Sense of Purpose in Life and Risk for Onset of Chronic Illness

by

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Abstract

Chronic health conditions have become increasingly common in recent years and may prove to be even more problematic given the aging population. Having a sense of purpose in life has been linked to a reduced risk for several chronic health conditions, though the mechanisms behind this relationship remain underexplored. The present research explored whether purpose in life predicted risk for onset of seven common chronic ailments using data from the Health and Retirement Study. Risk of initially healthy individuals developing arthritis, cancer, diabetes, high blood pressure, heart conditions, lung disease, and stroke was examined over an eight-year period from 2006 to 2014. The PROCESS procedure for testing mediation was used to analyse the direct association between purpose and onset of each of the seven chronic conditions, as well as testing whether vigorous and moderate physical activity, sleep quality, and health self-efficacy mediate these relationships. A greater sense of purpose in life was directly associated with a reduced risk for onset of stroke and indirectly associated with a decreased risk for arthritis, heart disease, lung disease, and hypertension onset through its effects on sleep quality. The current findings extend the literature by demonstrating that purpose in life predicts risk for onset of several chronic ailments. Further, these results point to the importance of considering sleep quality as a mechanistic link between purpose and long-term illness risk.

Table of Contents

List of Tables

List of Figures

Introduction

With the aging of the baby boomer generation, the developed world is about to experience unprecedented shifts towards older adulthood. Recent estimates suggest that the number of individuals over age 60 is expected to rise to 1.4 billion by 2030, and further increase to 2.1 billion by 2050, representing nearly a quarter of the population in developed countries at that time (United Nations, 2015). These demographic changes can in part be explained by increased life expectancy brought about by recent advances in access to food, medicine, and more effective treatment for acute illnesses. However, while individuals do appear to be living longer, for many these additional years of life will be spent in poor health. In fact, recent work suggests that approximately half of adults are living with at least one chronic health condition, and roughly 26% experience multiple chronic disorders (Ward & Schiller, 2013; Ward, Schiller, & Goodman, 2014). These numbers become even greater after age 65, with as many as 88% of older adults experiencing one or more chronic illness (Statistics Canada, 2010). In particular, illnesses such as heart disease, stroke, and various forms of cancer represent a large proportion of health care costs and mortality. Moreover, debilitating conditions such as arthritis, diabetes, and lung disease require frequent medical care, may incur significant costs, and reduce quality of living. As of 2010, roughly 63% of all deaths worldwide were caused by chronic diseases, with conditions such as those mentioned above accounting for a large number of these deaths (Mendis, Puska, & Norrving, 2011). These illnesses represent a significant portion of chronic ailments and unless addressed, could present considerable challenges to the medical system.

The health psychology literature has acknowledged the importance of studying dispositional traits and individual differences in determining one's risk for illness. Past work points to the value of dispositional traits in understanding who is likely to engage in certain

health behaviours and in determining one's risk for disease and mortality (e.g., Adler & Matthews, 1994; Ferguson, 2013). Building off this notion, recent empirical work has sought to understand how individual differences influence one's risk for some of the most common chronic conditions. One study, for example, looked at personality and risk for developing seven chronic ailments: high blood pressure, heart conditions, lung disease, cancer, stroke, diabetes, and arthritis (Weston, Hill, & Jackson, 2014). Using a longitudinal design, tracking participants over a period of four years, this study found each of the Big Five traits to be predictive of at least one chronic condition. Similar work by this group has also found that characteristics of one's social environment predict risk of developing chronic ailments over a relatively short period of four years (Hill, Weston, & Jackson, 2014). Clearly, individual differences shape our risk for illness, though further work is needed to identify other trait-like characteristics which may influence illness risk.

Purpose in Life and Health

A growing body of research has suggested that having a sense of direction or purpose in life may confer benefits for health and wellbeing. A sense of purpose in life refers to an individual's view that their life has direction and is guided toward some overarching goal or aim (Ryff, 1989). Individuals' purpose in life forms a key component of their identity and provides an organizing framework around which they may direct their behaviour (Kashdan & McKnight, 2009). Past work suggests that sense of purpose in life represents a trait-like disposition insofar that it demonstrates rank-order stability over years (e.g., Hill, Turiano, Mroczek, & Spiro, 2015; Ko, Hooker, Geldhof, & McAdams, 2016). Individuals start to commit to a purpose in life around the time of adolescence (Damon, Menon, & Bronk, 2003) and one's stated life goals demonstrate relative stability during the adult years (Hill, Jackson, Roberts, Brandenberger, &

Lapsley, 2011). Approaching older adulthood, individuals' levels of sense of purpose tend to show moderate decline after around age 60 (Pinquart, 2002), followed by steeper declines around age 85 (Hedberg, Gustafson, & Brulin, 2010). However, it is important to note that not all older adults follow these trends as past work has demonstrated significant inter-individual variability in older adult purpose scores over time (Hill et al., 2015).

