

Effects of Perceived Health on Time Perception

by

Dalton M. Brown

A thesis submitted to the Faculty of Graduate and Postdoctoral Affairs

in partial fulfillment of the requirements for the degree of

Master of Arts

In

Psychology

Carleton University

Ottawa, Ontario

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Dalton M. Brown

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Abstract

Two online studies investigated the nature of the relationship between health and the perception of future time while controlling for chronological age and subjective age. In the initial pilot study ($N = 351$), I analyzed the relationship between multiple facets of health (i.e., frequency of exercise, preoccupation, and perceived health) and open-ended future time perspective, planning behaviours and the subjective passage of time. This study showed a significant positive relationship between perceived health and time perception, such that participants with a more positive self-evaluation of their current health reported a more open-ended future, more future planning behaviours and that the passage of time felt longer. Study 2 ($N = 298$) used temporal comparisons to momentarily manipulate participant's subjective physical health, prior to measuring time perception variables. Although the experimental manipulation of subjective health was not significant and causal links of health and time perception could not be determined, subjective health was again correlated with more open-ended future time perception and more future planning. The implications of the findings and directions for future research are discussed.

Keywords: subjective health, time perception, future time perspective, planning, optimism, passage of time, age, subjective age.

Effects of Perceived Health on Time Perception

Humans have the unique ability to imagine the future. Throughout human history, people have existed in a temporal context where their sense of self and their actions are guided not only by present circumstances, but also by what they expect their life to look like in the future. The way people think about their personal future, however, is different for each person. Some people might imagine the future as open-ended, imagine they have lots of time to do what they want, and make plans for the future. Other people might imagine the future as limited, and with that imagine they have less time to do what they want and make no or few plans for the future. Some people might plan for years in the future and strive to accomplish what is necessary to reach those plans. While others may limit themselves to thinking only about the next day or week. With all these possibilities and many others in mind, it is crucial to understand antecedents of individuals' outlook on the future.

There are multiple factors that predict this change in future outlook. One factor is chronological age of the individual. For example, older people have been found to have a more limited perception of their future (Demiray & Bluck, 2014), and tend to make fewer plans for the future (Kotter-Grühn & Smith, 2011), all the while time appears to be passing by much slower (Droit-Volet, 2019) than previously experienced years. Another factor may be the individuals' health. As people get older their health, generally speaking, gets worse. Health struggles may play a crucial role in future outlook beyond just age. For instance, a person with deteriorating physical health may perceive their future outlook that is very bleak, whereas a person in perfect health may have a future outlook that is filled with endless possibilities. Previous research has shown individuals that report engaging more in risk behaviours reported less future orientation (Henson et al., 2006). However, less research has investigated how feeling physically and

mentally healthy might promote an open-ended time perspective (Kooij & Voorde, 2011) and lend itself to making more plans for the future. In the current research I examined whether subjective health (i.e., perceived health) in the present moment has an effect on individuals' perception of their future, above and beyond the age of a person.

Time Perception

The perception of time can be conceptualized in many different ways and can be investigated with a variety of methods. For example, one aspect of time that has been shown to be psychologically relevant is the perceived distance to events and the self in the past and future (e.g., Kornadt et al., 2015; Rutt & Löckenhoff, 2016). Two additional commonly used methods for assessing time perception include analyzing the perceived duration of specific time periods or events (e.g., Ando et al., 1999; Winkler et al., 2017) and the open-endedness of an individual's perceived future (also termed future time perception, e.g., Rakowski, 1979; Lang & Carstensen, 2002). In the current study I focus on people's future time perspective, planning, and their perceived duration of time periods.

Future Time Perspective

Future time perspective can be defined as perceiving time as open-ended or limited, or in other words, a perspective on how much time people perceive they have remaining in their life. Derived from the Socioemotional Selectivity Theory (Carstensen, 1992; Carstensen et al., 1999; Lang & Carstensen, 2002), the perception of future time has been identified as fundamental to human motivation. Meaning that an individual's life cycle and future time perspective influences the importance of certain functions such as emotional regulatory goals, their self-concept, and knowledge acquisition goals (Carstensen, 1992; Carstensen et al., 1999). Future time perception has been operationalized by multiple valid measures, such as subjective time horizons

(Löckenhoff, 2011), subjective nearness to death (Lang 2000; Kotter-Grühn et al., 2010; Bergman et al., 2018), life expectancy (Mirowsky, & Ross, 2000), desired longevity (Lang et al., 2007) and the future time perspective scale (Carstensen & Lang, 1996). One of the most widely used measures of future time perspective in psychology and aging research is the Future Time Perspective Scale (FTPS; Carstensen & Lang, 1996; Kooij et al., 2018). More specifically, the Future Time Perspective Scale is derived from the Socioemotional Selectivity Theory and measures an individual's perceptions of their time remaining to live and their remaining opportunities in life. Someone who sees the future as open ended (i.e., they would score high on this scale) would think they have plenty of remaining time to live, and with that may have more hopes, aspirations, and expectations about what the future holds. In contrast, someone who sees the future as limited (i.e., they would score low on this scale) would think they do not have much time remaining to live and tend to have a more negative outlook towards the future, which may consist of fewer desires and wishes for their lives.

Individuals' future time perspective is meaningful, as previous research has shown that individuals who perceive a limited future (i.e., less time remaining in their lives), tend to report more emphasis on emotionally meaningful goals and social interactions as opposed to knowledge-related goals (Lang & Carstensen, 2002; Carstensen, 2006), while the opposite effect is found among individuals reporting an open-ended future perspective. Furthermore, a limited future time perspective has been found to be related to more negative affect (Kooij et al., 2018), more maladaptive emotional adjustments in aging (Grühn et al., 2016), less autonomy and optimism (Kotter-Grühn et al., 2010; Coudin & Lima, 2011), as well as greater preoccupation with the past (Simons et al., 2004). However, when individuals maintain an open-ended future time perspective, they tend to report more adaptive emotional adjustment, preoccupation with the

present time and future (Grühn et al., 2016; Simons et al., 2004), less depressive symptoms (Coudin & Lima, 2011), increased life satisfaction, and more proactive planning for retirement (Kooij et al., 2018). These studies utilized correlational designs that assessed the relationships between an individual's future time perspective and the outcome variables, indicating that future time perspective is likely associated with how people plan their lives. More specifically, the research indicates that thinking of the future as open ended may induce people to engage in more planning behaviours. For instance, it is possible that individuals with a more open-ended future time perspective might make plans for next week such as arrange appointments and social visits or plans for years in the future such as forming educational or career goals.

Future Planning

In addition to future time perspective, previous research has also examined future planning (Kotter-Grühn & Smith, 2011). Future planning has been recognized as a self-regulatory process that contributes directly to the individual's development (Bandura, 2006). More specifically, two of the four core properties of human agency in development Bandura (2006) described related directly to the future and planning; 1) intentionality, and 2) forethought. Intentionality refers to the development of action plans and strategies to accomplish personal objectives, whereas forethought specifically involves the temporal extension of agency beyond future-directed plans. Researchers have argued that planning for the future serves as an adaptive function in human beings that is complex, flexible, and temporally extensive responses to the environment (Klein et al., 2010), that improves considerably when an individual's plans are based on similar previously experience events (Klein et al., 2012). From a life-span perspective, Smith (1999) suggests that planning for the future is crucial in time-management, resource-management, interpersonal-management, and self-management, all of which may serve a

different purpose in different domains of each individual's life. Prenda and Lachman (2001) recognized two different categories of research on planning, 1) problem-solving process and task completion, and 2) open-ended, generalized life planning tasks. The latter of which is of primary interest in the current research, given that future planning serves to maintain one's direction and control in their life.

Planning for the future is meaningful given that previous research has shown planning for the future is positively related to future outlooks and optimism towards the future (Chang & Sanna, 2001; Prenda & Lachman, 2001). Future planning serves as a mental strategy to prepare an individual for future action and goal-directed behaviours (Gollwitzer, 1996). Furthermore, previous research suggests that planning for the future may serve by initiating proactive coping mechanisms (Aspinwall & Taylor, 1997), which may aid in reducing potential future stressors (Taylor et al., 1998) and allow people to feel more prepared for their possible future and self (Smith, 1999). Future planning serves a crucial role in forming intentions and identifying desired future outcomes, leading to subsequent actions and behaviours, which in turn eventually lead to desired outcomes (Gollwitzer, 1996; Bandura, 2006). Planning might also be linked to another aspect of time perception: the perceived duration of time periods. People might make more plans if they perceive more time available to pursue these plans in (i.e., if they have a more open-ended time perspective).

Subjective Duration of Time

Past research has also examined the subjective experience of event or time period duration through measuring the subjective passage of time (Wearden, 2005; Sucala et al., 2011), also referred to as the perceived speed of time. This research has mostly focused on shorter time periods in the seconds and minutes range (Block & Zakay, 1997). Often times, when

investigating the subjective experience of time, researchers have used a technique referred to as interval length estimation (i.e., in seconds, minutes, etc.), which are subjective evaluations for a specific duration (Sucala et al., 2011). Previous research investigating the speed of time passing has used both retrospective (estimate duration after an event) and prospective (tracking perceived duration while experiencing the event) time judgments (Wearden, 2016). The speed at which time passes is highly subjective. For example, individuals perceive time as passing more quickly when they are enjoying themselves (Wearden, 2005). Additionally, studies found that boredom led to individuals reporting the passage of time as being slower than normal time and they tended to estimate the duration of the time period as much longer than individuals who enjoyed their time (Watt, 1991; Wearden, 2005), indicating that time seemed to drag. Furthermore, multiple studies have found multiple other factors that influence the subjective passage of time such as, temporal relevance (i.e., awareness of time limit on task, Sucala et al., 2011), emotional state (Droit-Volet & Wearden, 2015), task difficulty (Sucala et al., 2011), and life circumstances and experiences (Flaherty et al., 2005).

Age and Time Perception

All the discussed aspects of how people perceive time have been linked with age. Below I review how future time perspective, planning, and subjective duration perception of time periods change as people age.

Future Time Perspective

There is a plethora of empirical evidence surrounding the effect of age on future time perspective (Demiray & Bluck, 2014; Kooij et al., 2018). As might be expected, a common finding in research is that with increasing age comes a more limited future time perspective (Lang & Carstensen, 2002; Demiray & Bluck, 2014; Grünh et al., 2016). This is in part due to

the size of a decreased social network (Lang & Carstensen, 1994; Lang, 2000) and putting more priority on emotionally meaningful goals (Lang, & Carstensen, 2002). However, the relationship between age and future time perspective is more complicated than a simple linear relationship. While older adults tend to report a more limited future time perspective (Grühn et al., 2016), some studies have found a curvilinear relationship between age and future time perspective. In other words, younger individuals perceive the future as increasingly more open ended as they age but once they reach and surpass middle age, individuals perceive the future as more limited (Kooij et al., 2018). Additional studies have found that older adults who report an open-ended future time perspective, most often had a higher income and education, and tended to be male (Padawer et al., 2007). Interestingly, research has shown that having an open-ended future time perspective mediated the relationship between positive affect and purpose in life (Hicks et al., 2012).

In addition to chronological age, subjective age has also been linked to future time perspective. Stephan and colleagues (2018) found that, on average, individuals felt 15-16 % younger relative to their chronological age. Weiss and Lang (2009) found that individuals that feel younger than their chronological age (i.e., the subjective age bias), reported a more open-ended future time perspective, whereas individuals that identify with their age cohort reported a more limited future time perspective along with lower psychological well-being.

