Is a better planned day a healthier day? A daily diary study

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Abstract

Objective: Previous research has shown that intentions, implementation intentions, active planning and coping planning predict engagement in important health behaviors. This study investigated the role of general daily planning as opposed to specific behavior planning as a predictor of engagement in lifestyle behaviors. The study also examined conscientiousness and mean levels of planning as moderators of that relationship.

Design: This study utilized a daily diary approach wherein seventy-six adults were recruited to complete daily diary surveys for 14 days. Multilevel models assessed the within- and between-person relationships between planning and five lifestyle behaviors.

Main Outcome Measures: physical exercise, fruit and vegetable intake, time spent in social interaction, time in nature and heavy alcohol intake.

Results: Within-person general daily planning predicted engagement in exercise. Interactions were found between within-person general daily planning and between-person general daily planning as predictors of exercise, social interaction, and time spent in nature.

Conclusion: These findings introduce general daily planning as a potentially influential variable for explaining engagement in some lifestyle behaviors. Further, the interactions shed further light on when planning may be more and less helpful depending on individual differences.

Key words: Lifestyle, Daily Planning, Exercise, Conscientiousness

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Chronic diseases are the major contributor to disability and mortality worldwide (Richards, 2015). Individual behavior choices play an important role in chronic diseases, such as heart disease, stroke and cancer (Danaei et al., 2009; U.S. Burden of Disease Collaborators, 2013). Further, lifestyle behaviors, which, most generally, are behaviors that are associated with health and well-being - are also being linked to the etiology and maintenance of mental disorders such as depression (Sarris et al., 2014; Walsh, 2011). And while 97% of U.S. adults agree that healthy eating habits and getting enough physical exercise are at least "somewhat important" (with > 71% saying "very important"; Pew Research Center, 2016), most individuals fail to translate that knowledge into their lives (U.S. Department of Health and Human Services, n.d.). For that reason, understanding the predictors of engagement in lifestyle behaviors is an important task. Further, because individuals fluctuate in their engagement in various behaviors across days, it is important to assess within-person processes to understand these fluctuations in behavior engagement. This is made possible by longitudinal assessment and by controlling for between-person effects which are based on person averages of variables. Within-person effects are important because they can provide insight into fluctuations in variables within persons, while between-person effects represent individual differences, potentially guiding the tailoring of interventions for different individuals. Specific planning of lifestyle behaviors such as physical activity has generally been shown to predict engagement in lifestyle behaviors (Carraro & Gaudreau, 2013), but little previous research has investigated how the quality of overall daily planning might influence engagement in lifestyle behaviors. This project explored the role of general daily planning on engagement in lifestyle behaviors using a daily diary approach. This

study also explored whether individual difference variables moderate the association of daily planning with engagement in lifestyle behaviors.

A review of the literature revealed a subset of lifestyle behaviors that have empirical and theoretical support as predictors of physical and mental health. These were exercise, fruit and vegetable intake, social interaction, time in nature, and heavy alcohol use. Theoretically, a model from the lifestyle medicine literature that aims to classify the determinants of health and well-being includes these factors, among others (Egger, Stevens, Binns, & Morgan, 2019). Empirically, there is substantial support for exercise (Ashdown-Franks et al., 2020; Booth, Roberts, & Lave, 2012), fruit and vegetable intake (Lassale et al., 2019; Slavin & Lloyd, 2012), social interactions (Holt-Lunstad et al., 2015; Leigh-Hunt et al., 2017), time spent enjoying nature (Bratman et al., 2019; Frumkin et al., 2017), and heavy alcohol use (Fernández-Solà, 2015; Khan et al., 2020).

Planning and lifestyle behaviors

The theory of planned behavior suggests that a person's intentions to engage in a behavior and their perceptions of control over that behavior partially explain later engagement in the behavior (Ajzen, 1991). Intentions do not explain a majority of the variance in engagement in behaviors (e.g. McEachan et al., 2011), so Gollwitzer (1999) suggested implementation intentions, which include planning to initiate a given behavior when faced with a specific situation, may predict health behaviors. Implementation intentions can be differentiated from general goal setting or goal intentions (specifying what one wants to accomplish) because of an explicit if/then structure indicating when, where, and how a behavior will be undertaken (Ziegelmann, Luszczynska, Lippke, & Schwarzer, 2007). Meta-analyses confirm that forming implementation intentions leads to healthier behaviors (e.g. Belanger-Gravel, Godin, &