Accruing longitudinal research has suggested that having a sense of purpose in life may be protective against several chronic conditions, particularly conditions effecting the cardiovascular system. Past work has found that individuals who reported having a sense of purpose in life (henceforth referred to as purposeful individuals) had a reduced risk of cardiovascular-related mortality than less purposeful counterparts (Koizumi, Ito, Kaneko, & Motohashi, 2008). Another study explored whether sense of purpose in life predicted risk for developing stroke over a four year period using data from the Health and Retirement Study (HRS), a large longitudinal study tracking adults over age 50 (Kim, Sun, Park, & Peterson, 2013). Controlling for health behaviours such as smoking and physical activity, cardiovascular biomarkers, and positive and negative psychological factors (e.g., depression, optimism), they found that more purposeful individuals had a reduced risk of stroke. The authors suggest that immune functioning may be a mediating factor for this relationship, though it was not tested. Further work by this group in the same sample also found that a higher sense of purpose in life is associated with a reduced risk for myocardial infarction over a two-year period (Kim, Sun, Park, Kubzansky, & Peterson, 2013). Once again, this association remained significant above and beyond health behaviours, body mass index, and psychological factors such as optimism and positive affect. These findings are particularly notable given that purpose predicted illness development over relatively short follow-up periods of four and two years, respectively.

In addition to predicting reduced risk for cardiovascular disease outcomes, sense of purpose in life is associated with several biomarkers of inflammation, metabolism, and immune functioning. Individuals reporting more purpose in life have been found to have significantly lower levels of soluble interleukin-6 receptors, a cytokine receptor which serves to amplify the inflammatory response (Friedman, Hayney, Love, Singer, & Ryff, 2007). Other work by this group has found more purposeful individuals to be lower in salivary levels of the stress hormone cortisol and have higher levels of the healthier, high density lipoprotein (HDL) cholesterol (Ryff, Singer, & Love, 2004). A higher sense of purpose has also been associated with a decreased allostatic load, which refers to deterioration of numerous bodily systems brought about by repeated activation of compensatory mechanisms in the face of chronic stress (Maestripieri, & Hoffman, 2011; Zilioli, Slatcher, Ong, & Gruenewald, 2015). In the work by Zilioli and colleagues, sense of purpose was found to predict reduced levels of biomarkers of lipid metabolism such as body mass index and cholesterol levels, inflammatory cytokines such as interleukin-6 (IL-6) and C-reactive protein, and parasympathetic nervous system activity. Therefore, the finding of decreased allostatic load in purposeful adults reflects reduced physiological strain on immune, cardiovascular, and other bodily systems, suggesting that these individuals may be less prone to diseases resulting from chronic wear on these systems. It should also be noted that this association was partially mediated by health locus of control, with purposeful individuals more likely to report greater self-control over health, leading to a reduced allostatic load.

Although the above research has primarily focused on middle adults, the health-protective effects of purpose in life do not appear to be limited to this period in the lifespan. Older adults higher in purpose are less at risk for developing physical disability (Boyle,

Buchman, & Bennett, 2010), as well as Alzheimer's disease and mild cognitive impairment (Boyle, Buchman, Barnes, & Bennett, 2010; Boyle et al., 2012). Additionally, a greater sense of purpose in life also appears to be protective against development of clinical Alzheimer's pathology in older adults who already have primary neurological characteristics of the disease, suggesting that purpose may promote neurological reserve (Boyle et al., 2012). In addition to these specific health outcomes, a greater sense of purpose in life is associated with a reduced all-cause mortality risk in older adults as well as individuals across the lifespan (Boyle et al., 2009; Hill & Turiano, 2014). Taken together, this research suggests that purpose in life may influence a wide range of health outcomes across numerous bodily systems. However, the mechanisms behind the relationship between purpose and health outcomes are not fully understood.

