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“I’ll look after my health later”: An investigation of procrastination and health

Fuschia M. Sirois, Michelle L. Melia-Gordon, and Timothy A. Pychyl

Department of Psychology

Carleton University, Ottawa

Correspondence concerning this article should be addressed to Fuschia M. Sirois, PhD,
Department of Psychology, University of Sheffield, 309 Western Bank, Sheffield, S10 2TP,
United Kingdom. Email: f.sirois@sheffield.ac.uk

Abstract

A recent study on the negative health consequences of procrastination suggested that procrastination was associated with higher stress and poor health (Tice & Baumeister, 1997). The current investigation sought to clarify and extend these findings by examining the mediational role of stress and health behaviors in the procrastination-illness relationship. It was hypothesized that in addition to stress, a behavioral pathway would be implicated, with poor wellness behaviors and delay in seeking treatment for health problems mediating the effects of procrastination on health. The model was tested with a sample of university students ($n = 122$) during a high stress period. As expected, the results indicated that procrastination related to poorer health, treatment delay, perceived stress, and fewer wellness behaviors. The process analyses supported the mediational role of stress and treatment delay, but not wellness behaviors, in the procrastination-illness relationship. The model is consistent with current conceptualizations of the personality-health relationship, and presents procrastination as a behavioral style that may increase vulnerability for negative health outcomes.

“I’ll look after my health later”: An investigation of procrastination and health

Procrastination has been described as a self-regulation style that involves delay in the start and/or completion of a task (Ferrari & Tice, 2000). Research indicates that procrastination is linked to a number of negative mental health states, including anxiety (Beswick, Rothblum, & Mann, 1988; Ferrari, 1991; Haycock, McCarthy, & Skay, 1998; Lay, Edwards, Parker, & Endler, 1989; Rothblum, Solomon, & Murakami, 1986; Senecal, Koestner, & Vallerand, 1995; Solomon & Rothblum, 1984), depression (Beswick et al., 1988; Martin, Flett, Hewitt, Krames, & Szanto, 1996; Saddler & Sacks, 1993; Senecal et al., 1995; Solomon & Rothblum, 1984), and higher perceived stress (Flett, Blankstein, & Martin, 1995; Tice & Baumeister, 1997). However, little attention has been given to the relationship between procrastination and physical health status.

An initial investigation by Tice and Baumeister (1997) of the health costs of procrastination suggests that procrastination may be associated with higher stress and poorer health. University students who rated high on procrastination reported better health and less stress at the beginning of the academic term, but were more stressed and had poorer self-rated health by the end of term. However, the reasons for this relationship were not empirically explored. Tice & Baumeister (1997) speculated that the higher stress experienced by the procrastinators may have been responsible for their diminished state of health at the end of term.

In this paper, we briefly review the current formulations of the personality-health relationship, followed by a conceptualization of how procrastination may relate to health outcomes. A mediational model that reflects these hypothesized relationships is then presented and tested.

Overview of personality-health models

Current theoretical and empirical research on the relationship between personality and

health offers some support for the associations between procrastination, stress and health suggested by Tice and Baumeister (1997). Investigations of the effects of stress on the immune system have been a fruitful area of research in human psychoneuroimmunology (PNI) for over a decade. This growing body of literature suggests that stressful life events are related to increased vulnerability to infectious conditions such as the common cold (Cohen, Tyrrell, & Smith, 1991; Cohen & Williamson, 1991; Lacey et al., 2000; Stone, Bovbjerg, Neale, & al, 1992; Turner Cobb & Steptoe, 1996), as well as poor health status (Jorgensen, Frankowski, & Carey, 1999).

Sergerstrom (2000) proposes that the personality-immune system relationship may be explained by several psychosocial mediators, including the impact of stress as suggested by PNI research. Specifically, the quantity or quality of stress experienced may be a function of personality, and this stress in turn affects the immune system. As Sergerstrom suggests, this relationship is a complex one, with personality implicated in both the exposure to stressors and the subsequent reactivity to these stressful events. Moreover, other psychosocial and behavioral factors may influence immune functioning and the subsequent changes in health status, either interacting with or independent of stressful events (Sergerstrom, 2000).

Similarly, Friedman (2000) states that there are two general types of mechanisms that mediate the relationship between personality and health: 1) psychophysiological reaction patterns that include changes in immune function due to stress; and 2) health behaviors. Earlier formulations of how personality affects health outcomes have referred to these two routes as direct and indirect pathways (e.g., Contrada, Leventhal, & O'Leary, 1990). The former refers to the psychophysiological reactivity associated with activation of the stress response and its associated neuroendocrine pathways, whereas the latter reflects behavioral paths and the interaction of personality with the environment. The distinctions between these two mediators of

the personality-health relationship may be arbitrary as both are interrelated (Friedman, 2000).