Amireault, 2011). This type of planning also appears to be more effective than more general goal setting (Ziegelmann, et al., 2007). A slightly different approach includes action and coping planning (Sniehotta et al., 2005). Action planning is specifying when, where and how one will engage in an action, while coping planning is anticipating barriers to engaging in the behavior and creating plans to deal with them. A meta-analysis also supported the role of both forms of planning as predictors of engaging in physical activity and as mediators between intention and behavior (Carraro & Gaudreau, 2013). Overall, goals are more effective when they are specific rather than general (e.g "do your best") and when they involve both proximal (e.g. eat three servings of vegetables a day this week) and distal (e.g. lose weight) components (Locke & Latham, 2002; Pearson, 2012).

Despite positive findings, not all studies support the role of planning as a predictor of engaging in behavior. For example, in one daily diary study, an intervention that aided in the direct planning of next-day exercise reduced the number of hours of exercise on the subsequent day (Payne et al., 2010). Other studies also failed to demonstrate a positive effect and sometimes resulted in a negative effect (Budden & Sagarin, 2007; Skår et al., 2011). Maher and Conroy (2015) found that an action planning intervention was helpful for those who had weak exercise habits but was detrimental for individuals with strong exercise habits.

One question to consider regarding these findings is the level of comprehensiveness in the planning process because most of these studies are focused on making plans to engage in individual behaviors. Other forms of planning may be important to investigate as predictors of lifestyle behaviors. For example, one study found a positive within-person association between overall daily planning (i.e. the extent to which a days' worth of tasks and activities were prioritized and scheduled) and work performance (Parke et al., 2018). In that study daily

planning had a buffering effect on work interruptions, such that on better planned days, interruptions had a smaller negative impact on work engagement. Thus, while having a more structured and well-thought out day seems to improve work performance, it is not clear whether this daily planning would also help people follow healthy lifestyles. In reaction to the interesting findings that lifestyle planning interventions can be detrimental to engagement in the specified lifestyle behavior at the within-person level, this study sought to explore a more global (i.e. non-lifestyle behavior specific) and naturally occurring planning to see whether it predicted engagement in lifestyle behaviors. The goal was to assess a form of planning without referencing any specific behaviors to see if better planned days might predict wiser lifestyle choices. While not tested in this initial study, this sort of planning might buffer a person from stressful or negative mood inducing events that might otherwise influence the person's desires to eat healthy, stay active, be outside, or avoid heavy drinking.

Of note, there are likely important differences among the way these behaviors are carried out in daily life and the motivations driving them. Some may be more dependent on planning or scheduling such as time spent in social interaction or exercise. In contrast, others may be considered more discrete behaviors, less dependent upon scheduling, such as consumption of fruits and vegetables or alcohol. Investigating the association of planning with these behaviors may shed light on how different types of lifestyle behaviors are linked to a well-planned day.

Self-report of various lifestyle behaviors may suffer from recall biases. For example, objective measures of physical activity and self-reports are only modestly correlated (Prince et al., 2008). These recall biases may be reduced through use of daily diary or experience sampling studies because the time between the activity and the assessment of the activity is shorter (Smith, 1991). At the same time, recording and reporting on various lifestyle behaviors is likely not

something most individuals regularly do, which may itself influence behavior. In fact, a previous meta-regression looking at nutrition and physical activity intervention components found that self-monitoring explained the most variance (Michie et al., 2009). With that in mind, this study controlled for the influence of time on engagement in lifestyle behaviors.

Individual differences and lifestyle behaviors

Personality attributes, especially conscientiousness from the five-factor model of personality, is an important factor in lifestyle and health. Research has linked conscientiousness to longevity across time (Martin et al., 2007) and engagement in health behaviors (Bogg & Roberts, 2004). In line with previous research, direct associations of conscientiousness with healthy lifestyle behaviors were expected in this study. Conscientiousness' also acted as a control variable to daily planning, which helped answer the question of whether fluctuation in daily planning quality predicts engagement in lifestyle behaviors above and beyond a general planful, careful, diligent, personality disposition.