Purpose and Health Behaviours

One pathway that may link purpose and risk for chronic illness is through promoting health behaviours. McKnight and Kashdan (2009) suggest that the actions of purposeful individuals are highly guided towards their sense of purpose. With good health being a requirement for many individuals' major goals in life, the authors suggest that these individuals are more likely to engage in health protective behaviours than their less purposeful counterparts. Considering models of health behaviour promotion, being able to view one's own actions in the context of a larger, higher-order objective has been recognized in the health psychology literature as a critical step in promoting health. For example, the Transtheoretical Model (TTM) of health behaviour change (Prochaska, DiClemente, & Norcross, 1992) outlines the five stages of change leading up to the maintenance of health-promoting behaviour. The first stage in the model, the precontemplation stage, is the stage at which an individual has no intention to change their behaviour and are often unaware of how their current behaviour may have negative

consequences on their health and wellbeing. One of the biggest obstacles preventing individuals from progressing out of this stage is the recognition of how their actions may affect them long-term. The existence of broader, overarching life aims such as those associated with a sense of purpose in life may help individuals view behaviour in the context of its impact on long-term health and functioning, making these individuals more likely to progress towards higher stages of behaviour change.

One important factor in understanding whether an individual is likely to engage in health behaviours is the extent to which they feel they can exert control over their own health. Building from Bandura's Social Cognitive Theory (1986), feelings of personal control over a given domain, known as self-efficacy, are believed to be a critical antecedent to individual's pursuits in that domain. In the context of health, individuals who feel that they are able to exert control over their own health are more likely to engage in health-protective behaviours compared to individuals who view their health as being outside of their control (Strecher, DeVellis, Becker, & Rosenstock, 1986). Furthermore, according to the Health Belief Model (Rosenstock, Strecher, & Becker, 1988), belief in the effectiveness of health-promoting behaviours is considered a fundamental aspect predicting engagement in that behaviour. According to this model, in order to feel that a health behaviour will be effective, an individual must believe that the behaviour will lead to beneficial health outcomes and that they will be able to exert enough control to engage in this behaviour. Further, feelings of personal control have also been found to directly predict numerous long-term health outcomes including risk for cardiovascular diseases such as coronary heart disease and chronic inflammation, as well as mortality risk (Bosma et al., 1997; Surtees et al., 2010; Surtees, Wainwright, Luben, Khaw, & Day, 2006). Thus, feelings of control,

particularly in the context of one's health represents an important predictor of long-term illness risk and may explain the health protective effects of sense of purpose in life.

More purposeful individuals may experience favourable health outcomes because they are more likely to view their health as being within their own control and therefore, would be expected to regularly engage in health protective behaviours. Past empirical work suggests that purpose may promote feelings of greater control over one's health, which may in turn predict more positive health outcomes. The work by Zilioli and colleagues (2015) linking purpose with allostatic load also found that purpose was associated with a "self-health locus of control," meaning that more purposeful individuals were more likely to feel strongly that their actions, rather than some external force, primarily influenced their health. Notably, this self-health locus of control was found to mediate the association between purpose in life and decreased allostatic load. Similarly, in a study of purpose and physical activity in adult women, purposeful women were found to have a greater commitment to health and reported regularly putting more thought and effort into their health (Holahan et al., 2011). Given that purpose in life seems to promote a more health-conscious orientation, one would expect more purposeful individuals to engage more in health-protective behaviours. A number of health behaviours and their potential relationship with purpose in life and risk for chronic illnesses are summarized below.

Physical Activity. Regular physical activity has been linked to improved cardiovascular health and reduced risk for cancer and type II diabetes (World Health Organisation, 2009). American Heart Association recommendations suggests a minimum of 30 minutes of moderate-intensity physical activity (e.g. brisk walking, weight training) per day for at least five days a week or at least 20 minutes of vigorous physical activity (running, competitive sports) at least three days per week (Haskell et al., 2007). Engaging in moderate and vigorous physical activity

is also considered to be of paramount importance to older adult health, with similar guidelines being recommended among older adults to reduce frailty and improve cardiovascular health (Nelson et al., 2007).