A conceptualization of procrastination and health

In terms of procrastination, the indirect behavioral pathway may be the more salient route for understanding the possible deleterious effects of procrastination on health than psychophysiological processes. This is not to imply that the stress experienced by procrastinators does not involve changes in immune functioning that may compromise health. Indeed, the association between negative mood states and procrastination is well established (Beswick et al., 1988; Ferrari, Johnson, & McCown, 1995; Martin et al., 1996; Pychyl, Lee, Thibodeau, & Blunt, 2000; Senecal et al., 1995; Solomon & Rothblum, 1984), and these affective changes are known to negatively impact immune system functioning (e.g., Cohen et al., 1995; Irwin, Daniels, Smith, Bloom, & Weiner, 1987). However, according to Milgram (1991) the emotional upset experienced by procrastinators is a result of the behavior sequence of postponement; therefore, these negative mood states are largely the result of the behavioral manifestations of procrastination rather than the cause of the dilatory behavior.

Unlike other personality constructs, such as the Type A behavioral pattern, which may be linked to health primarily through reactive or direct pathways (Friedman & Rosenman, 1974) with behavior as a secondary route, procrastination can be thought of as influencing health primarily through indirect behavioral means. Consequently, we argue that the tendency of procrastinators to delay tasks is the proximal cause of their negative mood states and increased stress, as opposed to an innate physiological proneness to react to situations in a stressful way, that may predispose them to poor health.

This conceptualization of procrastination as a behavioral style affecting physical health fits one of the three major routes suggested by Suls and Rittenhouse (1990) to explain the

relationship between personality and increased illness risk. According to the “personality as predictor of dangerous behavior model,” certain personality profiles lead to the creation or choice of situations that elicit reactivity, create unnecessary stress, promote unhealthy behaviors, or hinder preventative behaviors. Moreover, it is a combination of unhealthy habits, such as poor diet, lack of activity, exposure to stressors, and non-compliance with medical regimens, that is key for predicting illness risk rather than the frequency or magnitude of any one behavior (Suls & Rittenhouse, 1990). In this case trait procrastination may be associated with unhealthy behaviors and ultimately contribute to or even cause poor health behaviors.

Big-five factors, health behaviors, and procrastination. Although the relationship between procrastination and health behaviors has not been formally investigated, previous research suggests that certain higher-order personality dimensions may be associated with a variety of health-related behaviors. Much of this research has employed the five-factor model of personality (Costa & McCrae, 1985) as a framework for understanding the relationship between personality and health behavior patterns. Two consistent predictors of health behaviors that have emerged from this research are conscientiousness and neuroticism.

Conscientiousness, the tendency towards persistence, goal-directedness, and organization, was found in one study to be substantially related to higher rates of wellness behaviors (e.g., proper diet, sleep and exercise), accident control (e.g., fixing household hazards), and lower rates of traffic risk-taking and substance-related risk-taking (Booth-Kewley & Vickers, 1994). Other studies have linked low conscientiousness to lower levels of health promoting behaviors such as exercise, and higher levels of unhealthy behaviors, such as smoking and excessive drinking (Caspi et al., 1997; Friedman et al., 1995a; Lemos-Giraldez & Fidalgo-Aliste, 1997; Tucker et al., 1995). The importance of conscientiousness for long-term health

outcomes has also been demonstrated, with conscientiousness predicting longevity (Friedman et al., 1995a; 1995b).

Neuroticism, a disposition to experience strong negative emotions and vulnerability to stress, may also affect the immune system through a health behavior pathway (Sergerstrom, 2000). Research suggests that both increased harmful health practices and fewer positive health behaviors are associated with this major personality trait (Booth-Kewley & Vickers, 1994; Lemos-Giraldez & Fidalgo-Aliste, 1997; Mechanic & Cleary, 1980; Vingerhoets, Croom, Jeninga, & Menges, 1990).

Recent investigations of the relation between procrastination and the five-factor model have identified conscientiousness (Johnson & Bloom, 1995; Lay, 1997; Lay & Brokenshire, 1997; Lay, Kovacs, & Danto, 1998; Milgram & Tenne, 2000; Schouwenburg & Lay, 1995) and neuroticism (Johnson & Bloom, 1995; Milgram & Tenne, 2000; Schouwenburg & Lay, 1995; Watson, 2001) as the two main factors associated with procrastination. These studies indicate that conscientiousness is highly, negatively related to procrastination and makes a significant contribution to the variance in procrastination scores, especially task avoidance procrastination (Milgram & Tenne, 2000). Nonetheless, when compared to conscientiousness, procrastination is the better predictor of trait-specific dilatory behavior (Lay, 1997). Neuroticism, however, is positively associated with procrastination, and is primarily related to goal-directed tentativeness (Schouwenburg & Lay, 1995) and decisional procrastination (Milgram & Tenne, 2000).

Mediators of the procrastination-health relationship. The connection between procrastination and conscientiousness (and to a lesser extent neuroticism), and the impact of these higher-order personality factors on health behaviors, provides a plausible explanation for the mediation of the effects of procrastination on health. As Sergerstrom (2000) has suggested,

the mediational role of health behaviors may work in conjunction with or independent of the role of stress. Health-promoting behaviors often require long-term efforts before results are obtained, and can be viewed as unpleasant and lacking immediate rewards. Health behaviors that are preventative, or serve to maintain health (e.g., exercise, proper diet), can be thought of as wellness behaviors that may help buffer the effects of stress as well as enhance one's health states. However, the changes involved in altering one's diet or activity levels are often viewed as challenging and/or unpleasant (Turk & Meichenbaum, 1991). Given that task aversiveness is related to procrastination (Blunt & Pychyl, 1998, 2000; Clark & Hill, 1994; Lay, 1992; Milgram, Marshevsky, & Sadeh, 1994; Milgram, Sroloff, & Rosenbaum, 1988), it is likely that procrastinators may "put off" many health behaviors, such as wellness behaviors, that are viewed as unpleasant.

