.02], $t(188) = -0.81$, $p = .417$; Global Mental Health $b = .004$, $SE = 0.03$, 95% CI [-0.05, 0.05], $t(188) = 0.18$, $p = .861$). All relationships were also robust to the inclusion of age squared (to test a curvilinear relationship) as a covariate.

² We acknowledge that this intervention shares similarities with interventions used in the literature on temporal construal theory, a point we further discuss in the General Discussion section.

³ These data were collected for a study that predicted brand usage based on various attitudinal measures and another study that examined daily reports of stress and eating. Specifically, participants reported whether they ate at any of several chain restaurants, how much of several brands of bottled beverages they drank, and how many hours of several different TV networks they watched; they also reported the stress they experienced that day.

Results and Discussion

Of the 535 participants who completed the writing task when registering for the study, 498 participants completed at least one day of the diary study, and thus recorded at least one measurement of the exercise outcome variable. The final sample consisted of those 498 participants.

Participants' exercise outcomes ($M = 21.22$ min per day, $SD = 42.4$, 95% CI [19.68, 22.76]) were fitted with a multilevel mixed-effect model examining all 2,917 records of exercise across the participants; this sample size exceeds the 350 records needed to detect a medium effect size, $d = .50$ at 80% power (Scherbaum & Ferreter, 2009). This analysis strategy is ideal for such a data set, eliminating the need to sum or average over days of the study per participant or to only analyze participants with some number of responses, both of which lead to a loss of data. A multilevel model can instead examine all exercise records, controlling for random variance from participants and wave of study. The multilevel model was implemented with the R package lme4, and to calculate p values, lmer models were run through Satterthwaite approximation tests to estimate the degrees of freedom (which scale model estimates to best approximate the F distribution and thus can be fractional and differ across tests; Bates et al., 2015; Kuznetsova, Brockhoff, & Christensen, 2013).

In Wave 1 ($M_{\text{age}} = 19.75$, 67% female), 276 participants completed Day 1, and 251, 243, 257, 274, 269, 268, 255, 233, and 238 participants completed Days 2 through 10, respectively (average number of days completed = 3.46). In Wave 2 ($M_{\text{age}} = 19.77$, 71% female), 183 participants completed Day 1, and 170 participants completed Day 2 (average number of days completed = 1.31; again, the multilevel model can analyze all data points). The number of days completed by participants did not differ by condition (distant future self $M = 5.80$, $SD = 3.52$, 95% CI [5.36, 6.23], near future self $M = 6.00$, $SD = 3.68$, 95% CI [5.54, 6.46], $t(496) = 0.63$, $p = .53$, $d = 0.06$, 95% CI [-0.12, 0.23]).

Likelihood to exercise. We first modeled exercise outcomes as a dichotomous variable (exercised that day = 1, or not = 0), thus conducting a stepwise multilevel model. In Step 1, we entered both condition and day as fixed factors (model pseudo- $R^2 = .61$), which revealed an independent effect of condition; in line with H_2 , writing a letter to the distant future self, relative to the near future self, increased the likelihood of exercise, $B = 0.36$, 95% CI [0.02, 0.70], $SE = 0.17$, $z = 2.08$, $p = .038$. There was no independent effect of day, $B = -0.03$, 95% CI [-0.06, 0.01], $SE = 0.02$, $z = -1.62$, $p = .105$. Converting B (log-likelihood) to an incidence ratio revealed that participants who wrote a letter to their distant future self were 1.43 more times likely to exercise than participants who wrote a letter to their near future self (Figure 1 displays both average total minutes exercised by condition and mean minutes exercised per day estimated by the multilevel model).

In Step 2, we entered both fixed factors and their interaction term (with participants and wave of study as random factors), which revealed no interaction, $B = -0.02$, 95% CI [-0.08, 0.05], $SE = 0.03$, $z = -0.49$, $p = .623$. Thus, the effect of condition did not differ across days in predicting likelihood of exercise (i.e., it did not increase nor decay over time).