Recent research has found that purposeful women in early midlife reported engaging more frequently in moderate and vigorous physical activity (Holahan et al., 2011). In addition to self-reported measures of physical activity, sense of purpose in life is associated with higher objectively measured physical activity. Hooker and Masters (2014) explored the relationship between purpose and physical activity using accelerometers to track participants' movement over a three-day period. Purpose in life was found to be associated with greater overall movement and moderate to vigorous physical activity as measured by accelerometer. Although more work is needed to better understand the directionality of this relationship, increased likelihood of engaging in moderate and vigorous physical activity may be a mechanism through which purpose influences health.

Sleep quality. Another health behaviour that has been recognized as an important predictor of health is sleep quality. Sleep is a time in which many bodily systems return to baseline levels, allowing the body to regenerate and recover from accumulated insults throughout the day (see Luyster, Strollo, Lee, & Walsh, 2012 for a review of homeostatic properties of sleep). Notably, sleep has been shown to be particularly important for the cardiovascular system, with sleep disturbances such as waking up frequently being associated with an increased risk for cardiovascular conditions such as hypertension (Bansil, Kuklina, Merritt, & Yoon, 2011; Buman et al., 2013). Poor sleep quality is also a risk factor for several forms of cancer and can promote obesity and diabetes risk (Luyster et al., 2012; Zimmerman, Bigal, Katz, Derby, & Lipton, 2013). In terms of purpose in life, one recent study explored sense of purpose and risk for developing

sleep disturbances among adults from the Health and Retirement Study (Kim, Hershner, & Strecher, 2015). They found that more purposeful individuals were less likely to develop sleep disturbances over a four-year period, even after controlling for demographic factors, health behaviours such as alcohol consumption, moderate and vigorous physical activity, anxiety, and presence of other health conditions. Further, individuals higher in purpose have reduced bodily movement during sleep, suggesting lest restlessness during this time (Ryff, Singer, & Love, 2004). Thus, sense of purpose in life may also support health by promoting better quality sleep and decreasing one's likelihood of experiencing sleep disturbances.

Predictors of Individual Conditions

Though purpose is likely to influence health through the pathways discussed above, the influence of traits and different health behaviours are likely to differ between certain illnesses. For example, work by Weston et al. (2015) explored whether the Big Five measures of personality predicted risk for initially healthy individuals being diagnosed with a chronic condition over a four year period. Using longitudinal data from the Health and Retirement Study (HRS), a longitudinal study of American adults over the age of 50, they examined personality and risk of onset for high blood pressure, diabetes, cancer, lung disease, heart conditions, stroke, and arthritis. The authors found that several conditions were more heavily influenced by personality than others. For instance, the trait of conscientiousness was found to predict reduced risk for onset of high blood pressure, diabetes, stroke, and arthritis, but did not significantly impact risk of developing cancer, heart or lung disease during this time. In fact, cancer did not show any significant associations with the Big Five traits and only neuroticism predicted increased risk for development of lung disease and heart conditions over four years. One

possibility is that these conditions take longer to develop and would thus be less influenced by recent measures of personality.

These findings may also reflect the fact that some ailments will be less influenced by certain psychological and behavioural factors. Take for instance the broad category of cancer, which encompasses many subtypes of the disease that have widely different aetiologies. Whereas many forms of cancer such as lung and throat cancer are highly influenced by health behaviours such as physical activity and smoking, other forms of the disease may be more the result of genetic susceptibilities than any one specific behaviour (Dutta et al., 2013; Molina, Yang, Cassivi, Schild, & Adjei, 2008). Thus, a trait such as sense of purpose may be less able to predict risk for the category of cancers as a whole. In fact, the previously mentioned Japanese study looking at purpose in life and risk of death from cardiovascular conditions found no significant association between purpose and cancer-related mortality (Koizumi, et al., 2008).

While some conditions may be less easily predicted by traits over a short period of time, other conditions are more controllable and would be more heavily influenced by health behaviours. Indeed, conditions such as high blood pressure, arthritis, and diabetes are relatively common conditions that have been shown to be sensitive to health behaviour habits. For example, type II diabetes occurs in about 20% of American adults, with the health behaviours of diet, smoking, drinking, and lack of physical activity being primary risk factors for developing the disorder (Wray, Alwin, McCammon, Manning, & Best, 2006). Similarly, high blood pressure or hypertension is particularly common among adults who are obese, and represents a state of chronic cardiovascular strain which is often followed by more severe conditions such as coronary heart disease and stroke (Wang et al., 2006). Thus, one might expect more controllable

conditions such as these to be more likely to show associations with dispositional traits over a short period of time compared to illnesses such as cancer or lung disease.