Future Planning

Aging individuals tend to be less optimistic about reaching future goals (Kotter-Grühn & Smith, 2011) and less likely to plan for the future (Prenda & Lachman, 2001). However, similar to the evidence on age and future time perspective, previous research has demonstrated that the relationship between future planning behaviours and age can be curvilinear. Studies have found

that as individuals age from adolescence into young adulthood they report planning more for the future (Cameron et al., 1977; Nurmi, 1991); but once adults reach late middle-age and old-age future planning behaviours decrease (Fingerman & Perlmutter, 1995; Kotter-Grühn & Smith, 2011). Interestingly, Fingerman and Perlmutter (1995) found that young adults tend to think less about the future overall compared to older adults, but when young adults do think about the future it often involves a more distant time period than when older adults think about the future (i.e., a year from now, ten years from now), again reflecting how older individuals perceived limited future. Research has also demonstrated that older adults who manage to remain optimistic about their future and make plans for the future, reported higher life satisfaction than individuals that do not make future plans (Prenda & Lachman, 2001; Chang & Sanna, 2001). In sum, research has shown that tendency for planning is related to the age of a person.

Subjective Duration of Time

Age can also affect how long a year (or other periods of time) feels to a person. Some studies have found that as individuals age, they tended to report time as passing slower when they were younger relative to their current age (Droit-Volet, 2019; Lemlich, 1975; Walker, 1977; Gallant et al., 1991), indicating the acceleration of time with age. For example, a study conducted with a sample of older adults at least 64 years of age, found that individuals over 75 years of age reported the present time as passing slower than individuals under 75 years of. Age (Droit-Volet, 2019).

However, other studies have found that time passes faster with age (Friedman & Janssen, 2010; Gallant et al., 1991; Winkler et al., 2017; Wittman & Lehnhoff, 2005). In fact, Gallant and colleagues (1991) found that, on average, a person 19 years of age will retrospectively report the current year as feeling 1.4 times shorter in duration than the previous year. Similarly, older adults

reported the previous 10 years as passing much faster than younger adults (Wittman & Lehnhoff, 2005; Friedman & Janssen, 2010). Passage of time is linked to completing more monotonous daily activities and fewer new life experiences as well (Winkler et al., 2017), so a faster perceived passage of time might be due to a more established life as people grow older.

Finally, some studies did not find any significant differences in the perceived passage of time in the present moment between young adults and older adults (Droit-Volet & Wearden, 2015). The relationship between age and the perception of the passage of time or how long time periods feel likely depend on several other factors.

Age and Health

As people age, a number of things in their life changes. One of the most common things that change is their health. Health is often studied as a multifaceted concept, often operationalized using subjective and objective measures (Connor Gorber, 2009). Subjective health measures focus on individual feelings regarding aspects of their health, whereas objective measures are quantifiable in that they can be directly measured.

As people get older, they tend to have more chronic health issues (World Health Organization, 2017). For example, Lewington and colleagues (2002) found that older adults tend to have higher blood pressure than younger adults, and that older adults displayed relatively higher rates of mortality from stroke and heart disease. Furthermore, research has found an increase in chronic health conditions among older adults (65 years and older) in the United States (Boersma et al., 2020; Ward et al., 2014). Some of these objective measures of health include Body Mass Index (BMI), body fat percentages, clinician diagnoses, among others (Connor Gorber, 2009). However, these direct measures tend to be more intrusive, are difficult to obtain, and may decrease response rate in studies (Connor Gorber, 2009).

Subjective measures of health have focused on perceived general health, physical and/or mental health (Kristensen et al., 2005; Ngamaba et al., 2017), quality of life (Pinquart & Sörensen, 2000), happiness (Yang, 2008a), subjective well-being (Pinquart, 2001), and many others. More specifically, Pinquart (2001) found that subjective health was positively correlated with physical health, mental health, and functional health as well as multiple objective health measures including physician-rated health. Subjective health has also been demonstrated to be a predictive factor of late-life health changes that may occur prior to death (Gerstorf et al., 2008). Additionally, research has demonstrated that self-reported/subjective measures of health are reliable (Lundberg & Manderbacka, 1996), and predictive indicators of mortality (Sillén et al., 2005) and other health-related problems (Sajjad et al., 2017).

Health and Time Perception

Due to the close link between age and health, it is possible that some of the effects of age on time perception discussed in the previous sections may be explained by individuals' subjective feelings of health. Extant research on the link between health and time perception tends to focus primarily on subjective well-being and life satisfaction as the health variables of interest (Guthrie et al., 2009; Düzel et al., 2016), as opposed to subjective ratings of physical health. For example, a systematic review of research on the future time perspective scale by Kooij and colleagues (2018) found that life satisfaction, happiness, subjective health, and physical exercise were positively associated with future time perspective, while depression, substance use, and risk behaviours (e.g., drinking and driving) were negatively associated (Kooij et al., 2018). However, of the 212 studies included in the meta-analysis, only 39 examined the relationship between these variables and the Future Time Perspective Scale (Carstensen & Lang, 1996), whereas most of the studies assessed this construct with other scales.

One paper that did directly examine the relationship between subjective general health, using a single item (i.e., “*in general, would you say your health is excellent, very good, good, fair, or poor?*”), and the Future Time Perspective Scale found a positive relationship (Kooij & Voorde, 2011). Indicating that individuals that experienced an increase in subjective general health between two measurement dates also reported subsequent increases in open-ended future time perspective. Specifically, experiencing an increase in subjective general health over time predicted experiencing an increase in the perceived open-endedness of an individual’s future, whereas experiencing a decrease in subjective general health predicted a more limited future time perspective (Kooij & Voorde, 2011). In contrast, when examining the link between future time perspective and physical fitness among older adults, Düzel and colleagues (2016) did not find a significant relationship between the two variables. This may indicate that the link between subjective health and time perception needs to be investigated further as it may contribute to explaining the well-established link between age and time perception.

There is also indirect evidence on the link between health and time perspective: Individuals that have a more open-ended future time perspective tend to report engaging in more protective health behaviours (Hamilton et al., 2003), such as practicing safe sex (Agnew & Loving, 1998), less smoking (Keough et al., 1999; Adams & Nettle, 2009), less alcohol consumption (Henson et al., 2006), and less substance abuse (Mahon & Yarcheski, 1994, 1997, 2000), more physical activity (Hall & Fong, 2003), more seat belt use (Daugherty & Brase, 2010), less risky driving (Zimbardo et al., 1997), and many more protective health behaviours (Picone et al., 2004). Interestingly, Gellert and colleagues (2012) found that among individuals with a limited future time perspective, intentions to engage in healthier behaviours were more likely to follow through on the actions to improve their health.

In sum, while previous research has identified the existence of a relationship between subjective health and future time perception, the exact nature of the relationship remains unclear. As mentioned previously, only one study found subjective health predicted changes in future time perception (Kooij & Voorde, 2011), other studies have not found consistent finding (Kooij et al., 2018). Therefore, in the present research I will be examining how subjective health influences future time perception, planning, and the subjective passage of time. In other words, how does someone's feelings about their own health influence how much perceived time they have remaining in life?

Study 1: Correlational Study

The present research aims to examine how health might contribute to explaining variations among individual's perception of time – open-ended time perspective, planning, and subjective duration – beyond the effects of chronological age. Given previous research, I hypothesized that individuals experiencing better health in the moment will report a more open-ended future time perspective, and more plans for the future relative to individuals with poorer ratings of health. However, given the inconsistent findings regarding the subjective passage of time, I am unable to hypothesize how subjective health relates to the passage of time.

In this initial study, I examined multiple aspects of health as well as age and their link with future time perspective, future planning, and subjective duration estimates of time. This initial study showed evidence that subjective health was linked consistently with the different aspects of time perception, above and beyond the effects of age. The purpose of this exploratory study was to establish a link between health and time perception, while controlling for age.

These finding guided the subsequent experimental study.

Method

Participants

I recruited 401 North American participants through Amazon Mechanical Turk (MTurk) on June 18, 2020, to take part in an online survey. Of the initial 401 observations, 37 participants were excluded from further analysis because they provided a nonsense response to an open-ended attention check item, and 12 participants were excluded because their response sets were incomplete (i.e., if two or more items are missing data from the predictor variables or dependent variables of interest). Furthermore, the Mahalanobis distance statistic identified one additional outlier on the Future Time Perspective Scale (FTPS) was also removed. The final sample size consisted of 351 participants between the ages of 18 and 71 years old ($M_{age} = 36.02$, $SD_{age} = 10.67$; 66.1% male, 33.9% female; 346 Canadians, 5 non-Canadians). The study took approximately 7 minutes to complete, and respondents were compensated \$0.75 for their time.

Measures

Demographics. All participants reported their gender, age, ethnicity, current country of residence, and employment status. Given the interest in age and the perception of time, I also asked participants to rate where they perceive themselves currently in their life on an analogue-type scale from 1 to 100, with the anchor points marked as “*Birth*” to “*Death*”, respectively. Similar measures have previously been employed in time perspective research such as the Rappaport Timeline (Rappaport et al., 1985), the Line Test (Cottle, 1976), or the Time Bar Procedure (Rychlak, 1972). However, the timeline measures different aspects of time based on what participants are asked to mark along the timeline (e.g., personal past, personal future, historical past, historical future, Rappaport et al., 1985; experiences in life, Rychlak, 1972). The current study utilizes the single item to examine where participants perceive themselves currently

in life relative to their birth and eventual death, we refer to this variable as subjective life position, similar to the methods employed by Hicks and colleagues (2012). Participants were also asked, “*are you currently living with a permanent health condition?*” as an exploratory measure, responses were coded as 1 (“*yes*”) and 2 (“*no*”). Additional demographic measures were assessed but are not reported further below (See Appendix A for full survey).

Health Measures. Participants were asked to provide three separate ‘subjective’ ratings of health for their current mental (i.e., *how would you rate your current mental health?*), physical (i.e., *how would you rate your current physical health?*) and overall health (i.e., *how would you rate your current health in general?*) on a 7-point Likert-type scale ranging from 1 (“*very poor*”) to 7 (“*excellent*”). For the current study, these items were combined to create what will be referred to as the Subjective Health Scale (SHS), which was utilized as an overall measure of participant’s perceived subjective health. All participant’s responses were averaged across the three items and demonstrated a high degree of reliability (Cronbach’s $\alpha = .83$).

Next, participants were asked to estimate how often in the previous 4 weeks they had engaged in physical activities of various intensity levels (e.g., vigorous, moderate, and light). Each of the three items were measured on a 5-point scale ranging from 1 (“*less than one hour per week*”) to 5 (“*8 or more hours per week*”). These three items were combined to form an Exercise Scale (Cronbach’s $\alpha = .69$).

Additionally, five additional items were included to assess individuals’ preoccupation with their health. Three items pertaining to the degree to which participants think about their current physical health and how worried they are about their future health were worded as follows, 1) *How often do you think about your physical health in a typical day?* 2) *How worried are you about your current physical health?* and 3) *How worried are you about your future*

physical health? Each item was measured on a separate scale ranging from 1 (“*never*” or “*not at all*”) to 5 (“*very often*” or “*very worried*”). Two items pertained to preoccupation with pain and were worded as follows, 1) *How much bodily pain have you experienced during the past 4 weeks?* 2) *In the past 4 weeks, how much has your physical health interfered with your daily life?* Each of was scored on a 6-point Likert-type scale ranging from 1 (“*none*” or “*not at all*”) to 6 (“*very severe*” or “*extremely*”). These five items were averaged to provide a measure of participants’ preoccupation their physical health, which will be referred to as the Preoccupation with Pain and Health Scale (PPHS). The PPHS also demonstrated high internal consistency (Cronbach’s $\alpha = .86$; ICC = .54).