In consideration of the findings by Maher and Conroy (2015), where individual differences moderated the relationship between planning and behavior, this study investigated between-person variables might moderate within-person processes. Some research on mental health treatment that describes a framework for investigating whether capitalizing on strengths or compensating for weaknesses is better for outcomes (Cheavens et al., 2012). In terms of lifestyle change, one planning intervention was only helpful for individuals low in conscientiousness (Webb et al., 2007), which would support the compensation approach. However, another study found an interaction between planning to engage in physical activity and conscientiousness as predictors of engagement in activity 6 months later (Lippke et al., 2018), such that planning was more effective for individual higher in conscientiousness, supporting the capitalization approach.

Other research found mixed effects of conscientiousness and planning interventions on behavior (e.g. Walsh et al., 2005). This study focused on the cross-level interaction by asking whether the influence of within-person fluctuations in daily planning on lifestyle behaviors would be moderated by conscientiousness.

In conjunction with the inspection of conscientiousness as a between-person moderator, the person-average of daily planning was also investigated as a moderator. People who plan less on average, may benefit from planning more than their average on a given day, while individuals who plan to a high degree on average, may have diminishing returns from an even better planned day. An aim of this study was to see whether there is a ceiling effect on the benefits of planning for high-average planners, whereas those who plan less on average may benefit from a better planned day as a form of compensation.

The present study

This project was driven by the following research questions: 1) Will general daily planning be positively associated with engagement in healthy lifestyle behaviors? 2) Will that same association hold, controlling for individual difference variables, including average daily planning and conscientiousness? And 3) Will those individual difference variables moderate the relationships between daily planning and the lifestyle behaviors. The hypotheses for the study were that within-person daily planning will be positively associated with engagement in exercise (h1), fruit and vegetable consumption (h2), time spent in meaningful social interaction (h3), time spent enjoying nature (h4), and negatively associated with heavy drinking (h5). Conscientiousness was hypothesized to positively predict all the lifestyle behaviors (h6-h9), except heavy alcohol use for which there would be a negative association (h10). It was also hypothesized that average general planning and conscientiousness would moderate the

relationship between daily planning and engagement in lifestyle behaviors such that those who are lower in each, would experience a compensation effect when they planned more than their average on a given day (h11-h15 for average planning; h16-h20 for conscientiousness). This compensation would result in increased engagement in healthy behaviors. As a secondary analysis, this study aimed to investigate the association between planning, lifestyle behaviors and individual difference variables.

Method

Participants

Participants were recruited from the survey participant website www.prolific.ac. Prolific has been described as a source of potentially high-quality data (Palan & Schitter, 2017), meaning that the response quality and participant diversity tended to be greater than college samples and other online samples. One-hundred four adult users clicked on the link to review the baseline survey. Of those participants, 76 completed the baseline survey and at least 7 daily surveys without missing attention check items or answering mindlessly — meaning no variation in any of their measures across days. Only individuals living in the United States and those that could read English were recruited. Using the site's participant filters, the sample was generally stratified by age and gender, with some differences due to completion rate differences. The sample was 57.9% female, 40.8% male and one participant selected "other" for their sex (1.3%). The participants' average age was 40.29 years (*SD* = 13.69) and the sample was predominantly White (85.5%). Other participants identified as Black, African American (9.2%), Chinese (1.3%), bi-racial (1.3%) and "Other" (1.3%). Four participants identified as Latinx (5.3%). In terms of relationship status, twenty-sex participants were single (34.2%), twenty-five were married (32.9%), seventeen were in a relationship (22.4%) and eight were divorced or separated (10.5%).

Procedures

Participants were given a study description, provided their consent, and completed a baseline survey with demographic questions and between-person questionnaires (e.g. personality). The survey was administered through Qualtrics. Each evening (8:00 PM Eastern Standard Time), for the next 14 days, the participants were sent an email through the Prolific system with a link to the daily survey. Participants were paid according to their degree of participation – with a payment for each daily diary study and a bonus for completing thirteen or more diary studies. The total payment ranged from $12 to $26 per participant. Study procedures were reviewed and approved by the local institutional review board.

Measures

Personality. Conscientiousness was assessed with the 9-item subscale of the 44-item Big Five Inventory (John et al., 2008). This is a widely used assessment of the "Big Five" factors of personality. The consistent item stem is "I am someone who..." followed by statements (e.g "Tends to be disorganized.") that the person rates on a 5-point Likert format. Previous research has shown that the measure has high reliability, convergence with more comprehensive Big Five assessments, and a clear factor structure (John et al., 2008). In this sample the alpha reliability for conscientiousness was .89. The items were summed to create a composite variable, which was then standardized.