Current Study

The present study sought to extend the literature by testing whether sense of purpose is longitudinally associated with reduced risk for developing seven common chronic conditions (high blood pressure, diabetes, cancer, lung disease, heart conditions, stroke, and arthritis) using a large sample of American adults from the Health and Retirement Study (HRS). The current study builds upon past work from the HRS linking purpose with physical health outcomes such as myocardial infarction and stroke (Kim, Sun, Park, & Peterson, 2013; Kim, Sun, Park, Kubzansky, & Peterson, 2013). Though these studies used a relatively short follow-up period of two and four years, respectively, the current work will use an eight-year time interval to allow greater time for individuals to develop the seven conditions listed above. Moreover, the present research seeks to extend the literature by exploring the association between purpose and risk for developing diabetes, cancer, lung disease, and arthritis; conditions which have not been previously explored in the context of purpose in life. In addition to testing the direct association between purpose and risk for the seven chronic health conditions, the present study also looks to clarify the mechanisms through which purpose may predict risk for these conditions by testing sleep quality, health self-efficacy, and moderate and vigorous physical activity as mediators.

It is expected that more purposeful individuals will have a reduced risk for developing several chronic conditions. Given the past literature linking purpose to reduced risk for cardiovascular disease, it is expected that higher purpose in life will be associated with a reduced risk for the cardiovascular illnesses of high blood pressure, heart disease, and stroke. On the other hand, conditions such as cancer and lung disease may exhibit a less clear relationship with

sense of purpose in life given the wide range of known aetiologies associated with these conditions. As such, it is predicted that purpose in life will not be associated with risk of developing cancer or lung disease. In addition, past work has connected purpose in life with the health behaviours of physical activity and sleep quality (Hooker & Masters, 2014; Kim et al., 2015). It is expected that the current study will replicate this work and find a similar association between sense of purpose and health self-efficacy. Finally, it is expected that physical activity, sleep quality, and health self-efficacy will be higher in purposeful individuals, though it is uncertain whether one or more of these variables will mediate the association between purpose and risk for chronic health conditions above and beyond the effects of the other variables. Therefore, a primary research question for the current analyses will be which of the potential mechanistic variables will be most influential in the association between purpose and risk for the seven chronic conditions and whether this may differ between ailments.

Methods

Participants

The current study utilized data from the 2006 and 2014 waves of the Health and Retirement Study (HRS). The HRS is a nationally representative longitudinal sample of American adults, which has tracked over 27,000 individuals via in-person and telephone based interviews since its inauguration in 1992. At each wave completed every two years, participants were surveyed on a wide range of topics including health, finances, employment, living environment and family dynamics. In addition to the main battery of testing, since 2006, the HRS has included a "leave behind questionnaire" assessing a number of psychosocial variables including sense of purpose in life. In 2006, 8705 participants were given the leave behind questionnaire, of which 7730 (88.8%) responded and returned the survey. For the current study, the 2006 and 2014 waves were used as this maximizes the time between a wave including the measure of purpose in life and a follow-up to assess onset of chronic illnesses.

Participants were excluded from the current analyses if they did not complete the purpose in life scale in the 2006 leave behind or did not provide a response to at least one of the items assessing chronic illnesses at either of the 2006 or 2014 waves. The resulting sample consisted of 7571 participants aged 30 to 105 (M = 67.99, SD = 10.66), with age distributed as follows: 2.5% of participants were aged between 30 and 49 years, 21.9% aged 50-59, 32.2% aged 60-69, 28.0% aged 70-79, 13.3% aged 80-89, and 1.7% were age 90 or older. The sample was predominantly female (n = 4444, 58.70%). A total of 6291 (83.09%) identified as white or Caucasian, with the remaining 16.11% of participants being classified as "other", including African-American and non-white Hispanic. A summary of descriptive characteristics of the current sample is displayed in Table 1.