All the health-related items were constructed or modified ad-hoc by the researcher from previously validated questionnaires (i.e., RAND-36) based on theoretical distinctions, and to limit the total number of items included in the online survey to increase response rates on MTurk. A factor analysis was conducted with all health-related items to differentiate between multiple components of health. See results section for factor analysis.

Time Perception Measures. Participants completed the Future Time Perspective Scale (FTPS; Carstensen & Lang, 1996). This scale was developed within the Socioemotional Selectivity Theory (SST) framework, which predicts that motivational changes across life span are due to age-related alterations in the perception of time remaining in life (Carstensen, 2006). The FTPS consists of 10-items rated on a 7-point Likert-type scale from 1 (*very untrue*) to 7 (*very true*). Scoring on the FTPS involves reverse coding items 8, 9, and 10, followed by calculating participant’s mean scores for the ten items. Higher scores indicate a more positive an individual’s perception is of their future. Our sample demonstrated high internal consistency (Cronbach’s $\alpha = .86$).

Adapted from Kotter-Grühn and Smith (2011), future planning was measured by three separate items (e.g., “*I have made plans for the next year.*”). All three items were measured on a 5-point Likert-type scale from 1 (*does not apply to me at all*) to 5 (*applies very well to me*). Where high scores indicate positive future perceptions and more planning for future events. The three future orientation items proved to have high reliability (Cronbach’s $\alpha = .78$). A general item assessing participant's optimism towards the future rated on a scale from 1 (“*does not apply to me at all*”) to 5 (“*applies to me very well*”) was also included as an exploratory item.

Additionally, participants were asked to provide three estimates of the subjective duration of how long a specific time period feels (i.e., a year, a month, and a week) to them on an analogue scale from 1 (“*feels very short*”) to 100 (“*feels very long*”). Scores for each of the three items were averaged across participants to provide a measure of subjective duration. Higher scores indicate the longer time periods feel to the participant. The three items provided high interclass correlations ($ICC = .57$) as well as internal consistency (Cronbach’s $\alpha = .80$).

Exploratory Item: Time Movement. I also assessed a single item to examine temporal reasoning as an outcome measure. Participants were asked to “*imagine that you have a meeting next Wednesday. If that meeting is moved forward two days, what day will it be on now?*” A response of “Monday”, indicates the individual perceives time as moving forward (time-moving perspective, coded as “1”) whereas a response of “Friday” indicates the individuals views themselves as moving through time (ego-moving perspective, coded as “2”). Previous research has demonstrated that this metaphor is indicative of how individuals perceive space and time along a continuum (Duffy et al., 2014), and that individual’s may change their perception of the time depending on the valence of the future event (Lee & Ji, 2014). For instance, recalling a negative past event resulted in more the ego-moving responses, to put further separation between

the individual and the negative event. Whereas recalling a positive, pleasant event prompted the time-moving perspective so individuals may feel closer to the pleasant memory. This item also served as an attention check, as everyone who entered nonsense responses in the open-ended textbox was excluded. See Appendix A for the initial study survey.

Results

Initial Analyses

All statistical analyses were conducted using IBM SPSS Statistical software version 27. Basic scale descriptive statistics, Cronbach's alpha, and Intraclass Correlation Coefficients (*ICC*) for the scales of interest are shown in Table 1. All scale measures demonstrated satisfactory, if not excellent, internal reliability and there were no issues with skewness or kurtosis that required any transformations to correct for them.

Table 1

Descriptive Statistics and Cronbach's Alpha

Variable	<i>M</i>	<i>SD</i>	α	No. Items	<i>ICC</i>
Age	36.02	10.67		1	
Life Position	55.02	20.80		1	
Subjective Health scale	5.66	0.99	.83	3	.62
Exercise scale	2.94	0.93	.69	3	.42
Preoccupation with Pain & Health	2.88	1.05	.85	5	.54
Future Planning scale	3.35	1.05	.78	3	.55
Subjective Duration Estimates	53.57	23.12	.80	3	.57
FTPS	4.53	1.05	.86	10	.38

Note. $N = 351$. FTPS = Future Time Perspective Scale. Estimated ranges for above variables were as follows: Age = 18 – 71, Life Position = 1 – 100, Subjective Health Scale = 1 – 7, Exercise Scale = 1 – 5, Preoccupation with Pain and Health Scale = 1 – 5, Future Planning Scale = 1 – 5, Subjective Duration Estimates = 1 – 100, FTPS = 1 – 7.

Factor Analysis. Prior to analyzing our primary hypotheses of interest, a factor analysis among the results to the 11 health-related items was performed using the Principal Component Analysis method of extraction. Bartlett's test of sphericity was significant ($\chi^2(55) = 1731.79, p < .001$) indicating the overall of all the correlations within the correlation matrix was statistically significant, and that a factor analysis among these items was appropriate given our data. The Kaiser-Meyer-Olkin measure of sampling adequacy indicated that the proportion of variance among the items was high (KMO = .80); thus, conducting a factor analysis was deemed appropriate.

Initially, the 11 health-related items were entered into a factor analysis with a Direct Oblimin rotation given the extracted components were expected to be highly correlated as facets of health. The initial analysis extracted two components with Eigenvalues exceeding 1, which accounted for 60.17% of the cumulative variance within the response set.

The first component had a high eigenvalue of 3.802 and uniquely accounted for 34.56% of the variance in the data. The second component had an eigenvalue of 2.82 and accounted for an additional 25.60% of variance in the data. However, a third component that was not extracted had an eigenvalue of 0.94 in the initial model despite accounting for an additional 8.57% of variance. Therefore, a second factor analysis was conducted set to extract three components.

In the second factor analysis, the overall model explained 68.73% of the cumulative variance in the data. The pattern matrix demonstrated that factor loadings on each of the three components provided the most simplistic structure of the for the model. Component 1 contained the 3 preoccupation with health items as well as the two pain-related items. In theory these 5-items all tended to focus on an individual's awareness with their health, therefore we identify this factor as Preoccupation with Pain and Health scale (PPHS). The second extracted factor, accounting for 25.60% of the variance in the data had high factor loadings from our three original subjective health items, which reinforced the original establishment of the Subjective Health Scale (SHS). Finally, the third factor, which uniquely explained an additional 8.57% of the variance in the data, had all three exercise-related items with high negative factor loadings, suggesting this component was oriented towards activity level per week. This third component was identified as our Exercise scale (ES). The obtained pattern matrix is displayed in Table 2.

Table 2

Factor Analysis applying Direct Oblimin Rotation Outcome Pattern Matrix

Items	Factor		
	1 Preoccupation with Pain and Health	2 Subjective Health	3 Exercise
Worry about current health	.85		
Pain Interference	.80		
Worry about future health	.80		
Think about health	.76		
Pain	.71		
General Health		.89	

Physical Health			.84	
Mental Health			.84	
Light Exercise				-.83
Moderate Exercise				-.76
Vigorous Exercise				-.57
Percentage of Variance	34.56		25.60	8.57
Eigenvalue	3.80		2.82	0.94

Notes. Extraction method: Principal Component Analysis. Rotation method; Direct Oblimin with Kaiser normalization. Loadings less than .40 are suppressed.

Bivariate Correlations. Next, bivariate correlations were conducted between all health-related measures and time-related measures to ensure all the items and scales demonstrated the proper convergent and discriminant validity as well as content validity. Table 3 demonstrates the scale bivariate correlations.

Table 3

Bivariate Correlations

Variables	1.	2.	3.	4.	5.	6.	7.
1. Age	–						
2. Life Position	.35**	–					
3. Subjective Health	.14**	-.03	–				
4. Exercise	-.02	.27**	.28**	–			
5. PPHS	.03	.47**	-.14**	.46**	–		
6. Future Planning	.05	.16**	.35**	.35**	.32**	–	

7. Subjective Duration	-.03	.41**	.19**	.45**	.58**	.34**	–
8. FTPS	-.17**	-.30**	.52**	.17**	-.19**	.28**	-.02

Note. $N = 351$. * $p < .05$, ** $p < .01$. PPHS = Preoccupation with Pain and Health Scale, FTPS = Future Time Perspective Scale.

Primary Analyses

Next, I examined whether health indicators independently predicted each of the time perspective variables. Three separate multiple linear regression analyses were conducted using a backward stepwise selection process to develop a model for predicting different aspects of future time perception. The backward stepwise regression approach was used in the initial study because I was most interested in identifying the predictors that were most influential from a set of five predictors. Mantel (1970) suggests that with fewer predictors (i.e., five) the backward stepwise regression approach is more suitable given that the mean square error terms are more unbiased at each step because only important predictors are retained. Given that I expected the predictors to be related to one another, the backward stepwise regression approach allowed me to reduce multicollinearity as well as the final number of predictors included in the final model, which avoids the problem of overfitting the data to the model (Hocking, 1976). Therefore, the initial full model for each of the three outcome variables consisted of five total predictor variables, age, life position, and our three health indicators of interest, the Subjective Health Scale (SHS), the Preoccupation with Pain and Health Scale (PPHS), and the Exercise Scale.

At each successive step, the predictor with the lowest semi-partial correlation (sr^2) with the dependent variable was removed. By using the semi-partial correlation coefficient of determination, predictors were removed based on their importance in the analysis. In other words, based on the unique proportion of variance in the outcome variable of interest that is

explained by that individual predictor. All multiple regression assumptions were checked and satisfied prior to reporting results below (i.e., no multicollinearity, independence of errors and normality of errors, homoscedasticity, no outliers, and linearity and additivity).

Future Time Perspective. The overall model was significant and predicted 38.2% of the total variance in the Future Time Perspective scale ($F(5, 345) = 42.59, p < .001$). Upon analyzing semi-partial correlations, the Preoccupation with Pain and Health scale (PPHS) was identified as the least valuable predictor of FTPS, accounting for almost none of the variability in responses ($sr^2 < .01$). Therefore, it was removed from Model 2 of the backward stepwise regression. The subsequent model consisting of the four remaining predictors of interest accounted for a similar amount of total variability in the FTPS as our full model ($R^2 = .38, F(4, 346) = 52.93, p < .001$). At this point in the analysis, no additional predictors could be removed with significantly reducing the overall model fit. This final model is shown in Table 4. Of the four remaining predictors, subjective health was deemed the most important predictor in the model, accounting for 22.5% of the unique variance in FTPS. Suggesting that the more positive an individual's rating of perceived general, physical, and mental health is, the more positive subsequent perception of the future is. The next most valuable variable in the analysis was shown to be where participants viewed their current position in life, which explained an additional 5.1% of unique variance in responses to the FTPS. Indicating that the more advanced an individual is in life, the less likely they are to have a positive attitude towards the perception of future time.

Table 4

Backward Stepwise Regression Predicting Future Time Perspective Scale. Model 2

Predictors	<i>b</i>	<i>SE_b</i>	β	<i>Sig.</i>	<i>sr²</i>
Age	-0.02	0.01	-.15**	.002	.02

Life Position Item	-0.01	< 0.00	-.26**	< .001	.05
Subjective Health Scale	0.54	0.05	.51**	< .001	.23
Exercise Scale	0.11	0.05	.09*	.047	.01

Note. DV: Future Time Perspective Scale (FTPS). * $p < .05$, ** $p < .01$.