Daily planning. Daily planning was measured at the end of each of the 14 days with three items from the time management planning scale (Parke et al., 2018). The three items used in this study were "I made a list of all things I have to do today," "I prioritized the tasks I want to accomplish today," and "I made a schedule of the activities I have to do today." Each of these three items was rated on a 7-point continuum ranging from "not at all" to "to a very great

extent." Parke et al., (2018) found that the average alpha reliability across 10 days was .93 in their daily diary study. The present study used the procedures described by Bonito et al. (2012) to obtain reliability estimates at the day-level (.64) and person-level (.93). The three items were summed to create a composite variable. The composite was person centered for within-person effects and the person means were also included in the models for between-person effects.

Exercise. Exercise was measured by the Godin Leisure-Time Exercise Questionnaire (Godin & Shephard, 1985), which has been modified for daily use (Flueckiger et al., 2014). The participants were asked "How many minutes did you do the following kinds of exercise today during your free time?" and reported on minutes spent in mild, moderate, and strenuous exercise. The participants were provided with example exercises for each level of intensity (e.g. "running, basketball" for strenuous exercise). All exercise bouts of longer than 15 minutes were recorded and assigned a metabolic unit: 3 for mild, 5 for moderate and 9 for strenuous. These values were summed resulting in a total activity value ranging from 0 to 17. Previous research has demonstrated a test-retest consistency greater than .70 (Godin & Shepard, 1985) and the measure's ability to predict physical fitness and fitness center usage (Amireault & Godin, 2015).

Fruit and vegetable intake. Participants reported on the number of fresh, frozen or canned fruits and vegetables consumed that day (e.g. "How many servings of fruits (fresh, frozen, or canned, but not dried or juiced) did you eat today?"). The questions were similar to those used in previous daily diary research (Conner et al., 2015) and were paired with images of serving sizes used in previous research (Mujcic & Oswald, 2016). Item choices ranged from "<1 serving" to "≥6 servings." The values of the two questions were summed to create a total count of servings of fruits and vegetables.

Meaningful social interaction. Time spent in social interaction was measured by a single item that asked the participants how much time they spent "having meaningful interactions with close others." Participants selected a time value ranging from "0:00" to "8:00+", with five-minute increments. The value was divided by 60 to rescale the variable into hours. This single item was used to represent their time spent in meaningful social interaction. Another daily diary study found that meaningful social interaction was associated with overall social connectedness (Reis et al., 2000).

Heavy drinking. As part of the daily surveys, participants were also asked "How many drinks of alcohol did you consume in the past 24 hours?". The participants were provided with an image from the National Institute on Alcohol Abuse and Alcoholism (n.d.) that provided a reference for alcohol serving sizes. Heavy drinking was categorized according to the USDA's 2015-2020 (2015) dietary guidelines which states that moderate drinking is up to one drink a day for women and up to two drinks a day for men. A binary variable was created with 1 indicating any time a participant drank more than the recommended servings of alcohol for their sex.

Time spent enjoying nature. Participants were asked "How much time did you spend enjoying natural spaces yesterday?" A description of natural spaces was taken from Kuo and Taylor (2004) who describe it as "a park, a farm, or just a green backyard or neighborhood space." Participants selected a time value ranging from "0:00" to "8:00+" hours, with five-minute increments. The value was divided by 60 to rescale the variable into hours. This single item was used to represent time spent enjoying nature.

Control variables. Because socioeconomic status can influence lifestyle behaviors and health, the participants responded to the MacArthur Scale of Subjective Social Status (Adler, Epel, Castellazzo, & Ickovics, 2000). This single item assesses individuals' perceptions of their

overall socioeconomic status, where the participants rank themselves (from 1 to 10) relative to the rest of the United States in terms of money, education, and occupation. This item predicts health and well-being even when controlling for objectively measured socioeconomic status indicators (Präg, Mills & Wittek, 2016). Relationship status was also measured and controlled for in each model.