Measures

Purpose in life. Purpose in life was assessed in the HRS as part of the leave behind questionnaire beginning in 2006. Purpose was assessed using the purpose subsection of the Psychological Well-being scale (Ryff, 1989). Participants responded using a six point Likert scale to indicate the extent to which they agreed with seven items (e.g. "I live life one day at a time and don't really think about the future", "some people wander through life aimlessly, but I am not one of them"). Past work has shown this subscale has been to have good reliability and predictive validity in adult samples (see Ryff & Singer, 2006). A complete version of this measure as it was administered in the HRS is displayed in Appendix A. This measure was found to have acceptable reliability in the present sample, Cronbach's $\alpha = .74$.

Health Conditions. The HRS included measures of seven types of chronic health conditions; arthritis, cancer, diabetes, high blood pressure, heart conditions, lung disease, and stroke. These health conditions were assessed via self-report over telephone in 2006 and 2014. Participants responded to the prompt "Has a doctor ever told you that you have [specific condition]?" Participant responses were coded as either *yes* (1) or *no* (0). In the case of health conditions representing a number of potential illnesses, additional examples were provided. For example, participants were asked about heart conditions using the following prompt: "Has a doctor ever told you that you had a heart attack, coronary heart disease, angina, congestive heart failure, or other heart problems?" For lung diseases, the examples of chronic bronchitis and emphysema were provided. In the case of cancer, participants were asked about whether they had been diagnosed with a malignant tumour or cancer excluding skin cancer.

Covariates. Demographic characteristics of age, sex, education, and ethnicity were measured in the initial wave of the HRS. Participants were asked to indicate the highest grade of

school or year of college they completed and are assigned scores ranging from zero to 17 indicating the number of years of formal education completed (17 representing at least 17 years of formal education, equivalent to graduate or post college education). Male participants were coded as 0, while females were coded as 1. Participants also reported whether they considered themselves to be white or Caucasian or belonging to some other racial or ethnic group. White participants were coded as 0, while participants belonging to other racial or ethnic groups including African-Americans and non-white Hispanics were coded as 1.

Potential Mediators. In addition to demographic covariates, the potential mediators of physical activity, sleep quality, and health self-efficacy were also included. These variables were assessed in the 2006 wave to maximize the follow-up period and allow greater time for illnesses to develop.

Physical Activity. Physical activity was measured via two items pertaining to moderate and vigorous physical activity. For moderate activity, participants were asked "how often do you take part in sports or activities that are moderately energetic such as, gardening, cleaning the car, walking at a moderate pace, dancing, or floor or stretching exercises?" For vigorous activity, participants were asked "How often do you take part in sports or activities that are vigorous, such as running or jogging, swimming, cycling, aerobics or gym workout, tennis, or digging with a spade or shovel?" For each physical activity question, participants indicated whether they engaged in these activities more than once a week, once a week, one to three times a month, or hardly ever or never. This activity measure has been previously used to predict outcomes such as risk for dementia and mortality in the same sample (Bowen, 2012; Wen, Li, & Su, 2014).

Sleep Quality. Sleep quality was assessed using a four-item version of the Jenkins Sleep Questionnaire (Jenkins, Stanton, Niemcryk, & Rose, 1988). Participants self-reported how often

they have trouble falling asleep, trouble with waking during the night, trouble waking too early, and how often they feel rested in the morning and indicated whether they experience these most of the time (coded as 1), sometimes (coded as 2), or rarely/never (coded as 3). This brief measure exhibited moderate reliability in the current sample, Cronbach's α = .64.

Health Self-Efficacy. Participants were asked to rate the amount of control they feel they have over their health at the present time. Participants responded on a Likert scale ranging from 0 to 10, with 0 indicating no control at all and 10 indicating very much control. This measure has been used elsewhere to predict overall health, functional ability, and illness risk (Lachman & Weaver, 1998).

Analytic Strategy

The current analyses tested whether purpose longitudinally predicts onset of the seven major health conditions over an eight-year period between 2006 and 2014. To test the basic association of sense of purpose on onset of the seven ailments, t-tests were performed with 2006 purpose scores as the test variable grouped by whether or not participants have been diagnosed with the specific condition between 2006 and 2014. Next the association between purpose and the potential mediators of sleep, health self-efficacy, and moderate and strenuous physical activity were assessed using correlational analyses; first with Pearson correlations, followed by partial correlations controlling for the effects of the other potentially mediating variables.