Procrastination may also relate to important therapeutic health behaviors such as treatment-seeking. Treatment-seeking delay is a health-specific dilatory behavior often referred to as patient delay and defined as the period of time between the individual's first awareness of a symptom and the time of medical consultation (Andersen, Cacioppo, & Roberts, 1995; Safer, Quincy, Jackson, & Leventhal, 1979). Delay in seeking treatment for health problems has been conceptualized as a multi-stage process comprised of delays in the appraisal of symptoms as signs of illness (appraisal delay), the decision to seek treatment (illness delay), acting on this decision (behavioral delay), and actually being seen by a medical professional (scheduling delay) (Andersen et al., 1995). Although a wide variety of factors are proposed to influence delay in seeking treatment for medical problems (Cameron, Leventhal, & Leventhal, 1993; Green & Pope, 1999), a full investigation of these relationships is beyond the scope of this paper. For example, symptom characteristics and perceptual processes are implicated in the first two stages

of delay (Andersen et al., 1995). However, it is possible that procrastination, a personality variable that directly affects behavior, would influence the behavioral delay stage of treatment-seeking.

Rationale for the present study

In the present study, we sought to clarify and extend the findings of Tice and Baumeister (1997) regarding the relationships between procrastination and health. Tice and Baumeister found that procrastination was related to both higher stress levels and increased symptom reporting at the end of the academic term. However, self-reported symptoms are often inflated by the presence of neuroticism (Watson & Pennebaker, 1989). Therefore, it is unclear if the higher reports of illness by the procrastinators were attributable to neuroticism, inasmuch as neuroticism is positively associated with procrastination (Johnson & Bloom, 1995; Milgram & Tenne, 2000; Schouwenburg & Lay, 1995; Watson, 2001). To address this potential confound we used an illness checklist rather than a symptom checklist. The former reflects more concrete and enduring physical health concerns, rather than passing symptoms that are often exacerbated by concurrent negative mood states (Watson & Pennebaker, 1989). Furthermore, we assessed neuroticism in order to control for its possible confounding effects on self-reported health.

The findings of Tice and Baumeister (1997) also suggest that stress mediated the effect of procrastination on health status. However, this mediating role was not directly tested. Our first objective in the current study was to assess the hypothesized mediating role of stress in the procrastination-illness relationship. We elected to examine this relationship using a single time sample that would be representative of the end-of-term sample used by Tice and Baumeister. Our second objective was to explore the role of other factors in mediating the possible relationships between procrastination and health. In accordance with current models of the personality-health

relationship, it was expected that procrastination would influence health through a behavioral pathway. Thus, the behavioral style of procrastinators to routinely delay or not complete tasks was explored in relation to other behaviors that impact on health.

Some of these behaviors may be related to stress and may interact to mediate the effects of stress on health (Sergerstrom, 2000). Health-promoting behaviors, such as exercise and proper diet, are well known to be affected by stress levels (Baum & Posluszny, 1999; Steptoe, Wardle, Pollard, & Canaan, 1996), especially in student populations (Hudd et al., 2000; Lawrence & Schank, 1993). Given the negative association between procrastination and conscientiousness, and the positive relationship between conscientiousness and positive health behaviors, it was expected that procrastination would be associated with a lower occurrence of wellness behaviors. Further, it was expected that wellness behaviors would be associated with both high stress and poor health (see Figure 1).

A final health behavior that may mediate the procrastination-illness relationship, and yet has received little attention with respect to personality, is treatment delay. Health problems that are not treated promptly or at all may linger or worsen, and may contribute to a poorer overall state of health. By definition, treatment-seeking delay is a dilatory health behavior. Therefore, it was hypothesized that trait procrastination would be related to treatment delay, and that treatment-seeking delay would mediate the procrastination-illness relationship, independent of stress. In sum, it may be that putting off looking after one's health both preventatively and therapeutically, rather than stress alone, is responsible for procrastinators' poorer health.

The current study examined the proposed relationships between procrastination, stress, and health with a population of predominately first-year university students. The first year of university presents students with many challenges and demands (Arthur, 1998; Holdaway &

Kelloway, 1987) making this a naturally stressful time to study these relationships. Student well-being is often compromised by stress during the first year (Matheson & Anisman, 2001). Further, dietary habits and physical activity, two risk factors for the development of chronic illnesses, can change for the worse during the college years (Patrick, Grace, & Lovato, 1992). Understanding the associations between procrastination, stress, health behaviors, and physical health may therefore also provide useful insights for improving student well-being.