Future Planning. The future planning scale adapted from Kotter-Grühn & Smith (2011) was also significantly predicted by the five predictor full model ($R^2 = .27$, $F(5,345) = 25.26$, $p < .001$). In the initial model, age contributed the least to the overall model by accounting for almost no unique variability in future planning ($sr^2 < .01$; $\beta(345) = -.00$, $t(345) = -0.01$, $p = .991$) and was removed.

The model remained significant and accounted for the exact same amount of total variability (26.8%) in future planning ($F(4,346) = 31.66$, $p < .001$). Perceived current position in life was also a non-significant predictor of future planning ($sr^2 < .01$; $\beta(346) = -.02$, $t(346) = -0.37$, $p = .708$) and was removed prior to the third iteration. The third step in the backward regression consisted of three predictors that significantly accounted for the same amount of variance (26.8%) in future planning ($F(3,347) = 42.27$, $p < .001$). Additionally, exercise was identified as the least valuable predictor in the model, accounting for 0.07% unique variance in future planning ($\beta(347) = .09$, $t(347) = 1.56$, $p = .119$), and was also removed prior to identifying the reduced model of best-fit.

Finally, the fourth back regression model was deemed the model-of-best-fit, with only two predictors remaining, the subjective health scale and the preoccupation with pain and health scale ($F(2,348) = 61.93$, $p < .001$). Table 5 displays this model of best-fit. The reduced model accounted for 26.2% of the total variability in the future planning scale. Furthermore, the

subjective health scale uniquely accounted for 15.9% of the variance in future planning, while the preoccupation with pain and health scale accounted for an additional 13.99% unique variability in future planning. The overall model results indicate that an increase in subjective health as well as an increase in preoccupation with pain and health corresponds with a significant increase in future planning specifically.

Table 5

Backward Stepwise Regression Predicting Future Planning Scale. Model 4

Predictors	<i>b</i>	<i>SE_b</i>	β	<i>Sig.</i>	<i>sr²</i>
Subjective Health Scale	0.43	0.05	.40**	< .001	.16
PPHS	0.38	0.05	.38**	< .001	.14

Note. PPHS = Preoccupation with Pain and Health scale. DV: Future Planning scale. * $p < .05$, ** $p < .01$.

Subjective Duration of Time. Although the full backward stepwise regression model with the five predictor variables accounted for a significant proportion of variance explained in responses to subjective estimates of time period lengths ($R^2 = .46$, $F(5,345) = 58.46$, $p < .001$), it was not the model of best-fit. The results showed that exercise duration was not a significant predictor of subjective duration estimates despite approaching the significance threshold ($\beta(345) = .10$, $t(345) = 1.95$, $p = .051$), accounting only for 0.06% unique variance and was removed.

Therefore, the second step of the backward regression consisted of the four remaining predictors and continued to account for a significant proportion of variance in the outcome variable. The reduced model was significant and explained 45.3% of the variability in responses to subjective duration estimates of time periods ($F(4,346) = 71.53$, $p < .001$). The results of this

final backward stepwise regression are shown in Table 6. The most valuable predictor in the reduced model was the preoccupation with pain and health variable, which accounted for over 20% of the unique variance in subjective duration estimates of time periods, indicating that an increase in preoccupation with pain and health predicted a substantial increase in the length of subjective duration estimates. The second most important predictor in the model was subjective health, followed by perceived position in life, and age. As an individual perceives an increase in their subjective health and in their current life position (i.e., closer to death), they also experience time periods as being significantly feeling longer. Additionally, as an individual ages they perceive time periods as being shorter, even while controlling for all other predictors.

Table 6

Backward Stepwise Regression Predicting Subjective Duration Estimates. Model 2

Predictors	<i>b</i>	<i>SE_b</i>	β	<i>Sig.</i>	<i>sr²</i>
Age	-0.35	0.09	-.16**	< .001	.02
Life Position	0.25	0.05	.22**	< .001	.03
Subjective Health	6.79	0.95	.29**	< .001	.08
PPHS	11.49	1.02	.52*	< .001	.20

Note. PPHS = Preoccupation with Pain and Health scale. DV: Subjective Duration Estimates of Time Periods. * $p < .05$, ** $p < .01$.

Exploratory Analyses

To examine the potential differences between individuals that reported living with a permanent health condition and individuals living without one, multiple independent samples t-tests were conducted with the health-related and time-related measures as dependent variables.

The results demonstrated there was a significant difference in perceived life position ($t(349) = 6.77, p < .001$), preoccupation with pain and health scale ($t(319.45) = 14.56, p < .001$), future planning ($t(349) = 4.53, p < .001$), subjective duration estimates ($t(325.86) = 8.01, p < .001$), and Future Time Perspective scale ($t(327.59) = -2.37, p = .019$). More specifically, individuals that reported living with a permanent health condition, on average, had a less positive outlook of the future, were more preoccupied with their bodily pain and health, they planned more for future events, and they experience time periods as feeling significantly longer than individuals without a permanent health condition. Group statistics are reported in Table 7 below. Additionally, it is important to note that we did not control for the type of permanent health condition, nor did we inquire further, therefore, it was up to the participant's discretion of what they personally thought of as a permanent health condition, which may have biased the results.

Table 7

Results of Independent Samples T-Test Between Individuals Living with a Permanent Health Condition and Individuals Living Without

	$M_{PHC} (SD)$	$M_{None} (SD)$	t	p
Age	36.46 (10.32)	35.62 (10.98)	0.74	.458
Life Position	62.48 (21.11)	48.32 (18.10)	9.68	< .001
Subjective Health Scale	5.56 (1.05)	5.76 (0.93)	-1.92	.056
Exercise Scale	3.26 (0.91)	2.64 (0.84)	6.62	< .001
PPHS	3.57 (0.91)	2.27 (0.74)	14.56*	.028
Future Planning Scale	3.61 (1.03)	3.12 (1.03)	4.53	< .001
FTPS	4.39 (0.83)	4.63 (1.23)	-2.37*	.019
Subjective Duration Estimates	63.08 (22.97)	44.69 (19.69)	8.01*	< .001

Note. Subscript indicates group: M_{PHC} = Individuals living with a permanent health condition ($n = 165$); M_{None} = Individuals living without permanent health condition ($n = 186$). *Equal variance not assumed due to violation of Levene's test of homogeneity. Estimated ranges for above variables were as follows: Age = 18 – 71, Life Position = 1 – 100, Subjective Health Scale = 1 – 7, Exercise Scale = 1 – 5, Preoccupation with Pain and Health Scale = 1 – 5, Future Planning Scale = 1 – 5, FTPS = 1 – 7, Subjective Duration Estimates = 1 – 100.

The second exploratory analysis investigated participant's optimism towards the future used an additional backward stepwise regression with the same predictor variables as the primary analyses. Overall, the initial model was significant ($R^2 = .44$, $F(5,344) = 53.27$, $p < .001$). However, age was the least valuable predictor in the full model, and was removed from further analyses. The second model containing the four remaining predictors accounted for 43.6% of overall variability in optimism towards the future. The preoccupation with pain and health scale accounted for only 0.06% of the variability in optimism and was therefore removed.

The final model remained significant and continued to account for 43.6% of the total variability in optimism responses, $F(3,346) = 89.02$, $p < .001$). This final backward stepwise regression model is displayed in Table 8. Subjective health was the most valuable predictor in the model, uniquely accounting for 33.9% of the variability in reported optimism towards the future, and indicated that as individual's subjective health increases, their optimism towards the future increases. Additionally, an individual's perceived current life position and reported exercise each accounted for a unique 1.2% of the variability in optimism.

Table 8

Backward Stepwise Regression Predicting Optimism Towards the Future. Model 3

Predictors	<i>b</i>	<i>SE_b</i>	β	<i>Sig.</i>	<i>sr²</i>
Life Position Item	-0.01	0.00	-.11**	< .001	.01
Subjective Health Scale	0.64	0.04	.61**	< .001	.34
Exercise Scale	0.13	0.05	.12**	< .001	.01

Note. DV: Optimism. * $p < .05$, ** $p < .01$.

Finally, the third exploratory analysis investigating temporal reasoning, found only 321 participants (91.5%) provided an answer of either “Monday” or “Friday”. A backward conditional binary logistic regression was conducted investigating the same five predictor variables of interest: 1) age, 2) life position, 3) subjective health, 4) preoccupation with pain and health, and 5) exercise. The initial model accounted for a total of 6.9% ($R^2 = .07$, Cox & Snell; $R^2 = .10$, Nagelkerke) of the variance in temporal reasoning ($\chi^2(5) = 22.93$, $p < .001$). However, age was the only significant predictors of temporal reasoning. By the final step of the backward logistic regression (Step 5), age was the only remaining predictor in the model ($\chi^2(1) = 17.57$, $p < .001$), while accounting for 5.3% of the total variance in temporal reasoning ($R^2 = .05$, Cox & Snell; $R^2 = .07$, Nagelkerke). More specifically, age alone significantly predicted participant’s temporal reasoning (i.e., ego-moving vs. time-moving), and accurately predicted 68.2% of responses (22.3% as time-moving; 92.8% as ego-moving). It was found that for each year increase in age, individuals were 1.05 times less likely to perceived time as ego-moving ($b(1) = -0.05$, $p < .001$; $Exp(\beta) = 0.96$). Table 9 displays step 5 of backward conditional binary logistic regression analysis.

Table 9*Logistic Regression for Temporal Reasoning. Model 5*

Predictors	<i>b</i>	<i>SE_b</i>	<i>Sig.</i>	95% C.I. for Odds Ratio		
				Lower	<i>Exp(β)</i>	Upper
Constant	2.30	0.43			9.99	
Age	-0.05	0.01	< .001	0.94	0.96	0.98

Note. *N* = 320. Participants that responded “Monday” (*n* = 112), versus “Friday” (*n* = 208).

Despite no variables other than age being significant predictors of temporal reasoning, it is still interesting to note that older participants adopted a time-moving perspective by being more likely to answer with “*Monday*”. These results are in line with those of Lee and Ji (2014), perhaps due to the notion that older individuals perceive more pleasant experiences in their past and less pleasant events in their future or current lives; however, this is mere speculation.

Discussion

In this initial study, I examined the possible predictive effects of health on time perception. Based on a factor analysis, three aspects of health emerged: subjective health, exercise, and preoccupation with pain and health. Throughout the statistical analyses, subjective health was consistently linked to all time perception variables of interest. On average, individuals with greater subjective health reported perceiving a more open-ended perception of time on the FTSP, reported more future plans, and reported perceiving time periods as subjectively longer. These results remained significant when controlling for participant’s actual age and subjective age (i.e., perceived life position). Greater preoccupation with pain and health was (independently from subjective health) linked with reporting more plans for the future and reported perceiving

time periods as feeling subjectively longer (i.e., slower passage of time in the present). This may be because those participants who report thinking more about their health also just tend to think more in general (i.e., are more predisposed to planning). Furthermore, more exercise (i.e., hours per week) was also (independently from subjective health) predictive of a more open-ended perception of time on the Future Time Perspective Scale.