[Table 1 near here]

Data analysis plan

Multilevel models were used to assess the associations of the study variables while accounting for their nested structure. As a count variable, fruit and vegetable intake was modeled using a generalized linear mixed-effects model with a Poisson distribution and log link function. As a binary variable, heavy alcohol use was modeled with a generalized linear mixed-effects model with a logistic distribution. To account for some non-normality and heteroskedasticity the exercise, social interaction, and time in nature models were analyzed with robust general linear mixed effect models. The fruit and vegetable and heavy alcohol use models were analyzed with the *lme4* package (Bates, Maechler, Bolker, & Walker, 2015) and the robust models were analyzed with the *robustlmm* package (Koller, 2016). Following Barr, Levy, Scheepers, & Tily (2013), as many random effects as the data could handle were included in the models.

The models were built in a sequence following guidance by Hox (2010). First unconditional models with a random intercept were run for each lifestyle behavior to obtain the intraclass correlation coefficients (ICC). To calculate the ICC for the binary alcohol outcome, the method described by Wu, Crespi, & Wong (2012) was used. The ICC can be interpreted as the proportion of variance occurring due to between-person differences with 1-ICC being the proportion of variance due to within-person fluctuations. Multilevel models including a second-

order polynomial of time and related visual plots did not indicate curvilinear relations and, as such, only linear effects of time are reported below. To examine the interaction patterns, simple slope tests were conducted following Preacher, Curran and Bauer (2006). To facilitate convergence for the fruit and vegetable intake and heavy alcohol models, the planning variable was rescaled for those models such that it ranged from 0 to 1, rather than 0 to 18.

Some of the lifestyle behavior values were greater than 3 SDs from the mean. To assess for the impact of these potential outliers they were recoded to equal a value 3 SDs above or below the mean. From the 893 days' worth of data, 14 exercise values, 11 fruit and vegetable values, and 20 enjoying nature values were recoded. However, results from analyses using the raw data were very similar to results from analyses on the recoded data, and as such, the analyses on the raw data are reported in the manuscript. The data for the study are available at https://osf.io/vezbd/.

Results

On average, participants completed 11.80 daily surveys (*SD* = 1.86). Missing data was 0.3% for only one variable (time spent in social interaction) and was assumed to be missing completely at random. The descriptive statistics for the variables, including ICC values are presented in Table 1.

The results of the multilevel models are available in Table 2. The model predicting exercise found that exercise was associated with within-person planning (h1; b = 0.16, 95% CI [0.05, 0.27]), conscientiousness (h6; b = 0.65, 95% CI [0.12, 1.19]), and an interaction between within- and between-person planning (h11; b = -0.02, 95% CI [-0.03, 0.01]). Simple slopes analyses indicated that individuals who were lower (1 *SD* below the mean; γ = 0.13, *SE* = 0.05, *Z* = 2.84, *p* = .005) on mean levels of planning had a significant positive association between their

within-person planning and that day's exercise (See Figure 1). Individuals who were higher (1 *SD* above the mean; γ = -0.03, *SE* = 0.03, *Z* = -1.14, *p* = .25) on mean levels of planning had no significant association between within-person planning and exercise. The within-person planning and conscientiousness interactions (h16-h20) were not significant in this, or any of the models.

[Table 2 near here]

In the fruit and vegetable intake model, only single relationship status was positively associated with fruit and vegetable intake (b = .46, 95% CI [0.05, 0.87]). Against expectations, conscientiousness was not positively associated with fruit and vegetable intake (h7; b = 0.16, 95% CI [-0.02, 0.34]). In the heavy drinking model, only conscientiousness was unexpectedly a significant positive predictor of heavy drinking (h10; b = 1.29, 95% CI [0.13, 2.45])[1].

In the social interaction model conscientiousness was significantly positively related to time spent socializing (h7; b = 0.36, 95% CI [0.07, 0.66]). Relationship status was also a significant predictor, with those who were divorced or separated (b = -1.05, 95% CI [-1.99, -0.12] and those who were single (b = -0.99, 95% CI [-1.68, -0.30]) spending less time in meaningful social interaction than those who were married. There was also a significant interaction between average planning and within-person planning (h13; b = -0.01, 95% CI [-0.01, 0.00]. Simple slopes analyses indicated that participants who were higher on average planning (1 *SD* above the mean; γ = -0.04, *SE* = 0.01, *Z* = -3.30, *p* = .001) had a negative association between within-person planning and time spent in nature, while participants who were lower on average

[1] This unexpected positive association with heavy alcohol use had large confidence intervals was further probed by rerunning the analysis with a higher threshold of heavy drinking (>2 drinks for women and >3 drinks for men). In that model conscientiousness was no longer significant (b = .93, 95% CI [-.74, 2.59]).

planning (1 *SD* below the mean; $\gamma = 0.01$, *SE* = 0.02, *Z* = 0.43, *p* = .67) had no association between within-person planning and time in nature (See Figure 2).