Method

Sample

A sample of 122 students (41 males, 81 females, mean age = 21.2 years, $SD = 5.53$, range = 17 to 56 years) attending Carleton University, Ottawa, Canada, completed a questionnaire package on campus during the final weeks of term. Overall, the sample was relatively young with 81 percent of the sample comprised of students age 21 and under, and 55 percent of the sample falling in the 17 to 19 years age range. The majority of the students were enrolled in the first year of university (79.5 %), and an additional 15.6 percent were in their second year. The remaining students were enrolled in the third or fourth year of university. Most of the students were enrolled full time (86.1%).

Students were recruited in one of three ways: by a poster campaign advertising the study that was distributed campus-wide; by a sign-up for extra credits towards an introductory psychology course; or by phone from a list of names obtained through a mass testing of introductory psychology students. As an added incentive, students who participated also had their name entered into a draw for a chance to win \$200. Although overall response rates are difficult to accurately calculate given the variety of recruiting methods used, the response rate from the phone call invitations was 72 percent.

Measures

Demographics. General questions about age, gender, and year of university enrollment were included to assess the demographic characteristics of the sample.

Procrastination. Trait procrastination was assessed with Lay's General Procrastination scale (GP) (Lay, 1994). Ferrari (1992) suggests that the GP is an effective measure of dilatory behavior across different situations, and therefore this measure was considered an appropriate choice for assessing the relationship between procrastination and health behaviors in the current study. This 20-item scale assesses global tendencies towards procrastination across a variety of daily tasks. Items such as "I am continually saying I'll do it tomorrow" are scored on a 5-point Likert-type scale ranging from 1 for false of me to 5 for true of me. The scale includes ten reverse-scored items, and the mean of all items yields a single composite score with high values indicating a higher tendency to procrastinate. The GP has demonstrated good internal consistency (Cronbach alpha = 0.82) (Blunt & Pychyl, 1998; Lay, 1986), and good stability with a test-retest reliability of .80 (Ferrari, 1989). The internal consistency for the current sample was very good, Cronbach's alpha = .89.

Stress. The frequency and severity of daily stressors occurring within the past month was assessed with an abbreviated version of the Hassles Scale (Kanner, Coyne, Schaefer, & Lazarus, 1981). This 60-item measure lists common daily stressors and asks the respondent to indicate whether the stressor occurred within the last month. The severity of the stressor is also rated with 1 for somewhat severe, 2 for moderately severe, or 3 for extremely severe. A severity score is calculated from a sum of the 3-point ratings of the stressors and can range from 0 to 180, indicating the level of subjective stress experienced. Research suggests that daily hassles assessments are better indicators of subjective stress and its effects on health than a life events

approach to stress measurement (DeLongis, Coyne, Dakof, Folkman, & Lazarus, 1982; Kanner et al., 1981).

Wellness behaviors. The frequency of preventative and health maintaining behaviors was assessed with a Wellness Behavior Checklist (WBC). This original measure consists of 10 items that assess how often a variety of wellness behaviors are performed. A hierarchical model of health behaviors proposed by Vickers (Vickers, Conway, & Hervig, 1990) suggests that preventative health behaviors are multidimensional, and that wellness maintenance behaviors form an empirically distinct subset of health behaviors separate from those related to accident control and substance use. The items in the WBC were chosen to reflect the set of health behaviors from this model related to health maintenance and enhancement, such as diet, exercise, and rest/relaxation. For example, items such as “I eat at least 3 meals a day” and “I eat fresh fruits and/or vegetables” reflected dietary habits. Physical activity was assessed with items such as “I walk as much as possible, for example, I take the stairs not the elevator, etc.” and “I exercise for 20 continuous minutes or more, to the point of perspiration”. The frequency of these behaviors was rated on a 5-point scale with possible responses ranging from 1 for less than once a week to 5 for every day for each of the listed behaviors. After reversing the score for 2 items, a mean of the 10 items was calculated to produce an overall wellness behavior score with higher scores indicating more frequent wellness behaviors. The WBC has demonstrated good internal consistency in other samples of university students (e.g., Cronbach’s alpha = .75, $n = 257$; Sirois, Melia-Gordon, & Pychyl, 2001). Reliability analysis of the WBC in the current study revealed adequate internal consistency (Cronbach alpha = .68, $n = 122$).

Physical health problems. The number of health problems experienced and whether or not these problems were treated promptly was assessed with a Brief Medical and Treatment

History questionnaire adapted for this study from a brief medical history questionnaire developed previously (Sirois & Gick, in press). Fourteen physical problems were listed along with an additional item (“other”) which provided blank space for the respondent to fill in as necessary. Participants indicated whether they were currently experiencing the health problem or had experienced it within the last year. For each problem experienced, participants were asked to indicate whether they sought treatment promptly. Prompt treatment was coded as “0”, and delayed or no treatment coded as “1” for each health problem listed. The total number of non-chronic health problems was summed for each participant, and excluded chronic or life-threatening conditions such as cancer, heart problems, diabetes, arthritis, and chronic pain. These latter problems were excluded in order to compensate for any long-term health conditions that may be more related to long-standing factors than to procrastination *per se*.