Finally, the PROCESS macro for SPSS (Hayes, 2013) will be used to test the direct effect of purpose on risk of onset of the seven conditions, as well as the indirect pathway via the mediating variables of physical activity, sleep quality, and health self-efficacy. The PROCESS macro utilizes an ordinary least squares path analysis framework, conducting a series of hierarchical regressions to estimate direct and indirect effects above and beyond included

covariates. For the current analyses, sense of purpose in life was entered as the independent variable, with moderate physical activity, strenuous physical activity, sleep quality, and health self-efficacy entered as mediators. The covariates of age, sex, education, and race/ethnicity were included in tests of direct and indirect effects. This model was tested seven times with each chronic condition as the outcome variable. For each analysis, bootstrapping resampling methods using 1000 bootstrapped samples were used to improve the reliability of the estimated parameters.

Given the number of simultaneous tests in the current analyses, a more stringent alpha level of .01 was utilized. Results that do not quite meet this criteria, but are marginally significant at the .05 level were discussed with caution. Further, since PROCESS utilizes an ordinary least squares framework, it is subject to the same assumptions and issues as an ordinary least squares regression. Variance inflation factors (VIF) were calculated for each of the seven models to test for multicollinearity among the variables. For each model, VIF values did not differ considerably from 1, suggesting minimal inflated variance resulting from multicollinearity (all mean VIFs between 1.126 and 1.139).

Table 1.

Descriptive Characteristics of the Sample.

Variable	*M*	*SD*	Range
	n(%)		
Purpose in life	4.52	.94	1 - 6
Age (in years)	67.99	10.66	30 - 105
Female	4444(58.70)		
Education (in years)	12.62	3.09	
Caucasian	6291(83.09)		
Moderate Activity	2.17	1.33	0 - 4
Vigorous Activity	.94	1.33	0 - 4
Sleep Quality	2.36	.52	1 - 3
Health Self-Efficacy	7.21	2.40	0 - 10

Results

Illness Onset

Hypertension was the most commonly developed illness over the eight-year period, with 746 participants being diagnosed during this time, followed by arthritis (*n* = 708) and heart disease (*n* = 674). Fewer new cases of diabetes (*n* = 457), cancer (*n* = 438), lung disease (*n* = 279), and stroke (*n* = 272) were reported during this time. Seven *t*-tests were performed to test for differences in sense of purpose at time 1 between those who did and did not develop each illness over the following eight years. Participants were included in these analyses only if they had reported not being previously diagnosed with the specific condition at the 2006 wave, resulting in different sample sizes for each test. The results of these analyses are displayed in Table 2. Two significant differences were found in these tests. Individuals who later developed lung disease, as well as those who had a stroke reported less purposefulness in 2006 compared to those who did not develop these conditions.

Table 2.

Mean Purpose Scores and t-tests of the Difference between Those Who Did and Did Not Develop Each Illness

Illness	*M* (Purpose)	*SD*	*t*	Effect Size (Cohen's *d*)
Diabetes				
Onset (*n* = 457)	4.58	.95		
No onset (*n* = 5563)	4.57	.94		
			-.14	.01
Hypertension				
Onset (*n* = 746)	4.63	.90		
No onset (*n* = 2450)	4.63	.93		
			-.02	0
Cancer				
Onset (*n* = 438)	4.59	.87		
No onset (*n* = 5979)	4.53	.94		
			-1.21	.07

Lung Disease				
Onset (*n* = 279)	4.41	.94		
No onset (*n* = 6466)	4.56	.93		
			2.63**	-.16
Heart Disease				
Onset (*n* = 674)	4.54	.95		
No onset (*n* = 4982)	4.58	.93		
			1.11	-.04
Stroke				
Onset (*n* = 272)	4.34	.91		
No onset (*n* = 6817)	4.55	.93		
			3.70***	-.23
Arthritis				
Onset (*n* = 708)	4.68	.87		
No onset (*n* = 2214)	4.63	.94		
			-1.17	.06

Note. Participants were excluded if they had reported being previously diagnosed with that illness at time 1.