Duration of exercise. We next modeled minutes of exercise with a zero-inflated negative binomial multilevel model. Given a

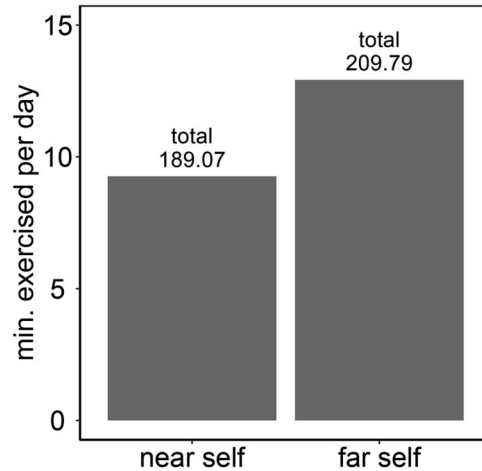


Figure 1. Exercise as a function of writing task condition. Note: Mean minutes of exercise per day estimated by the multilevel model. Above each bar is the participant average total min. exercised during the study in each condition.

skew toward fewer minutes of exercise, we first examined which distribution the data most closely fit; a zero-inflated negative binomial model fit the data best (i.e., the intercept of a zero-inflation model was significant, intercept = .81, $z = 20.10$, $p < .0001$, indicated more zeros than would be predicted by a Poisson distribution, and $\log(\theta) = .72$, differed significantly from zero, $z = 15.11$, $p < .0001$).

In Step 1, we entered both condition and day as fixed factors (model pseudo- $R^2 = .55$), which revealed an independent effect of condition; in line with H_2 , writing a letter to the distant future self, relative to the near future self, increased length of exercise, $B = 0.33$, 95% CI [0.05, 0.62], $SE = 0.15$, $z = 2.28$, $p = .022$. There was no effect of day, $B = -0.01$, 95% CI [-0.04, 0.01], $SE = 0.01$, $z = -1.20$, $p = .232$. Converting B (log-likelihood) to an incidence ratio revealed that participants who wrote a letter to their distant future self exercised 1.40 times longer than participants who wrote a letter to their near future self (an estimated 9.26 min of exercise a day in the near future self condition, and 12.92 min of exercise a day in the far future self condition).

In Step 2, we entered both fixed factors and their interaction term (with participants and wave of study as random factors), which revealed no interaction, $B = 0.01$, 95% CI [-0.05, 0.05], $SE = 0.02$, $z = 0.04$, $p = .969$. Thus, the effect of condition did not differ across days in predicting minutes of exercise (i.e., it did not increase nor decay over time).

Study 2, then, demonstrates that increasing the salience of the distant future self—which heightens continuity with the future self (e.g., Hershfield et al., 2011)—also increased exercise behavior. An estimated 3.66 min per day of increased exercise by itself represents approximately one sixth of the 150 min/week of exercise that physicians recommend (Haskell et al., 2007). Given the deleterious effects of physical inactivity (estimated to cause some 5.3 million deaths per year; Wen & Wu, 2012), an increase of this seemingly modest magnitude could have an important impact on public health.

General Discussion

In two studies, we found evidence that a stronger connection between present and future selves is associated with better health in both correlational (Study 1) and causal (Study 2) investigations. Prior work has demonstrated that focus on the future, in general, can lead to decisions that benefit one's future self, but this work has not often examined an important applied domain, health. Healthy behaviors, in particular, can be hard to commit to, given the very large time spans required to realize their benefits. Saving money from a paycheck today instead of spending it immediately yields a larger sum in one's bank account, and studying for a test in the preceding week can recognizably yield a better grade. Attending an exercise class today, however, does not lead to weight loss or improved fitness today nor even in the near future. Conversely, forgoing a healthy behavior today does not hurt health immediately. We propose that future self-continuity may be key to linking future-oriented thinking to the motivation to act today. Furthermore, we proposed a brief, two-min intervention that asks participants to focus on the connection between one's self and a self far in the future that could increase healthy behaviors.

As noted in the Introduction, the study by Hall and Fong (2003) appears to be the only one that has addressed the question of how to motivate healthy behaviors by shifting temporal perspective. They introduced a time perspective intervention to students who were taking a fitness class, and the intervention was designed to emphasize the link between thinking about exercise with long-term outcomes in mind and successfully engaging in that exercise. Students who experienced 90 minutes of this intervention over the first three weeks of the class reported engaging in more vigorous exercise after the intervention, and this difference persisted six months later. Although this study was conducted on a fairly small sample and used a manipulation of temporal perspective that was quite extensive (i.e., 90 minutes of intervention), which explicitly focused on the outcome of interest (i.e., participants were directly told that thinking about the long-term benefits of exercise would make them more likely to exercise), the findings show that there is clear potential for this kind of intervention to bring about adaptive behavior.