Treatment delay. A Treatment Delay Index (TDI) was calculated to determine the extent to which treatment for health problems was delayed, while controlling for differences in the number of health problems reported. Certain health problems may require immediate or ongoing attention and would tend to be treated promptly by most people, while others tend not to elicit treatment-seeking because they may be perceived as less serious or troublesome. Cancer and infections were deemed to be serious/acute issues that would likely be treated quickly or would include ongoing treatment once diagnosed and would therefore be treated by the majority of people. However, headaches and flus/colds are often not treated immediately or at all. It was expected that the treatment delay ratings for these health issues would show very little variance and they were therefore excluded from the calculation of the TDI. Although heart problems are indeed serious health issues (and relatively rare in a sample of undergraduates), research suggests that treatment delay of this health problem is prevalent and may be influenced by individual

difference factors (Dracup & Moser, 1997; Horne, James, Petrie, Weinman, & Vincent, 2000).

Therefore, this health item was included in the TDI calculation. The TDI was calculated according the following formula, where health problems exclude cancer, infections, headaches, and flus/colds:

$$\text{TDI} = \frac{\text{sum of treatment delay scores for health problems}}{\text{number of health problems}}$$

The TDI values can range from “0”, indicating that no treatment delay occurs across the various health problems, to “1” suggesting a global tendency to delay the treatment of health issues.

Thus, the numeric value of the TDI reflects the proportion of all health problems reported for which treatment was delayed.

Neuroticism. A direct magnitude scale of the Five Factor Model of personality traits (Little, 2000) was used to assess this personality factor. This brief measure of the Five Factor Model of Personality is based on the NEO Personality Inventory (Costa & McCrae, 1985) and assesses each of the five personality factors on an 11-point scale. Ratings range from 0 to 10, with 0 indicating the most identification with a particular dimension, and 10 indicating the least identification with a domain. The ratings for Neuroticism were reverse scored so that higher values reflected stronger identification with this dimension. Burisch (1984) has argued that self-ratings are more directly communicable, more economical, and potentially more valid than their lengthier questionnaire counterparts.

Data Analysis

The proposed mediational model of the effect of procrastination on health was tested using a process analysis. According to Judd and Kenny (1981) three conditions need to be satisfied in order to demonstrate mediation. First, the predictor variable (procrastination) must be

related to the outcome variable (illness). Second, the proposed mediator variable(s) (stress, treatment delay, and wellness behaviors) must each be associated with the predictor variable to establish the first link in the causal chain. In addition, the mediator variable(s) must also be related to the outcome variable (health status) after controlling for the predictor variable. Finally, mediation is established when, after controlling for the mediating variable, the predictor variable exerts no effect upon the outcome variable.

The relations among the model variables were assessed by first calculating the Pearson product moment correlation coefficients between procrastination and the health-related variables. Multiple regression analyses were then performed in order to satisfy the requirements of process analyses necessary to establish mediation (Judd & Kenny, 1981).

Results

Preliminary analyses involved screening the data for missing values and replacing missing data points with the value of the variable's overall mean. Two students did not report any health issues and were subsequently excluded from the analyses because calculation of a TDI score was not possible. The remaining sample of 120 students was included in the testing of the mediational model.

Potential associations between neuroticism, procrastination and illness were also assessed with a correlational analysis in order to establish if neuroticism presented a possible confound to the procrastination-illness relationship. Neuroticism was not significantly related to either procrastination ($r = -.02$) or illness ($r = .11$) in the current sample, and therefore was not entered into the regression equations.

Descriptive statistics

The procrastination scores of the current sample ($M = 2.86$, $SD = .68$) were comparable

to those reported in previous research with a university student sample (e.g., $\underline{M} = 2.81$, $\underline{SD} = .62$; Blunt & Pychyl, 2000). Overall, the participants were fairly healthy, reporting few non-chronic health problems ($\underline{M} = 3.49$, $\underline{SD} = 1.70$) and an average frequency of wellness behaviors ($\underline{M} = 3.04$, $\underline{SD} = .62$; scale midpoint = 3). However, the tendency to delay treatment of health issues was high, with participants reporting that treatment was delayed for nearly three-quarters of the health problems (TDI mean = .73, $\underline{SD} = .34$). Conversely, perceived stress was relatively low ($\underline{M} = 35.26$, $\underline{SD} = 20.09$) given the possible maximum score of 180 with the hassles scale and the time when the data was collected (i.e., just before and during final exams).

Correlational analyses

The zero-order correlations between procrastination and the health-related variables are presented in Table 1. As expected, procrastination was associated with higher reports of stress and illness, paralleling the results reported by Tice and Baumeister (1997) for the end-of-term student sample. Procrastination was also associated with a tendency to delay treatment of health issues and with the practice of fewer wellness behaviors. Both stress and treatment delay were related to illness reporting. However, stress and treatment delay were not associated. Contrary to what was expected, the practice of wellness behaviors was not significantly related health status or perceived stress.

Mediational analyses

The results of the proposed mediation models of the procrastination-illness relationship are presented in Table 2. The standardized regression coefficients for each predictor are presented, as well as the change in variance attributable to each variable entered into the regression equation (\underline{R}^2 change). When two predictor variables are included in the same analyses, the regression statistics reflect the effect of each variable when entered into the

regression equation last.