Nevertheless, this study examined all potential links between variables through correlational analyses and cannot speak to whether subjective health affected time perception or vice versa. Therefore, in the next study, I attempted to experimentally manipulate subjective health momentarily to examine the potential causal relationships with the various measures of time perception.

Study 2: Experimental Manipulation

The experimental study was designed to build on the results obtained from the exploratory correlational study. The experimental manipulation attempts to momentarily manipulate participant's perception of their subjective physical health; given that subjective health was an important predictor of all the time perception outcomes in the initial study. This manipulation allowed me to test whether immediate ratings of subjective health have a causal influence on individual's outlook on their future.

The theoretical basis of the experimental manipulation of participant's subjective health was derived from the temporal comparison theory (Albert, 1977) and social comparison theory (Festinger, 1954). The temporal comparison theory posits that when individuals are asked to make a temporal or social comparison, there are three possible types of comparisons they could make: 1) a downward comparison, 2) an upward comparison, or 3) a lateral comparison. First, a downward comparison occurs when an individual compares their current self to a more negative

past self (Rickabaugh & Tomlinson-Keasey, 1997). A downward comparison results in more positive ratings of the current self (i.e., favorable/growth). Second, an upward comparison occurs when an individual compares their current self to a more positive past self (i.e., unfavorable), generally resulting in a more negative judgment of the current self (Festinger, 1954). Finally, a lateral comparison occurs when an individual compares their current self to a past self that is perceived the same (i.e., continuity) (Wayment & Taylor, 1995). The fourth condition was a control group, in which participants were not asked to make a temporal comparison.

Given that previous studies have found significant differences in the type of temporal comparison made each condition had a set of specific instructions for participants to complete prior to continuing in the study. For example, Wilson and Ross (2000) demonstrated that when left up to individuals to decide on the type of comparison to make, on average, they were more likely to make downward comparisons and as a result, they reported a perceived improvement over time. More specifically, they found that people with high self-esteem showed an increased tendency to make downward comparisons with their past self (Ross & Wilson, 2002). However, research examining the effect of increased age, has found mixed results in individuals' tendencies to make temporal comparisons. More specifically, Suls and colleagues (1991) found that as individuals age, they were more likely to make unfavourable judgments of the current self through upward temporal comparisons (i.e., more likely to view their past as much more positive than the current self). Furthermore, Ferring and Hoffmann (2007) found that older individuals reported significantly more upward comparisons leading to more unfavourable judgments across multiple health domains (physical fitness, mental fitness, and psychological resilience), and less downward comparisons, and less lateral comparisons than young individuals (Ferring & Hoffmann, 2007). Nevertheless, studies have shown that older adults who engage in more

downward temporal comparisons tend to be better adjusted to the aging process and have improved self-esteem (Rickabaugh & Tomlinson-Keasey, 1997). Therefore, the current study controlled for both actual age as well as subjective age (i.e., perceived life position).

Given that research has shown when individuals are asked to recall past events or selves that were positive, they rated their subsequent subjective well-being lower than if they recalled a negative past event or self (Schwarz & Clore, 1983; Strack et al., 1985). Given these previous findings, the current study was designed to manipulate participant's subjective health in a similar manner by momentarily manipulating affective states to influence ratings of subjective physical health in the current moment.

To momentarily manipulate subjective ratings of physical health, participants were randomly assigned to one of four conditions. The four conditions were as follows: 1) downward comparison, 2) upward comparison, 3) a lateral comparison, and 4) a control condition. The three temporal comparison conditions required participants to provide a brief description of their own health at a time in their life that corresponds with their assigned condition. For example, in the downward comparison condition, participants provided a description of a previous negative state of health relative to their current state of physical health. In the upward comparison condition, participants described a previous time in their life when their physical health was much better than it currently is. The lateral comparison condition asked participants to describe a previous time in their lives when their physical health was similar to their current physical. The control condition did not require participants to make any temporal comparisons.

Research Hypotheses

I expect to find significant differences of subjective physical health between conditions. More specifically, I expect that participants in the downward comparison condition should report

higher ratings of current subjective physical health than individuals in the other conditions. Participants in the upward comparison group should report significantly lower ratings of current subjective physical health than individuals in the other conditions. Given a difference in current health ratings by condition, there should be subsequent differences between conditions in terms of future time perspective as well. Individuals in the downward comparison condition should have reported a more open-ended perception of the future, more planning behaviours, and perceive time periods as feeling subjectively longer than those in the other conditions. The opposite should occur for participants in the upward comparison condition.

Method

Participants

We initially recruited a sample of 398 participants through Amazon Mechanical Turk (MTurk) on October 6, 2021. Of the initial 398 observations, our attention check item identified 100 response sets to be excluded from all further statistical analyses. The final sample size consisted of 298 participants between the ages of 21 and 71 years of age ($M_{age} = 38.51$, $SD_{age} = 10.19$; 59.4% male, 39.6% female). Unfortunately, the obtained sample had a 25% exclusion rate, which is considerably higher than the previously reported typical exclusion rate of 15% reported on MTurk (Barends & Devries, 2019; Thomas & Clifford, 2017). On average, the survey took approximately 8.5 minutes to complete, and all respondents were compensated \$1.00 for their time. Upon providing consent to participate in the study, respondents were immediately assigned to one of the four experimental conditions.

Procedure

Experimental Manipulation. To momentarily manipulate subjective health, all participants were randomly assigned to one of the experimental conditions. Participants that were

assigned to a comparison condition were immediately asked to recall and describe a time in their life that was congruent with their assigned condition. Individuals in the downward comparison condition were asked, “*Recall a time in your life when you felt you were in a far worse position as it relates to your physical health compared to how you feel now. Please describe in 3–5 sentences, how your health used to be worse than it is now.*” Participants in the upward comparison condition were asked, “*Recall a time in your life when you felt you were in a far better position as it relates to your physical health compared to how you feel now. Please describe in 3–5 sentences, how your health used to be better than it is now.*” The lateral comparison condition asked individuals to, “*Recall a time in your life when you felt you were in similar position as it relates to your physical health compared to how you feel now. Please describe in 3 to 5 sentences, how your health is similar to how it is now.*” Items were worded this way to have participants specifically ruminate on their physical health status at the highest or lowest or most similar points in their lives relative to their current state rather than focus on a specific point in time. Individuals assigned to the control condition did not receive any writing instructions.

This manipulation of subjective physical health (i.e., increase or decrease) was expected to have only a momentary effect. However, to ensure no lasting effects to participants, at the end of the study, all participants were provided with an opportunity to recall and describe a more positive time in their life as it relates to their health.

Manipulation Check: Subjective Physical Health

To check whether the experimental manipulation was effective, participants were asked two items relating to their subjective physical health. Both items were rated on a 5-point Likert-type scale from 1 (“*very poor*”) to 7 (“*very good*”). The two items were, “*how would you rate*

your past physical health?” and *“how would you rate your current physical health?”* I expected that the manipulation would shift not only the past health (as per instructions in the manipulation) but also current health such that downward comparisons would make participants feel better about their current health and upward comparisons would make participants feel worse about their current health.

Time Perception Measures

The participants completed the Future Time Perspective Scale (FTPS; Carstensen & Lang, 1996). This scale consists of 10-items rated on a 7-point Likert-type scale from 1 (*“very untrue”*) to 7 (*“very true”*). Scoring on the FTPS involved reverse coding items 8, 9, and 10, followed by calculating participant’s mean scores across the ten items. Higher scores indicate a more positive and open-ended perception is of one’s future. The FTPS continued to demonstrate high internal consistency (Cronbach’s $\alpha = .84$).

Participants also reported future planning. Adapted from Kotter-Gröhn & Smith (2011), future planning was measured by three separate items (e.g., *“I have made plans for the next year.”*). All three items were measured on a 5-point Likert-type scale ranging from 1 (*“does not apply to me at all”*) to 5 (*“applies very well to me”*). Again, high scores indicate that an individual has made more plans for their future and future events. The three future orientation items provided high internal reliability (Cronbach’s $\alpha = .71$).

Participants were also asked to provide three subjective duration estimates of how long a specific time period (i.e., a year, a month, and a week) feels to them on an analogue scale from 1 (*“feels very short”*) to 100 (*“feels very long”*). Scores for each of the three items were averaged across participants to provide a measure of subjective duration. Higher scores indicate that a participant perceives the corresponding time period as longer (i.e., time passes more slowly). In

the current study, the three subjective duration estimates demonstrated high internal reliability (Cronbach's $\alpha = .83$).

Exploratory Measure: Optimism

Given that the single optimism item included in the pilot study was significantly predicted by subjective health, I decided to explore optimism more thoroughly in the experimental study. To do so, I used a modified version of the Revised Life Orientation Test (LOT-R; Scheier et al., 1994). Originally, the LOT-R consists of 10-items rated on a 5-point Likert scale from 1 (“*strongly disagree*”) to 5 (“*strongly agree*”). The modified version did not include the four filler items of the LOT-R (items 2, 5, 6, and 8). Items 3, 7, and 9 were then reversed scored, and the six remaining items were summed to obtain an overall score of optimism. Total scores range from 6 to 30, with higher scores indicating more optimism. The LOT-R showed high internal consistency in the experimental study (Cronbach's $\alpha = .77$).

Demographics

At the end of the study participants were asked to report their gender identity, chronological age, subjective age, and ethnicity. Subjective age was obtained by asking “*sometimes people feel exactly the age they actually are and sometimes they feel older or younger. How old do you feel?*” (Adapted from Kotter-Grühn et al., 2009; Stephan et al., 2018). Subjective age was further categorized based on the reported subjective age relative to chronological age (i.e., if they felt younger (-1), the same (0), or older (1)). This coded variable is the one referred to as subjective age in the analyses reported below. Demographics were included at the end of the study to prevent a potential priming effect from participants providing subjective age estimates. See Appendix B for full survey.

Results

Initial Analyses

All statistical analyses were conducted using IBM SPSS Statistical software version 27. Basic descriptive statistics, and Cronbach's alpha for the scales of interest are shown in Table 10. All scales of interest demonstrated excellent internal reliability and there were no issues relating to skewness or kurtosis that required further corrective transformations.

Table 10

Scale Descriptive Statistics and Cronbach's Alpha

Variable	<i>M</i>	<i>SD</i>	α	No. Items	<i>ICC</i>
Age	38.51	10.19		1	
Past Physical Health	3.79	1.04		1	
Current Physical Health	3.99	0.79		1	
Future Time Perspective Scale	4.70	0.97	.84	10	.34
Future Planning Scale	3.62	0.91	.71	3	.45
Subjective Duration Estimates	53.53	23.85	.83	3	.62
Optimism Scale	19.65	4.65	.77	6	.36

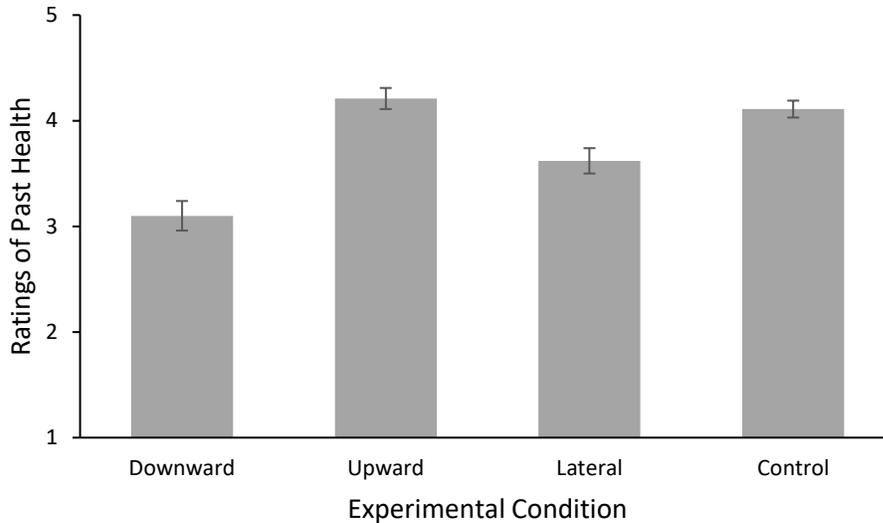
Note. $N = 298$. Optimism measured by the Revised Life Orientation Test (LOT-R). Ranges for above variables were as follows, Age = 21 – 71, Past Physical Health item = 1 – 5, Current Physical Health item = 1 – 5, Future Time Perspective scale = 1 – 7, Future Planning scale = 1 – 5, Subjective Duration Estimates = 1 – 100, LOT-R = 6 – 30.