[Figure 1 near here]

In the time spent enjoying nature model, there was a significant positive association between conscientiousness and time spent in nature (h9; b = 0.10, 95% CI [0.03, 0.17]) and a significant interaction between within-person planning and between-person planning (h14; b = -.002, 95% CI [-0.003, 0.00]). The simple slopes revealed that individuals with high average planning (1 *SD* above the mean; $\gamma = -0.01$, *SE* = 0.003, *Z* = -3.43, *p* = .001) had a significant negative association between within-person planning and time spent in nature, while individuals with low average planning (1 *SD* below the mean; $\gamma = 0.004$, *SE* = 0.005, *Z* = 0.87, *p* = .38) had no association between within-person planning and time enjoying nature (See Figure 3).

Discussion

This daily diary study explored the relation between general daily planning and lifestyle behaviors, with potential moderations by average daily planning and the conscientiousness personality trait. This study differed from other previous cross-sectional research because it focused on studying within-person fluctuations in lifestyle behaviors and planning in a natural, and uninhibited way – allowing the participants to report on their daily behaviors without any attempt on the researcher to change their behavior. This study was innovative in its emphasis on a general daily planning rather than the more focused action and coping planning or implementation intentions that focuses on individual behaviors.

[Figure 2 near here]

The expectation that within-person daily planning would significantly predict lifestyle variables, while controlling for average levels of planning and conscientiousness, was found only

in the exercise model (h1). Within-person planning did not predict fruit and vegetable intake (h2), or time spent in meaningful social interactions (h3), time spent in nature (h4), or heavy alcohol use (h5). Exercise can often take a significant amount of time and preparation to engage in when it is moderate or vigorous and as such, a better planned day might have created a structure within which the multistep behavior was better able to be enacted. This contrasts with decisions about fruit and vegetable intake and alcohol use, which may be more spontaneous and less affected by a well-planned day. As discussed further below, social interaction and enjoying nature may be facilitated by making plans, but also potentially hampered when someone overschedules their day with other activities. It remains to be seen whether experimentally induced daily planning has similar variation in its association with different types of lifestyle behaviors.

The participants' average level of planning across the two weeks was not predictive of any of the lifestyle behaviors when controlling for the other relevant factors. The lack of significance for this variable emphasizes the continuing need for research that parses out the within- and between-person associations because they can vary. Conscientiousness positively predicted exercise (h6), time in social interaction (h8), and heavy alcohol use (h10, see footnote in results section).

This study also explored whether average level of planning or conscientiousness would influence how likely one's daily fluctuations in planning will lead to engagement in lifestyle behaviors. The results indicated that for exercise (h11), time spent in social interaction (h13), and time spent enjoying nature (h14), the association between the fluctuations in planning around one's average planning and these lifestyle behaviors varied based on one's average levels of planning. The simple slopes analyses revealed interesting differences in the moderations where,

those who are low-average planners tend to engage in more exercise on days they plan more than their average, while people who tend to plan more on average, but plan at a higher level on a given day are less likely to spend time socializing and in nature. In the case of exercise, planning more than one's average might act as a compensatory factor, while overscheduling might impair one's ability to engage in social interaction and enjoying nature. These significant interactions might help explain mixed findings from previous studies that introduced planning or goal setting for behavior change (e.g. Budden & Sagarin, 2007; Skår et al., 2011). When designing lifestyle interventions, scholars might want consider individual differences in general planning and, as found previously, baseline habit strength (Maher & Conroy, 2015) as potential moderators. In this study, the association of daily planning with lifestyle behaviors did not differ by levels of conscientiousness (h16-h20). Conscientiousness and average planning were correlated at the between-person level, but apparently once daily plans have been made, their association with lifestyle behaviors was not affected by conscientiousness.