One reason that there may be few papers on this important topic is that, particularly in the health domain, focusing on the future may often fail to motivate action today. Indeed, thinking about one's self in 20 years may not immediately make the benefits of a single session of exercise apparent today, as an isolated act will be unlikely to implicate long-term health. On the contrary, reflecting on how one's current and future self are connected may present a different picture. With a continuous self that exists from today into the future (e.g., 20 years from now), each healthy behavior is no longer seen as isolated, but instead is part of a continuous stream of behavior. Indeed, the present work demonstrated the power of a two-minute intervention focused on increasing a sense of future self-continuity to influence exercise behavior over time.

Implications for Interventions

The current studies rely on self-reports of health (Study 1) and exercise behavior (Study 2). It is worth noting that these measures could be biased by social desirability and other factors. It would be

useful to conduct a clinical examination or use another objective measure of health, and obtain objective records of exercise. However, there is ample research demonstrating the power of simple, global assessments of subjective health to predict important health outcomes (e.g., mortality; DeSalvo, Bloser, Reynolds, He, & Muntner, 2006), and thus even these self-reported measures are useful proxies. Moreover, research demonstrates that self-reports of exercise can be fairly accurate (Hekler et al., 2012) and are unrelated to social desirability (Motl, McAuley, & DiStefano, 2005).

Finally, given that both conditions in our intervention asked participants to write about a self in the future, any inference participants draw about the aims of the study (e.g., testing for the effects of a future focus on exercise outcomes) would be common to both conditions. We specifically found increased exercise behavior as a focus of reflecting on one's continuity with the self in 20 years, relative to in three months. In other words, our intervention was specifically designed to reflect the very long time horizon required for realizing improved health from isolated healthy behaviors. Perhaps three months of healthy behaviors would lead to a healthier self, but clearly 20 years of healthy behavior would lead to a vastly healthier self.

The manipulation used in the current paper is well-suited to testing scalable concrete applications of future self-continuity. This intervention should apply broadly to other areas for self-improvement. For instance, highlighting future self-continuity could help people develop new skills for new careers or promotions. Realizing that a new set of skills or credentials are needed to move up the ranks might feel daunting when the future self feels too far removed. Yet, when seeing the continuity between one's current and future self, the benefit obtained by each effortful task may be better realized. Likewise, when it comes to saving money, whether for a child's college education or a future home purchase, the more one feels connected to the future self who hopes to afford such purchases, the more one might feel capable and ready to take the long road of putting money away.

Further, it may be worth testing whether similar interventions positively affect other aspects of healthy behavior such as dieting. Other research has suggested that the quest to lose weight may be hampered by licensing effects (Khan & Dhar, 2006): an hour of exercise might make people feel licensed to eat just a bit more at their next meal, which could ultimately make losing weight a difficult endeavor. Because boosting the connection to one's future self may not only highlight the positive health benefits that can be accrued today but also the negative health costs of unhealthy choices today, it is possible that increasing future self-continuity would not only promote positive healthy behavior (e.g., exercising) but also prevent negative behaviors (e.g., overeating).

Writing a letter to one's future self takes only a few minutes, and thus could be incorporated at the outset of an exercise program, a physical education course, an online financial literacy course, an orientation at college or a new profession, or any other longer-term project to improve the self. The distillation of theoretically grounded interventions into modules that can be "dropped in" to existing programs is a promising approach to enacting behavioral change.

Implications for Theories of Self and Time

The current work dovetails with theories of the self related to future self-continuity. A variety of theoretical approaches have been undertaken regarding the study of the future self, including *multiple selves* models that attempt to model negotiations between current and future selves (e.g., Bazerman, Tenbrunsel, & Wade-Benzoni, 1998), *future self as other* theories that attempt to understand the future self in much the same way that we understand our relationships with loved ones (e.g., Whiting, 1986), and *failures of imagination* theories that try to understand the reasons why people fail to adequately project their interests into the future (e.g., Hershfield et al., 2011). Finally, *continuity theories*, the umbrella under which the current work falls, attempt to understand how continuity between selves can determine intertemporal outcomes, and what aspects of a person determine this sense of continuity (e.g., Parfit, 1984). The current work proposes that the hard problem of starting a long project today (with benefits that are far from the present) may be facilitated by recognizing the connections one has to their future self. The present findings could potentially be applied to other behavioral health domains as well (e.g., skincare, such as sunscreen use and tanning salon use; dental care, such as regular flossing and dental visits; and road safety, such as texting while driving).