Manipulation Check

A one-way Analysis of Variance (ANOVA) with pre-planned contrasts using the subjective physical health items as the dependent variables with the experimental condition as the independent variable was significant overall ($F(3, 294) = 21.46, p < .001, \eta^2 = .18$). Tukey's post-hoc analysis identified that individuals in the downward comparison condition reported significantly lower past subjective physical health ($M = 3.10; SD = 1.19$) than individuals in the upward condition ($M = 4.21, SD = 0.83; t(294) = -7.00, p < .001$), lateral condition ($M = 3.62, SD = 0.95; t(294) = -3.18, p = .009$), and the control condition ($M = 4.11, SD = 0.82; t(294) = -6.80, p < .001$). Individuals in the upward comparison condition reported past physical health significantly higher than individuals in the lateral condition ($t(294) = 3.56, p = .002$), however, the upward condition was not significantly different from the control condition ($t(294) = 0.72, p = .892$). Finally, individuals in the lateral condition reported past health as significantly lower than individuals in the control ($t(294) = -3.11, p = .011$). This pattern of results suggests that participants followed instructions correctly in describing a more unhealthy or healthy past self in the appropriate conditions. Figure 1 displays the means and standard errors of each experimental condition.

Figure 1

Differences in Ratings of Past Health Between Experimental Conditions



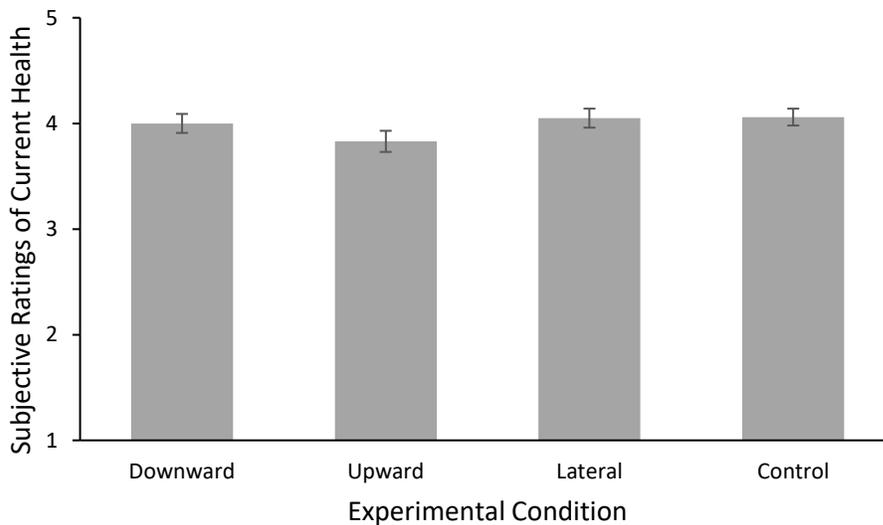
Note. Error bars represent standard error (*SE*) of each condition. The significant one-way ANOVA ($F(3, 294) = 21.46, p < .001, \eta^2 = .18$), indicated differences between the four experimental conditions in subjective ratings of past health. Means, standard deviations and planned contrasts are reported in-text above.

Nevertheless, the second one-way ANOVA analyzing ratings of subjective current physical health was not significant ($F(3, 294) = 1.37, p = .252$), indicating that there was no difference between the experimental conditions in current ratings of physical health. More specifically, the downward condition ($M = 4.00, SD = 0.74$), was not significantly higher than the upward condition ($M = 3.83, SD = 0.85; t(294) = 1.29, p = .573$), the lateral condition ($M = 4.05, SD = 0.69; t(294) = -0.36, p = .984$), or the control condition ($M = 4.06, SD = 0.82; t(294) = -0.51, p = .956$). Likewise, the upward condition was not significantly lower than the lateral condition ($t(294) = -1.59, p = .383$) or the control group ($t(294) = -1.89, p = .235$); and finally, there was no difference between the lateral comparison condition and the control condition ($t(294) = -0.11, p = 1.00$). Thus, the experimental manipulation was not effective as it did not

change subjective physical health in the *current* moment. Figure 2 displays the means and standard errors of each experimental condition.

Figure 2

Differences in Ratings of Current Health Between Experimental Conditions



Note. Error bars represent the standard error (*SE*) of each condition. The one-way ANOVA was non-significant ($F(3, 294) = 1.37, p = .252$), indicating the experimental manipulation was not effective. Means, standard deviations, and planned contrasts are reported in-text above.

Bivariate Correlations

Given that the experimental manipulation was not successful, bivariate correlations were conducted between the two subjective physical health items, time-related measures, optimism measure and age to ensure all items of interest and scales demonstrated appropriate content validity, convergent validity, and discriminant validity. These correlations were also compared to the pilot study results to confirm the expected nature of the relationships. Table 11 demonstrates the bivariate correlations of interest.

Table 11*Bivariate Correlations*

Variables	1.	2.	3.	4.	5.	6.	7.
1. Age	–						
2. Subjective Age	-.04	–					
3. Past Physical Health	-.02	.01	–				
4. Current Health	-.02	-.27**	.28**	–			
5. FTPS	-.14*	-.15*	.15**	.32**	–		
6. Future Planning	.10	-.04	.20**	.36**	.27**	–	
7. Subjective Duration	-.02	-.08	.18**	.28**	-.00	.27**	–
8. Optimism	.11	-.19**	.15*	.18**	.56**	.15**	-.20**

Note. * $p < .05$, ** $p < .01$. Optimism measured by total score on the LOT-R.

Exploratory Analyses

Given that the experimental manipulation did not demonstrate a significant effect, three separate linear regression analyses were conducted for each of the time perception variables. Each regression analysis included all four predictor variables of interest, 1) chronological age, 2) subjective age (coded), 3) subjective ratings of current physical health, and 4) subjective ratings of past physical health. All linear regression assumptions were checked and satisfied prior to reporting the results below (i.e., no multicollinearity, independence of errors, normality, homoscedasticity, no outliers, linearity, and additivity).

Future Time Perspective. The overall model was significant and accounted for 13.7% of the total variance in responses on the Future Time Perspective Scale ($F(4, 267) = 10.56, p = <$

.001). Of the four predictors included in the analysis, only two demonstrated a significant predictive relationship with responses on the future time perspective scale. In order of importance in the model, subjective ratings of current physical health provided the highest proportion of unique variance explained in the model, accounting for 7% of the variability in responses on the future time perspective scale. Indicating that individuals that felt better about their physical health in the current moment were likely to report having a more positive outlook of their future. The only other predictor that was significant was chronological age, which explained an additional unique 1.8% of the variance in responses on the FTPS. As the reported age of participants increased, there was a decrease in perceiving the future as open-ended. Subjective age and subjective ratings of past physical health were both non-significant predictors of the Future Time Perspective Scale. The full results of the model are shown in Table 12.

Table 12

Linear Regression Results Predicting the Future Time Perspective Scale

Predictors	<i>b</i>	<i>SE_b</i>	β	<i>Sig.</i>	<i>sr²</i>
Age	-0.01	0.01	-.13	.020	.02
Subjective Age	-0.11	0.08	-.08	.163	.01
Current Physical Health	0.36	0.08	.28	< .001	.07
Past Physical Health	0.08	0.06	.08	.196	.01

Note. DV: Future Time Perspective Scale (FTPS). *N* = 272.

Future Planning. The overall model predicting the future planning scale was significant and accounted for 15.2% of the total variability in reported future planning behaviours ($F(4, 268)$

= 12.01, $p = < .001$, $R = .39$). As expected, subjective ratings of current health demonstrated a significant positive relationship with the Future Planning Scale. More specifically, ratings of current physical health accounted for a unique 10% of the variability in responses, indicating that individuals that report feeling healthier currently also reported more future planning behaviours. Interestingly, chronological age also demonstrated a significant positive relationship with future planning, accounting for a unique 2% of the variability in responses, suggesting that an increase in chronological age was linked to a subsequent increase in future planning behaviours. Subjective age and subjective ratings of past physical health were non-significant predictors of future planning behaviours. The full model can be seen in Table 13.

Table 13

Linear Regression Results Predicting the Future Planning Scale

Predictors	b	SE_b	β	$Sig.$	sr^2
Age	0.01	0.01	.13	.028	.02
Subjective Age	0.06	0.07	.06	.332	< .00
Current Physical Health	0.40	0.07	.34	< .001	.10
Past Physical Health	0.10	0.05	.11	.060	.01

Note. DV: Future Planning scale. $N = 273$.

Subjective Duration of Time. The overall model including four predictor was significant ($F(4, 268) = 5.16$, $p = .001$, $R = .27$) and accounted for 7.2% of the total variance in subjective duration estimates of time. However, the only significant predictor in the model was current ratings of physical health, indicating that an increase in subjective ratings of current

physical health, corresponded to time periods being reported as feeling longer, that is, the time feels to be passing by more slowly. Table 14 demonstrates the full results of the model predicting subjective estimates of time periods.

Table 14

Linear Regression Results Predicting Subjective Duration Estimates of Time Periods

Predictors	<i>b</i>	<i>SE_b</i>	β	<i>Sig.</i>	<i>sr²</i>
Age	-0.06	0.14	-.02	.686	< .00
Subjective Age	-0.76	1.90	-.03	.690	< .00
Current Physical Health	6.64	1.93	.22**	< .001	.04
Past Physical Health	2.17	1.43	.09	.130	.01

Note. DV: Subjective Duration Estimates of time periods. *N* = 298.

Optimism. For the exploratory analysis examining the relationship between subjective physical health and optimism, I used total scores on the Revised Life Orientation Test (LOT-R; Scheier et al., 1994) as the outcome variable with all four predictor variables of interest included in the linear regression model.

As anticipated, the overall model was significant ($F(4, 268) = 6.66, p = < .001, R = .301$) and accounted for 9.0% of the variability in optimism scores reported on the LOT-R. All four predictors significantly explained variability in reported optimism. Participants who reported feeling older than their chronological age also reported being less optimistic, whereas older individuals, those reported feeling healthier in the past and in the current moment also

subsequently reported being more optimistic. The complete linear regression is shown in Table 15.

Table 15

Linear Regression Predicting Optimism

Predictors	<i>b</i>	<i>SE_b</i>	β	<i>Sig.</i>	<i>sr²</i>
Age	0.06	0.03	.12	.039	.02
Subjective Age	-0.92	0.38	-.15	.015	.02
Current Physical Health	0.76	0.38	.13	.047	.01
Past Physical Health	0.65	0.28	.14	.023	.02

Note. DV: Revised Life Orientation Test (LOT-R). *N* = 273.