Stress as a mediator of procrastination-illness. The results support a mediational model for stress in the procrastination-illness relationship as speculated by Tice and Baumeister (1997). Stress had a significant effect on illness, was predicted by procrastination scores, and uniquely predicted a significant portion of the variance in illness reports when procrastination was controlled. Consistent with current literature on the impact of stress on health status, the unique proportion of variance in illness reporting explained by stress was considerably higher than the proportion of variance accounted for by procrastination. Accordingly, when the effects of stress on illness were controlled for by entering stress first into the regression analyses, procrastination no longer significantly predicted illness.

Treatment delay as a mediator of procrastination-illness. The mediational role of treatment delay in the procrastination-illness relationship was also supported. As hypothesized, procrastination was related to treatment delay, which in turn was associated with illness reporting. Treatment delay continued to exert an influence over illness when the effects of procrastination were controlled, and explained an additional 3 percent of the variance in illness reporting beyond that explained by procrastination. However, the influence of procrastination on illness was no longer significant once the effects of treatment delay were removed. Treatment delay mediated the effects of procrastination on illness independent of perceived stress, because stress and treatment delay were not significantly associated ($r = .09$).

Wellness behaviors as a mediator of procrastination-illness. As expected, procrastination was associated with less frequent wellness behaviors. However, wellness behaviors did not predict illness, and had no effect on the procrastination-illness relationship when its influence was removed from the regression by entering the equation first

(R^2 change = .00). Thus, the mediational role of this variable in the procrastination-illness relationship was not supported.

Figure 2 presents the revised mediational model of the procrastination-illness relationship supported by the current analyses. Wellness behaviors have been trimmed from the model, leaving both stress and treatment delay as plausible variables to explain the relationship between procrastination and health.

Discussion

It will be recalled that we sought to clarify and extend the initial findings of Tice and Baumeister (1997) regarding the relationship between procrastination and health. Our findings confirm the mediational role of stress in the procrastination-illness relationship as speculated by Tice and Baumeister (1997). Procrastinators experienced more stress, which in turn was related to higher reports of illness. Moreover, the current study offered an additional explanation for the procrastinators' higher reports of illness. Procrastination was associated with a greater tendency to delay treatment of existing health problems, and treatment delay explained a significant amount of variance in illness reporting after accounting for the effects of procrastination. Our findings suggest that the relationship between procrastination and health is mediated through a behavioral pathway; specifically through health behaviors.

The mediation of the effects of procrastination on health may be best understood through Suls and Rittenhouse's (1990) "personality as a predictor of dangerous behavior" model. According to this model, certain personality traits confer greater risk of illness through an indirect behavioral pathway, both by greater physiological reactivity due to different lifestyle choices and because of greater tendency towards risky or unhealthy behaviors (Suls & Rittenhouse, 1990). The influence of heightened physiological reactivity is similar to

Sergerstrom's (2000) conjecture that personality is an integral part of the choices that may lead to the exposure and occurrence of stressful events, as well as the subsequent reactivity to these stressors. The tendency of procrastinators to delay unpleasant yet important tasks, such as completing a term paper, may result in more stress as the deadline approaches and the task demands completion. The higher stress levels experienced due to this behavioral style may lead to negative immune changes that put procrastinators at increased risk for illness. Indeed, in both the current study and the Tice and Baumeister (1997) investigation, procrastinators reported experiencing greater stress at a time when the demand for task completion was high (i.e., at the end of term).

Our mediational model of the effects of procrastination on health is also in accordance with the health behavior route suggested by Suls and Rittenhouse (1990). In addition to creating situations that elicit reactivity by creating unnecessary stress, procrastination may lead to poorer health because it hinders the practice of preventative health behaviors. The procrastinators in our study indicated that they delayed or omitted treatment of their existing health problems more than those who scored low on procrastination. Further, the delay in treating health problems reported by the procrastinators mediated the effects of this personality trait on health. By putting off looking after their current health issues, procrastinators may allow health problems to worsen or lead to other problems, which may further negatively impact health status.

As expected, the tendency of procrastinators to delay treatment of health problems was not related to perceived stress. Therefore, procrastinators may habitually put off a variety of important health-related tasks that include aspects of self-care and health maintenance regardless of other stressful demands. However, this may not be true for other types of health-related behaviors that are more sensitive to changes in stress levels. Indeed, the "personality as a

predictor of dangerous behavior” model (Suls & Rittenhouse, 1990) suggests that another behavioral route between personality and health involves the engagement in unhealthy or risky behaviors such as smoking, alcohol and drug abuse. These types of behaviors are often associated with both stress (Anisman & Merali, 1999) and avoidant coping styles (Carver & Scheier, 1994; Carver, Scheier, & Weintraub, 1989). Therefore, procrastination may be linked to other types of unhealthy behaviors, because it is related to stress. In this regard, a recent investigation into procrastinators’ coping styles found that procrastinators used more avoidant coping styles, specifically drug and alcohol disengagement, to cope with stress than those who scored low on this trait (Melia-Gordon, Sirois, & Pychyl, 2001). Further investigation is needed to clarify if procrastinators also suffer poor health through unhealthy behaviors that are elicited by stress.