[Figure 3 near here]

While the study included individual difference variables as both controls and moderators, other important moderators would be important to investigate such as self-efficacy and number of daily interruptions to plans. From a public health perspective, a better planned day was not a consistent predictor of health behaviors on its own. Assessing daily planning along with personal goals or motivations related to lifestyle behaviors, might more effectively explain engagement in most of these lifestyle behaviors. In the case of low motivation, motivational interviewing (Frost et al., 2018) or interventions based on self-determination theory (Gillison, Rouse, Standage, Sebire, & Ryan, 2018) might be helpful for increasing motivation, which might in turn be supported by training in effective daily planning.

This study's strengths were that it used a daily diary design to reduce recall biases and to allow for an investigation of within-person processes. Further, this study includes a greater number of lifestyle behaviors, which allows for a comparison of the influence of daily planning on each behavior. This approach helped establish a baseline understanding for how general daily planning, without reference to specific lifestyle behaviors, is associated with engagement in various health-related lifestyle behaviors. That only some of the behaviors were related to daily planning raises interesting questions about the structure of these behaviors in daily life. With so many lifestyle behavior decisions to be made every day, it might be wise to consider how global daily planning might facilitate healthy lifestyles in conjunction with approaches focused on planning specific behaviors (Carraro & Gaudreau, 2013; Pearson, 2012; Sniehotta et al., 2005). For example, individuals who set both proximal and distal goals for specific behaviors might have a better chance of completing those goals if they also structure their time and resources for a given day more generally. Future research should compare how a generally well-planned day may buffer the relationship between action plans and behavior engagement by providing more structure to the day and thus protecting specific action or coping plans. In this way, well-planned days may act as a self-regulation tool for individuals who are trying to avoid relapsing after making initial lifestyle changes (Kwasnicka, Dombrowskic, White, & Sniehotta, 2016).

This study, which explored a new set of associations, involved five outcome variables in separate models, possibly leading to some associations being discovered simply by random chance. Because that concern is substantial and because the confidence intervals were wide in some cases, replication of these findings in other samples is an important next step. To better assess the temporal association between early day planning and later behaviors, future studies should assess planning at the beginning of the day and behaviors should be assessed later. In

terms of generalizability, the prolific participant pool is not fully representative of the U.S. population and by only including participants who completed half of the daily diaries, the results may not generalize to those who could not fully participate. It is also possible that the findings were affected by shared method variance with some the variables being measured in similar ways. Lastly, the self-report nature of the variables brings in the potential for bias. Some research shows that objective measurement of physical activity is only moderately correlated with self-reported physical activity. Also, both enjoyment of nature and an emphasis on leisure-based physical activity have a mixture of behavioral and motivational aspects to their measurement. Objective measurement using GPS and accelerometer data might increase accuracy and help in the effort to more clearly parse apart behaviors and motivations.

Because lifestyle behaviors contribute so strongly to physical and mental health, it is important that the research continues to explore natural behavioral processes and how to intervene with those processes. This study contributes to the literature by exploring a new form of planning, general daily planning, as a predictor of healthy behaviors. General daily planning could be tested experimentally to see how and for whom it can bring about lifestyle change.

Human and animal rights and Informed consent: All procedures followed were in accordance with ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000. Informed consent was obtained from all patients for being included in the study.

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Figure 1

Exercise predicted by the person-centered planning and person-average planning interaction