Discussion

In this study, I attempted to identify a causal relationship between subjective health and time perception, by asking participants to make temporal comparisons with their past that was either better, worse, or the same as the current health. Although the manipulation was grounded in prior empirical research and temporal comparison theories (Wilson & Ross, 2001), my attempt at manipulating subjective physical health was not successful. Therefore, the current study could not provide evidence of a causal relationship between subjective physical health and time perception. There are many potential explanations for why the experimental manipulation of subjective health was unsuccessful.

For instance, I did not control for the quality of the recalled description for the temporal comparison conditions. Given that previous studies have found providing more vivid

descriptions of the relevant past temporal comparison were more effective than simply providing a shorter less detailed description (Strack et al., 1985). In this study I simply asked participants to provide a description and did not control for the quality of details reported in each of the temporal comparison conditions. Furthermore, I did not control for how long in the past the temporal comparison occurred. Given that studies have shown that people are more likely to distance themselves from past events that were negative, while if the event or past self is positive, they are more likely to perceive it as being closer in the past (Wilson & Ross, 2001; Haddock, 2004). This could have biased the subsequent ratings of subjective health in the current moment and led to the non-significant difference between comparison groups.

Nevertheless, despite the failed manipulation, throughout the remaining statistical analyses, subjective ratings of current physical health were a consistent significant predictor of all measures of time perception. On average, individuals who reported feeling healthier in the current moment, tended to report perceiving a more open-ended perception of the future (i.e., more opportunities remaining in life, more time remaining in life), more planning behaviours for the future, and they reported experiencing time as passing by more slowly (i.e., time periods felt longer). Perceived current health remained a significant predictor even when controlling for the effects of chronological age and subjective age.

General Discussion

The current thesis investigated the relationship between subjective health and time perception, with a specific emphasis on how individuals perceive their future. Two online studies provided empirical evidence to support the relationship between subjective health and three separate time perception measures. More specifically, individuals who rated themselves as healthier, on average, reported having a more open-ended perspective of their future, more plans

for their future, and perceive time as passing more slowly in the present moment. I found the same pattern of results across each study while controlling for age.

In the first study, I conducted a series of multiple linear regressions. I found that subjective health had a significant positive relationship with a positive future time perspective (i.e., perceived more time remaining in life, and a more open-ended future), more plans for their future (i.e., more plans for upcoming weeks, months, and years), and time periods were perceived as feeling longer (i.e., time passes slower). I conducted a second experimental study, in which I attempted to momentarily manipulate participants subjective health to see if there is a causal effect on these same time perception assessments. However, the experimental manipulation was not successful as I did not find a significant difference between any of the temporal comparisons in subsequent reports of subjective physical health. Nevertheless, Study 2 found the same significant positive correlations between subjective health and each of the time perception measures, even after controlling for age. These results support previous empirical findings that linked subjective health and open-ended time perspective (Kooij & Voorde, 2011).

Theoretical Implications

Although the manipulation of subjective health was not effective in the second study, the correlational results from the initial study are replicated. Therefore, I can say that an actual relationship likely exists between subjective health and time perception beyond the effects of age and how old a person feels. More specifically, a positive evaluation of health in the current moment was related to experiencing time periods as longer, perceiving the future as more open-ended, and engaging in more future planning behaviours. However, at this point I am unable to provide any further explanation for the direction of this relationship. I cannot state conclusively

that subjective health influenced time perception, or if time perception influenced subjective health, or if a third variable influenced both.

Given previous research in conjunction with the current findings, there are many potential explanations as to why a link between health and time perception may exist. For instance, individuals feeling healthier in the present moment may be more concerned with protective health behaviours (Hall & Fong, 2003), to improve their quality of life. Meaning that these individuals may be more aware of their health and the importance of maintaining their physical health as it can be directly related to longevity and happiness while aging (Li et al., 2019). Another potential explanation of this relationship is that individuals with more positive outlooks of their futures (i.e., more open-ended future perspective, more future planning behaviours, etc.) tend to, on average, be more optimistic and feel healthier as a result. However, given the results and the limitations of the current study there are plenty of other plausible explanations for the relationship between subjective health and time perception.

General Limitations

The current studies had several limitations in common. First, since both studies were conducted as online surveys via Amazon Mechanical Turk (MTurk), I was unable to control for the population from which the respondents belonged to. Meaning that the findings could have been biased because of a sampling error from the beginning. More specifically, online surveys tend to collect and analyze data from samples that are self-selected, which limits the generalizability of the study because I cannot control for how representative of the population interest my sample is (Andrade, 2020). For example, the samples from which the current findings were derived from could have had many participants that were healthy to begin with; thus, making it unrepresentative of the general population as health measures would have been

unusually higher. However, the chronological age of both samples in the current research were similar to the sample obtained by Kooij and Voorde (2011). More specifically, the average age in study 1 was 36.02 ($N = 351$, $SD_{age} = 10.67$, range from 18 to 71), in study 2 the average age was 38.51 ($N = 298$, $SD_{age} = 10.18$, range from 21 to 71) and the sample obtained by Kooij and Voorde was 43.90 (2011; $N = 600$, $SD_{age} = 11.19$, range from 19 to 67). Furthermore, ratings of subjective health were similar in study 2 ($M = 3.99$, $SD = 0.79$) as that reported by Kooij and Voorde (2011; $M = 3.43$, $SD = 0.75$).

A second limitation to both studies was that each was conducted during the COVID pandemic. At this point, it is not possible to gauge how the COVID pandemic influenced participants' responses in June 2020 of October 2021. During this time frame, perhaps more people adopted a more limited future time perspective due to their feelings surrounding the environment in which they were living or due to the news constantly highlighting mortality and illness risks. For instance, during these unprecedented times, between the constant attention to the COVID pandemic and multiple lockdowns, people may have had adopted a more negative view of time perception in general. For example, during lockdowns, individuals may have experienced time as passing more slowly than experienced previously due to boredom or being restrained to their homes. Another possibility is that people may have avoided making plans for the future because the pandemic had caused them to cancel plans, they had previously made. Regardless, at this point, it is not possible to state conclusively how the COVID pandemic influenced individuals' perception of time or their subjective health. Future research will be required in the years to come to shed further light on this potential limitation.

Another limitation to the current research is that third variables and confounds could have influenced the relationship between subjective feelings of health and time perception. Additional

variables such as perceived control (Demiray & Bluck, 2014), psychological well-being (Demiray & Bluck, 2014), life satisfaction (Prenda & Lachman, 2001), desired longevity (Hall & Fong, 2003), and cognitive functioning (Kotter-Grühn et al., 2010) prior to completing the surveys may also play a role in the relationship between health and time perception. It would be interesting to see in future research, how participants' mood before and during studies on time perception. For example, researchers may want to measure participants' mood state prior to the completing the survey to control for how mood may conflate individuals' responses. As previously mentioned, individuals with a more optimistic outlook, tend to have more positive affect and report a more open-ended future time perspective (Kotter-Grühn & Smith, 2011; Demiray & Bluck, 2014). Given that mood may also change during the study it would interesting to assess throughout to gauge the degree to which mood may influence individuals' ratings of subjective health as well as future time perception.

An additional limitation is the potential for measurement error. In the current studies, I could have used previously validated measures of health in both studies. To shorten the online surveys and improve response rates, I selected specific health-related items from previously validated measures (i.e., RAND-36, Hays & Morales, 2001), and relevant research (i.e., Kooij & Voorde, 2011). However, using the original scales in their entirety would have improved the generalizability as well provided support for the construct validity of the included scales that I included. For instance, in study 1, I attempted to obtain an objective measure of health by inquiring about participant's exercise habits over the previous 4 weeks. Perhaps a better measurement would have been the International Physical Activity Questionnaire – Short Form (IPAQ-SF; Craig et al., 2003), or I could have used a more objective physiological measure of health such as heart rate or blood pressure in a laboratory setting. Regardless, by not using

previously established measures of objective health, even the ‘objective’ health behaviour items I assessed in study 1 are subjective based on participants interpretation of the items. For example, these same exercise items inquired about the previous 4 weeks, perhaps a better measurement would have only investigated previous 7 days given the potential for participants to demonstrate a recall bias with a longer time frame to judge from. By not using previously validated scales, I am unable to state that the health-related items I employed were actual measurements of subjective health, as I cannot determine the extent to which the items accurately measured what I intended them to measure. Nevertheless, despite these potential limitations, future research could easily employ strategies to avoid these limitations from arising and to build on all the previous findings.

Future Directions

There are many directions for future research to take when examining the link between subjective health and time perception. First and foremost, the current studies should be replicated in a laboratory setting. By conducting the research in a lab setting, many confounding variables that I could not control could be held constant to lessen their influence on the variables of interest. For instance, I was unable to control for distractions in the participants’ environment. In-lab assessments would also allow for more objective physiological measures of health. Additionally, in a lab setting, researchers would be able to better control for time spent completing the study. In study 2, it took participants between 1:34 and 49:21 minutes to complete the survey. I suspect that boredom or further environmental distractions influenced the time required to complete the online survey. Although online surveys provide fast and convenient access to a rather large population, a lab setting may be more appropriate to receive high quality data.

Additionally, future research could also explore the link between subjective health and time perception within specific samples of interest such as a student population or a population of elderly individuals. For example, previous research has shown that a favourable evaluation of health is positively related to physical health, mental health, and functional health (Pinquart, 2001). I suspect that in a sample of students, individuals with a positive evaluation of their current health would perceive a much more open-ended future relative to individuals of the same age and physiological health status. Likewise, among elderly people, research has shown that subjective feelings of health have been found to be stable, while objective health suffers a decline (Wettstein et al., 2016). By studying this population of interest, perhaps, positively manipulating subjective health may further improve the stability of subjective health among elderly individuals. Nevertheless, this is all speculation as further research is required to improve the generalizability of the results for the relevant populations of interest.

While in the current research, I attempted to examine the predictive and causal effect of subjective health on various measures of time perception, using a past-temporal comparison approach, future research may use a different method to manipulate subjective health. For instance, temporal comparison theory requires individuals to make intrapersonal comparisons (Albert, 1977), whereas social comparison theory requires individuals to make interpersonal comparisons (Albert, 1977), which may serve to manipulate subjective health more efficiently. Future research could also attempt to manipulate subjective health through some type of pre-planned randomized feedback mechanism or performance evaluation designed to increase or decrease participants feelings about their health in the moment.

Finally, future research may examine the opposite direction of the effect. By testing the directionality of the relationship between subjective health and time perception, future research

should aim to examine whether having an open-ended perspective of one's future has positive subsequent causal effect on subjective health. For example, a study could have participants complete some subjective health measure and time perception measures on one occasion. Then have the same participants return to the lab after a delay to complete the same measures followed by them receiving some type of novel information that was designed to either increase or decrease their affective state in that current moment. Immediately after receiving the information, participants would complete the time perception measures a second time to examine whether the arousal produced a difference between the two testing periods. In this example by obtaining subjective health ratings prior to the manipulation, studies could identify whether subjective health is an actual predictor subsequent time perception or vice versa. Regardless, the current research provides a solid basis for future studies to explore other aspects of health as potential predictors of future time perception such as physiological measures (i.e., heart rate, blood pressure, etc.), different types of protective health behaviours, or some other psychological measures (i.e., affect questionnaires).