Procrastination in the current study was also associated with the practice of fewer wellness behaviors, supporting the conceptualization of procrastination as a personality trait that hinders the practice of healthy behaviors in general. Surprisingly, wellness behaviors did not mediate the procrastination-illness relationship and were not related to illness reporting in the current study. Several factors may account for this finding. Although wellness behaviors such as dietary habits and physical activity are important health behaviors subject to negative changes during the college years (Patrick et al., 1992), it may be that prolonged change in these key health behaviors are necessary before they negatively affect health. Given that the majority of the current sample were first-year university students, it is possible that any changes in wellness behaviors over the first three months of college were not sufficiently established so as to have a significant impact on health. Furthermore, wellness behaviors may influence transient health states such as flus, colds, and headaches, rather than overall health status as assessed in the

current study. Future investigations of the role of wellness behaviors in the procrastination-illness relationship should therefore take into account the long-term health effects of these behaviors and what aspects of health they are likely to impact.

Limitations

Possible limitations of the current study include the sample characteristics. The rather small sample of predominantly young and healthy university students may make decisions to treat health problems differently from a general population with more diverse health concerns. Although this may limit the generalizability of the results to other populations with more serious or chronic health problems, the present study provides an individual difference perspective on the reason for treatment delay in student populations and how this may impact health.

Beyond procrastination, other reasons for treatment delay that were not assessed here may explain the high treatment delay scores found in the current study. For example, students use health services differently than the general population, often delaying treatment because of academic demands (Grace, 1997). In addition, symptom perception and interpretation is an important determinant of treatment-seeking (Andersen et al., 1995), and the interpretation of symptoms as signs of illness varies as a function of age (Haug, Musil, Warner, & Morris, 1997). The high rates of treatment delay in the current sample may also be attributed to the relative youth of the sample and a possible belief in invulnerability. In effect, students may minimize or ignore the importance of treating any illness that they experienced. Delay of treatment may not have had as significant an effect on such a young and healthy sample as it would on other adult populations. These factors may account for the relatively modest associations between treatment delay, procrastination and illness in the current study.

Finally, although the process analyses in the present study supported the mediational

roles of both stress and treatment delay in the relationship between procrastination and illness, in order to fully establish the causal relationships implied by the mediational model, the direction of the proposed causal effects should be evaluated longitudinally (Kline, 1998). Ideally, the mediating variables should be measured prior to the assessment of health status if causality is to be assumed. Conclusions about the causal relationships regarding procrastination and health are therefore limited by the single data collection of the current study.

Despite these limitations, the current study did assess the possible confound of negative affect on self-reported health, as this variable is well-known to influence illness reporting (Watson & Pennebaker, 1989), and is associated with procrastination (Milgram et al., 1994; Schouwenburg & Lay, 1995). Given that we found no association between neuroticism and illness reporting, our health status assessment was not biased by this reporting variable. The use of a medical inventory in the current study rather than a symptom checklist also suggests our health status measure was a more accurate reflection of actual health problems than the symptom reporting of transient somatic states.

Conclusions and future directions

Overall, the results of the current study are consistent with current conceptualizations of the personality-health relationship that suggest personality influences health through both direct or reactive pathways, and indirect or behavioral routes (Contrada et al., 1990; Friedman, 2000; Sergerstrom, 2000). Procrastination, a personality trait marked by delay in the initiation and/or completion of tasks (Ferrari & Tice, 2000), may lead to greater perceived stress, as well as the delay or omission of important health behaviors. Consequently, procrastinators may experience poor health as a result of each of these influences. The present study adds to the current research on the possible negative consequences of procrastination (Flett et al., 1995; Tice & Baumeister,

1997) by demonstrating that procrastination is a personality style associated with increased vulnerability for negative physical health outcomes.

The association of procrastination to health-related behaviors was examined with respect to two behaviors (treatment-seeking and wellness behaviors) in the current study. Future research could expand the range of health behaviors that are investigated and include areas such as safety-related behaviors (e.g., changing smoke alarm batteries, reducing household hazards) and medical regimen adherence, as it is likely that the tendency to procrastinate extends to other behaviors necessary for the maintenance of health. And, as other findings suggest, procrastination may also be related to unhealthy behaviors, such as drug and alcohol abuse, that serve as a means of coping with increased stress (Melia-Gordon et al., 2001).

Although the health behaviors suggested may not be individually directly implicated in the causal pathways associated with illness outcomes, they may nonetheless reflect the types of risky health behaviors suggested by Suls and Rittenhouse (1990) to negatively affect health when they occur in combination. Future investigations to assess the combined effects of unhealthy behaviors associated with procrastination and their impact on health are needed to provide a more complete picture of the behaviorally mediated health risks associated with procrastination. Moreover, determining the influence of stress on the occurrence of these behaviors will be important for gaining a more complete understanding of the health risks associated with procrastination.