The current work also dovetails with, but differs from, work done on temporal construal. The manipulation that we used in Study 2, for example, shares some similarities with manipulations used in the temporal construal literature, in which a focus on the near versus distant future is often manipulated. One recent paper, for example, found that distant future construal helps individuals' behavioral intentions better align with their core values (Eyal, Sagristano, Trope, Liberman, & Chaiken, 2009). If, in fact, maintaining better health is a core value, then writing a letter to a distant self may boost healthy behaviors by calling to mind this core value. That said, one aspect of construal level theory (Trope & Liberman, 2010) concerns whether an action is considered more feasible or more desirable: with increasing temporal distance, the attractiveness of an action depends on how desirable it seems, and with decreasing temporal distance, the attractiveness of an action depends on how feasible it seems (Liberman & Trope, 1998). Construal level theory might thus predict that an exercise that prompts thoughts of the distant future would prompt a more abstract focus on actions that are consistent with one's values, whereas thoughts of the near future might prompt a more concrete focus on things that are more feasible at the day-to-day level. Notably, in Study 2, we find that writing a letter to a distant future self actually prompts people to engage more in a concrete, feasible behavior (i.e., exercise).

One way to reconcile these possibly competing predictions is by attempting to understand one mechanism through which future self-continuity is associated with subsequent health behaviors (and, indeed, with adaptive future-oriented behaviors in other domains). For example, it is possible that enhancing continuity with the future self may make people realize their core values will continuously exist from today to years into the future. Likewise, future self-continuity could cause individuals to more regularly focus on how actions taken today may scale up to affect the self over time. People are quite adept at "exceptionalizing" the present, and excuse away today's actions as not being part of a general

pattern of events (e.g., consumers categorize large expenses like electronics in narrow terms and do not include them as part of their overall budget, even though such expenses may occur regularly; Sussman & Alter, 2012). But, heightening the connection between the current self and the future self may help to limit this tendency and promote an understanding of how each action—even ones that are concrete and feasible in nature—fits into the "bigger picture."

Further, although we suggest that future self-continuity may be a key mechanism by which temporal horizon interventions affect health behavior, more research could further investigate this question, and examine other possible mechanisms that link future self-continuity to adaptive health behaviors. Another (non-mutually exclusive) mechanism could be that future self-continuity interventions help call to mind the vivid future consequences of today's (healthy or unhealthy) behavior on one's distant self. Future research should investigate the extent to which such interventions prompt individuals to more vividly imagine the effect of today's choices on distant points in time.

Finally, future work could also examine spillover effects, given that a recent study found that people who made positive changes for the future self in one domain (retirement saving) also made positive changes in another domain (physical health; Gubler & Pierce, 2014). Additionally, feeling more connected to one's future self could cause people to place more importance on health and health-promoting behaviors.

Conclusion

A simple, brief, and scalable intervention demonstrated that focusing on one's connection to the future self may help one realize the long road of repeated healthy decisions to improve long-term health, and perhaps this process would be further facilitated by shifting priorities, yielding a trajectory of self-reinforcing positive behaviors. Acting today for health benefits that may not be seen until far in the future may be easier to do when recognizing one's connection to that future, specifically to one's future self.

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Appendix

PROMIS Global Health Scale

PROMIS items	Range of response categories	Domain
In general, would you say your health is?	Excellent (1)–Poor (5)	General health
In general, would you say your quality of life is?	Excellent (1)–Poor (5)	Quality of life
In general, how would you rate your physical health?	Excellent (1)–Poor (5)	Physical health
In general, how would you rate your mental health, including your mood and your ability to think?	Excellent (1)–Poor (5)	Mental health
In general, how would you rate your satisfaction with your social activities and relationships?	Excellent (1)–Poor (5)	Social discretionary
In general, please rate how well you carry out your usual social activities and roles. (This includes activities at home, at work, and in your community, and responsibilities as a parent, child, spouse, employee, friend, etc.)	Excellent (1)–Poor (5)	Social function
To what extent are you able to carry out your everyday physical activities such as walking, climbing stairs, carrying groceries, or moving a chair?	Completely (1)–Not at all (5)	Physical function
In the past 7 days, how often have you been bothered by emotional problems such as feeling anxious, depressed or irritable?	Never (1)–Always (5)	Emotional problems
In the past 7 days, how would you rate your fatigue on average?	None (1)–Very severe (5)	Fatigue
In the past 7 days, how would you rate your pain on average?	No Pain (0)–Worst Imaginable Pain (10)	Pain

Note. PROMIS = Patient-Reported Outcomes Measurement Information System.

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