Conclusion

In conclusion, in the present program of research, I found that individuals who feel better about their current health reported significant more open-ended perspective of their future, more plans for their futures, and experienced time as passing more slowly, relative to individuals that perceive their current health more negatively. Healthier people appear to have a more open-ended perspective of their future, regardless of age. Maintaining a more favourable evaluation of your health as you age is crucial to maintaining positive well-being (Zaninotto & Steptoe, 2019). The current research demonstrates that feeling healthy might also account for some of the variability in individual's future time perception. Feeling healthier may also increase how much

people engage in protective health behaviours and avoid risky health behaviours, each of which have been shown to be related to a more positive view of the future (Hall & Fong, 2003; Henson et al., 2006). In sum, the current research shows that feeling healthy in the current moment is an important factor to consider when looking at how individuals perceive their future.

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Appendices

Appendix A: Study Materials for Study 1 (Correlational Study)

Demographics

1. Are you... ?
 - a. Male
 - b. Female
 - c. Other (please specify): _____
2. What is your age? ____
3. What is your ethnicity? _____
4. What country are you currently living in?
 - a. Canada
 - b. United States of America
 - c. Other
5. Current employment status (select all that apply):
 - a. Student
 - b. Part-time employed (less than 32 hours per week)
 - c. Full-time employed (More than 32 hours per week)
 - d. Self-employed
 - e. Freelancer
 - f. Unemployed
 - g. Retired
 - h. Other (Please Specify): _____
6. Are you currently living with a permanent health condition?
 - a. Yes
 - b. No
7. Are you currently living with a life-threatening illness?
 - a. Yes
 - b. No

Health Items

1. How would you rate your current health in general?

Extremely Bad 1	Moderately Bad 2	Slightly Bad 3	Neither Good nor Bad 4	Slightly Good 5	Moderately Good 6	Extremely Good 7
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2. How would you rate your current physical health?

Extremely Bad	Moderately Bad	Slightly Bad	Neither Good nor Bad	Slightly Good	Moderately Good	Extremely Good
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1 2 3 4 5 6 7

3. How would you rate your current mental health?

Extremely Bad	Moderately Bad	Slightly Bad	Neither Good nor Bad	Slightly Good	Moderately Good	Extremely Good
1	2	3	4	5	6	7

4. In the past 4 weeks, how often did you engage in **vigorous activities** such as jogging, lifting weights, etc.?

5. In the past 4 weeks, how often did you engage in **moderate-intensity activities** such as brisk walking, bike riding, housework such as scrubbing floors, etc.?

6. In the past 4 weeks, how often did you engage in **light activities** such as gardening, housework such as laundry/dishes, etc.?

7. How much **bodily pain** have you had during the past 4 weeks?

8. In the past 4 weeks, how much has your **physical health interfered** with your daily life?

9. How often do you think about your physical health in a typical day?

Never – very often

10. How worried are you about your **current** physical health?

Not at all worried – very worried.

11. How worried are you about your **future** physical health?

Not at all worried – very worried.

Future Planning Items

On a scale from 1 (*does not apply to me at all*) to 5 (*applies to me very well*), please mark down how well each of the following items apply to you (adapted from Kotter-Grühn, D., & Smith, J., 2011):

1. “I feel confident when I think about my future.” (*Optimism item*)
2. “I have made plans for things I’ll be doing a week from now.”
3. “I have made plans for things I’ll be doing a month from now.”
4. “I have made plans for things I’ll be doing a year from now.”

General Time Perception Items

1. Imagine that you have a meeting next Wednesday. If that meeting is moved forward two days, what day will it be on now? _____.

2. Sometimes it feels like time passes quickly (that is, it feels like an event is over “in the blink of an eye”) and sometimes it feels like time passes slowly (that is, it feels like an event “drags on”).
- How long does a year feel to you?
0 (*Feels very short*) ----- 100 (*Feels very long*)
 - How long does a month feel to you?
0 (*Feels very short*) ----- 100 (*Feels very long*)
 - How long does a week feel to you?
0 (*Feels very short*) ----- 100 (*Feels very long*)

Future Time Perspective Scale

Please read each item and, as honestly as you can, answer the questions: “How true is this of you?” Please select the appropriate number on the scale, where 1 means the statement is **very untrue** for you and 7 means that the statement is **very true** for you.

	Very untrue						Very true
1. Many opportunities await me in the future.	1	2	3	4	5	6	7
2. I expect that I will set many new goals in the future,	1	2	3	4	5	6	7
3. My future is filled with possibilities,	1	2	3	4	5	6	7
4. Most of my life lies ahead of me.	1	2	3	4	5	6	7
5. My future seems infinite to me.	1	2	3	4	5	6	7
6. I could do anything I want in the future.	1	2	3	4	5	6	7
7. There is plenty of time left in my life to make new plans.	1	2	3	4	5	6	7
8. I have the sense time is running out.	1	2	3	4	5	6	7
9. There are only limited possibilities in my future.	1	2	3	4	5	6	7
10. As I get older, I begin to experience time as limited.	1	2	3	4	5	6	7

1. On the line below, please mark where you believe you are at in life at the current moment.

1 (*Birth*) ----- 100 (*Death*)

2. How much time do you feel you have left to accomplish all the things you wanted to accomplish in life?

1 (*Very little time left*) ----- 100 (*A lot of time left*)

Promotion / Prevention Scale (Lockwood, Jordan, & Kunda, 2002).

Using the scale below, please select the appropriate number between 1 (Not at all true of me and 7 (very true of me) in the blank space beside each item.

1. ____ In general, I am focused on preventing negative events in my life.
2. ____ I am anxious that I will fall short of my responsibilities and obligations.
3. ____ I frequently imagine how I will achieve my hopes and aspirations.
4. ____ I often think about the person I am afraid I might become in the future.
5. ____ I often think about the person I would ideally like to be in the future.
6. ____ I typically focus on the success I hope to achieve in the future.
7. ____ I often worry that I will fail to accomplish my goals.
8. ____ I often think about how I will achieve success.
9. ____ I often imagine myself experiencing bad things that I fear might happen to me.
10. ____ I frequently think about how I can prevent failures in my life.
11. ____ I am more oriented toward preventing losses than I am toward gains.
12. ____ My major goal right now is to achieve my ambitions.
13. ____ My major goal right now is to avoid becoming a failure.
14. ____ I see myself as someone who is primarily striving to reach my “ideal self” – to fulfill my hopes, wishes, and aspirations.
15. ____ I see myself as someone who is primarily striving to become the self I “ought” to be – to fulfill my duties, responsibilities, and obligations.
16. ____ In general, I am focused on achieving positive outcomes in my life.
17. ____ I often imagine myself experiencing good things that I hope will happen to me.
18. ____ Overall, I am more oriented toward achieving success than preventing failure.

Appendix B: Materials for Study 2 (Experimental Study)

Manipulation (participants will be randomly assigned to one of the four conditions).

Control Condition

“Thank you for participating! This study is about your view of health.”

Lateral comparison condition

“We all experience ups and downs in our health. Recall a time in your life when you felt you were in similar position as it relates to your physical health compared to how you feel now. Please describe in 3–5 sentences, how your health is similar to how it is now.”

Upward comparison condition

“We all experience ups and downs in our health. Recall a time in your life when you felt you were in a far better position as it relates to your physical health compared to how you feel now. Please describe in 3–5 sentences, how your health used to be better than it is now.”

Downward comparison condition

“We all experience ups and downs in our health. Recall a time in your life when you felt you were in a far worse position as it relates to your physical health compared to how you feel now. Please describe in 3–5 sentences, how your health used to be worse than it is now.”

Subjective Physical Health Items

1. How would you rate your past physical health?

Very Poor	Poor	Fair	Good	Very Good
1	2	3	4	5

2. How would you rate your current physical health?

Very Poor	Poor	Fair	Good	Very Good
1	2	3	4	5

Future Time Perspective Scale

Please read each item and, as honestly as you can, answer the questions: “How true is this of you?” Please select the appropriate number on the scale, where 1 means the statement is **very untrue** for you and 7 means that the statement is **very true** for you.

	Very untrue						Very true
1. Many opportunities await me in the future.	1	2	3	4	5	6	7
2. I expect that I will set many new	1	2	3	4	5	6	7

goals in the future,

3. My future is filled with possibilities.	1	2	3	4	5	6	7
4. Most of my life lies ahead of me.	1	2	3	4	5	6	7
5. My future seems infinite to me.	1	2	3	4	5	6	7
6. I could do anything I want in the future.	1	2	3	4	5	6	7
7. There is plenty of time left in my life to make new plans.	1	2	3	4	5	6	7
8. I have the sense time is running out.	1	2	3	4	5	6	7
9. There are only limited possibilities in my future.	1	2	3	4	5	6	7
10. As I get older, I begin to experience time as limited.	1	2	3	4	5	6	7

Future Planning Items

On a scale from 1 (*does not apply to me at all*) to 5 (*applies to me very well*), please mark down how well each of the following items apply to you (adapted from Kotter-Grühn, D., & Smith, J., 2011):

	Does not apply to me at all				Applies to me very well
1. I have made plans for things I'll be doing a week from now.	1	2	3	4	5
2. I have made plans for things I'll be doing a month from now.	1	2	3	4	5
3. I have made plans for things I'll be doing a year from now.	1	2	3	4	5

1. How far into the future do you usually plan your life? ___years/ months/weeks/days

General Time Perception Items

Sometimes it feels like time passes quickly (that is, it feels like an event is over “in the blink of an eye”) and sometimes it feels like time passes slowly (that is, it feels like an event “drags on”).

1. How long does a year feel to you?
 1 (*Feels very short*) ----- 100 (*Feels very long*)

2. How long does a month feel to you?
 1 (*Feels very short*) ----- 100 (*Feels very long*)
3. How long does a week feel to you?
 1 (*Feels very short*) ----- 100 (*Feels very long*)

Revised Life Orientation Test (LOT-R)

Please answer the following questions about yourself by indicating the extent of your agreement using the following scale:

- 1 = *Strong disagree*
 2 = *Disagree*
 3 = *Neutral*
 4 = *Agree*
 5 = *Strongly agree*

Be as honest as you can throughout and try not to let your responses to one question influence your response to other questions. There are no right or wrong answers.

1. ____ In uncertain times, I usually expect the best.
2. ____ If something can go wrong for me, it will. (R)
3. ____ I'm always optimistic about my future.
4. ____ I hardly ever expect things to go my way. (R)
5. ____ I rarely count on good things happening to me. (R)
6. ____ Overall, I expect more good things to happen to me than bad.

Recalled Time Items

"In the initial survey when asked to recall and describe a time in your life when you felt you were in a far worse position as it relates to your general or physical health compared to your current health, how long ago was the time you recalled in your memory?"

Answer: _____ years/months/weeks.

Demographics

1. Are you... ?
 - a. Male
 - b. Female
 - c. Other (please specify): _____.
2. What is your age? _____.
3. Sometimes people feel exactly the age they actually are and sometimes they feel older or younger. How old do you feel? _____.

4. What is your ethnicity? _____

Equalizing Instructions (Attention Check)

“We all experience ups and downs in our health. This is normal. If you are worried about your health, please see your family doctor. Everyone has some aspects of their physical health they are content with or feel positive about. Please tell us about one aspect of your physical health that you feel happy with.”