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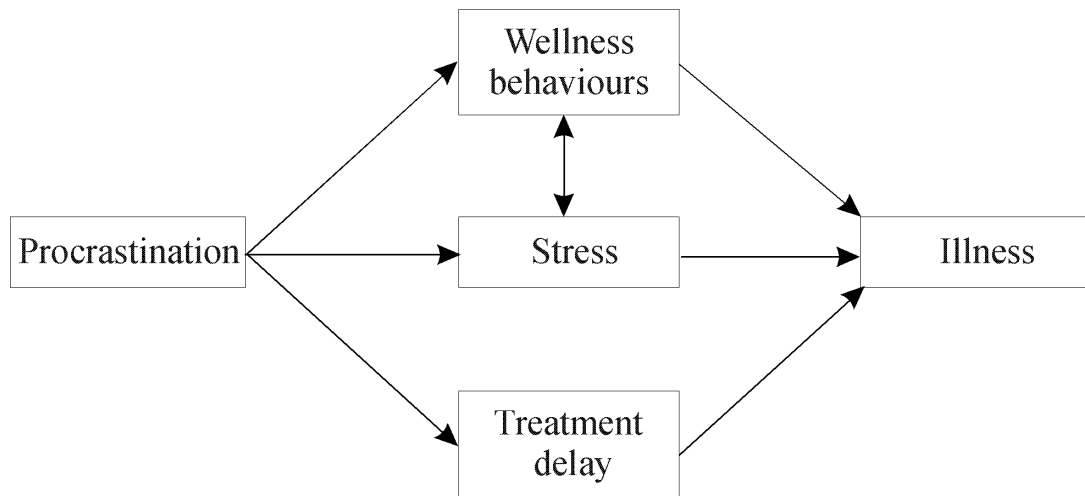


Figure 1. Proposed mediational model of the procrastination-illness relationship

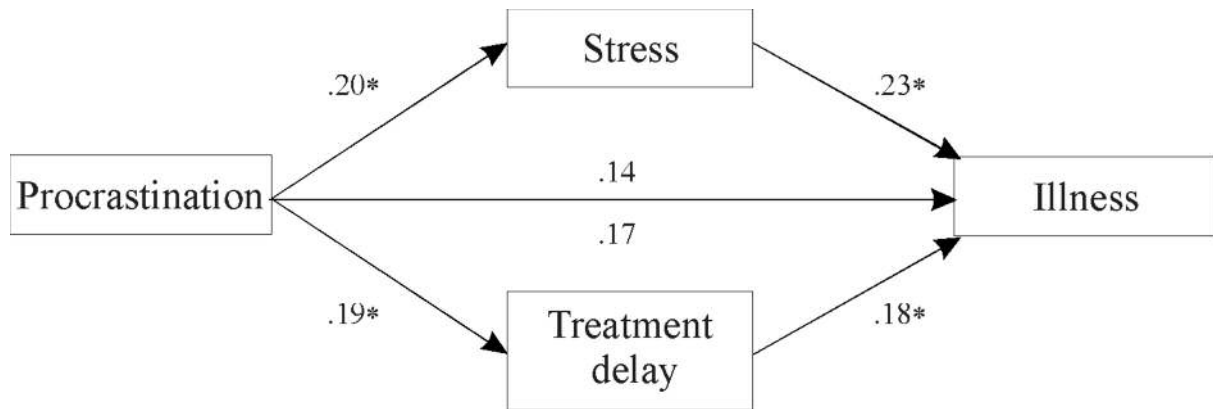


Figure 2. Revised mediational model of the procrastination-illness relationship. Numbers reflect standardized regression coefficients.

* $p < .05$.

Table 1. Zero-order correlations between procrastination and health-related variables

Variables	1	2	3	4
1. Procrastination	---			
2. Stress	.20*	---		
3. Treatment delay	.19*	.10	---	
4. Wellness Behaviors	-.24**	-.15	-.12	---
5. Illness	.20*	.24**	.21*	-.09

Note: $N = 120$

* $p < .05$

** $p < .01$

Table 2. Regression analyses of the proposed procrastination-illness mediational model

Outcome variable	Predictor variable	β	t	R^2 change	F change
Stress					
Illness	Procrastination	.20	2.27*	.04	5.14*
Stress	Procrastination	.20	2.19*	.04	4.41*
Illness	Stress	.26	2.89***	.07	8.36**
Illness	1. Stress	.23	2.57**	.05	6.61**
	2. Procrastination	.14	1.51	.02	2.28
Treatment delay					
Illness	Procrastination	.20	2.27*	.04	5.14*
Treatment delay	Procrastination	.19	2.08*	.04	4.34*
Illness	Treatment delay	.21	2.38*	.05	5.67*
Illness	1. Treatment delay	.18	2.01*	.03	4.04*
	2. Procrastination	.17	1.88	.03	3.52
Wellness behaviors					
Illness	Procrastination	.20	2.27*	.04	5.14*
Wellness	Procrastination	-.24	-2.65**	.06	6.98**
Illness	Wellness behaviors	-.09	-0.99	.01	0.65
Illness	1. Wellness behaviors	-.05	-0.49	.00	0.13
	2. Procrastination	.19	2.08*	.04	3.38

Note: When two predictor variables are included in the same analyses, the regression statistics reflect the effect of each variable when entered into the regression equation last.

When 1 predictor is entered, F value is for (1, 118) degrees of freedom; when two predictors are entered, F value is for (1, 117) degrees of freedom

$N = 120$, * $p < .05$, ** $p < .01$, *** $p < .001$