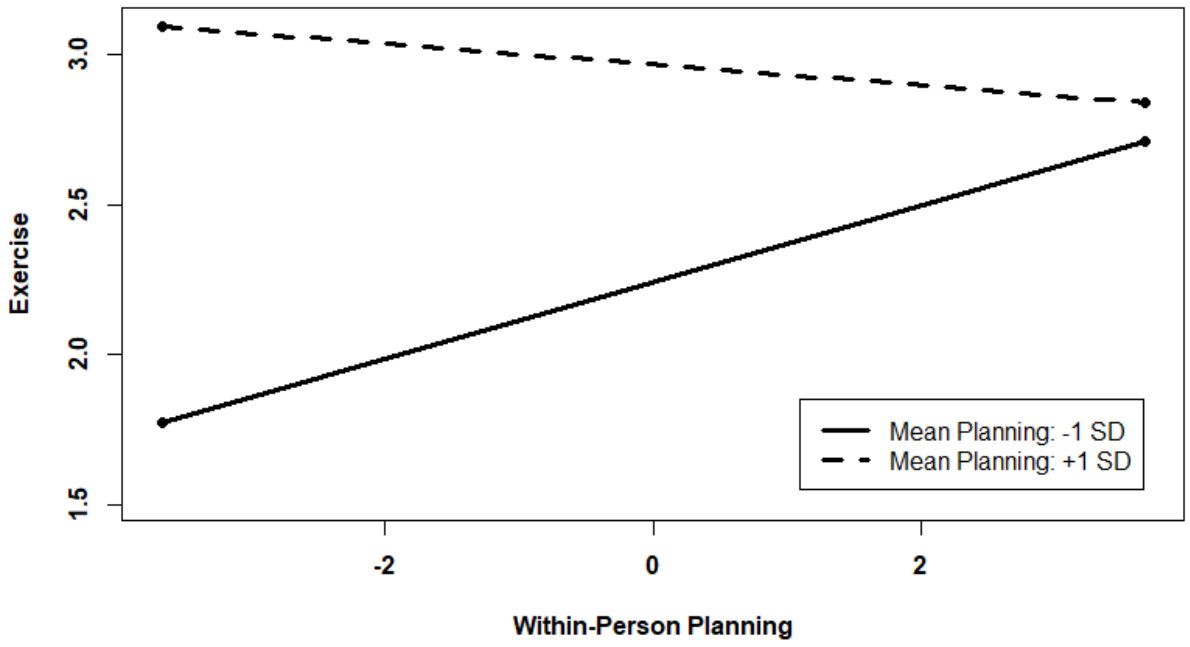

Figure 2

Time socializing predicted by the person-centered planning and person-average planning interaction

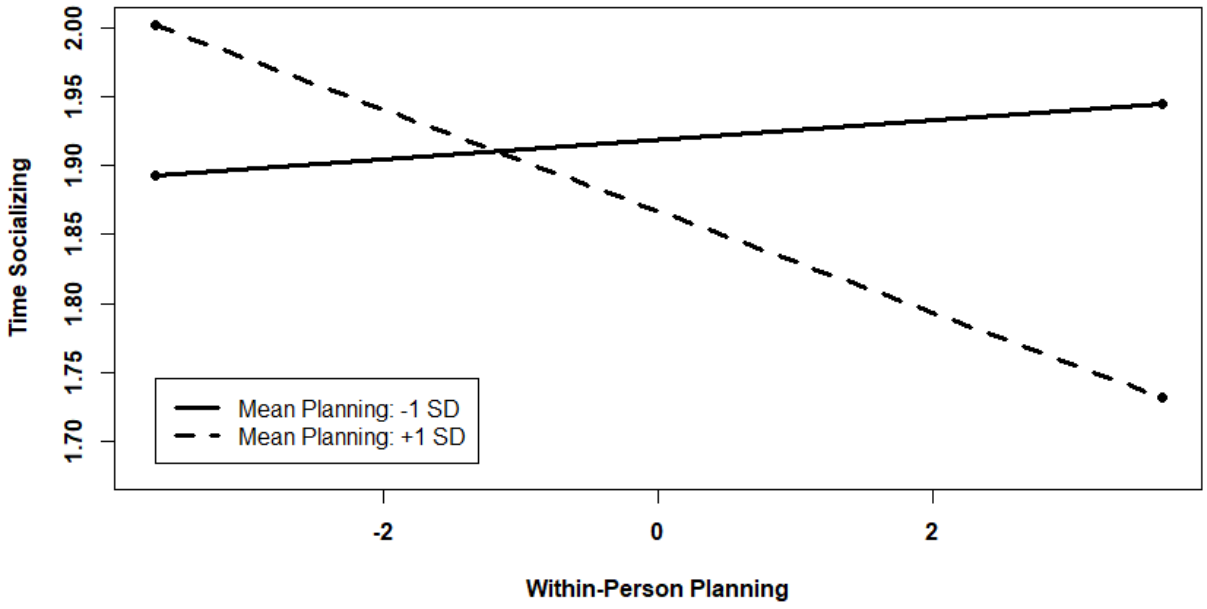

Figure 3

Time in nature predicted by the person-centered planning and person-average planning interaction