** $p < .01$; *** $p < .001$

Associations Between Purpose in Life and Potential Mediators

The association between sense of purpose in life and each of the potential mediators was then tested using correlation analyses. Sense of purpose was positively correlated with each of the potential mediators, with the strongest association being with health self-efficacy. The results of these correlational analyses can be found in Table 3. Next, partial correlations were calculated between purpose and each potential mediators while controlling for the effects of the other mediators and demographic characteristics of age, gender, race/ethnicity, and years of education. When controlling for vigorous physical activity, sleep quality, health self-efficacy, and demographic characteristics, the partial correlation between purpose and moderate activity was $r = .10$, $p < .001$. Similarly, the associations between purpose and both vigorous physical activity, $r = .08$, $p < .001$, and sleep quality, $r = .12$, $p < .001$, held with the effects of the other mediators

and demographic characteristics were partialed out. The association between purpose in life and health self-efficacy remained moderate, $r = .28$, $p < .001$.

Table 3.

Correlations Between Purpose in Life and Each Potential Mediator

	1	2	3	4	5
1. Sense of Purpose in Life	—				
2. Moderate Activity	.23***	—			
3. Vigorous Activity	.20***	.35***	—		
4. Sleep Quality	.20***	.15***	.12***	—	
5. Health Self-Efficacy	.35***	.21***	.18***	.20***	—

*** $p < .001$

Direct and Indirect Effects of Purpose on Illness Risk

Regression tests of mediation with bootstrapping were used to assess the direct effect of purpose on risk of illness onset, as well as indirect effects via vigorous and moderate physical activity, sleep quality, and health self-efficacy. These results are displayed in Table 4. In these analyses, the direct effects represent the effects on the illness outcome while controlling for the effects of all other variables in the model, including the mediator variables. The regression coefficients labelled as indirect effects represent the cross-product of the association between purpose and the mediators with the association between each mediator and the health outcome.

Table 4.

Direct and Indirect Effects of Purpose in Life on Illness Risk

	Direct Effects			Indirect Effects		
	B	*SE*	*z*	B	*SE*	99% CI
Hypertension						
Purpose in Life	-.003	.050	-.053			
Age	-.014	.004	-3.320***			
Sex	-.089	.088	-1.011			
Race	.325	.122	2.660**			
Education	-.025	.015	-1.713			
Total Indirect				-.015	.026	[-.060, .030]
Vigorous Activity				-.003	.007	[-.021, .015]

Moderate Activity				-.007	.009	[-.031, .015]
Sleep Quality				-.017	.009	[-.044, .003]*
Health Self-Efficacy				.012	.015	[-.027, .051]
Diabetes						
Purpose in Life	-.014	.059	-.234			
Age	-.032	.005	-6.574***			
Sex	-.290	.103	-2.828**			
Race	.527	.122	4.312***			
Education	-.053	.017	-3.230**			
Total Indirect				-.013	.021	[-.071, .038]
Vigorous Activity				-.018	.009	[-.045, .005]
Moderate Activity				-.004	.010	[-.032, .022]
Sleep Quality				-.001	.010	[-.028, .030]
Health Self-Efficacy				.010	.018	[-.038, .056]
Cancer						
Purpose in Life	.085	.060	1.406			
Age	-.005	.005	-.918			
Sex	-.221	.102	-2.159*			
Race	-.011	.137	-.079			
Education	-.028	.018	1.574			
Total Indirect				-.041	.022	[-.098, .018]
Vigorous Activity				.008	.010	[-.018, .036]
Moderate Activity				-.006	.012	[-.041, .022]
Sleep Quality				-.007	.011	[-.034, .021]
Health Self-Efficacy				.036	.019	[-.087, .015]
Lung Disease						
Purpose in Life	-.105	.072	-1.460			
Age	-.011	.006	-1.871			
Sex	.113	.130	.867			
Race	-.201	.174	-1.160			
Education	-.061	.020	-3.108**			
Total Indirect				-.027	.072	[-.095, .041]
Vigorous Activity				.000	.012	[-.031, .029]
Moderate Activity				-.007	.013	[-.041, .026]
Sleep Quality				-.025	.012	[-.059, .007]*
Health Self-Efficacy				.005	.020	[-.048, .058]
Heart Disease						
Purpose in Life	.027	.050	.541			
Age	.015	.004	3.579***			
Sex	-.186	.086	-2.155*			
Race	-.029	.115	-.253			
Education	-.007	.014	-.496			
Total Indirect				-.044	.017	[-.087, .001]
Vigorous Activity				-.000	.008	[-.021, .018]
Moderate Activity				.005	.008	[-.015, .028]
Sleep Quality				-.036	.010	[-.061, -.010]**

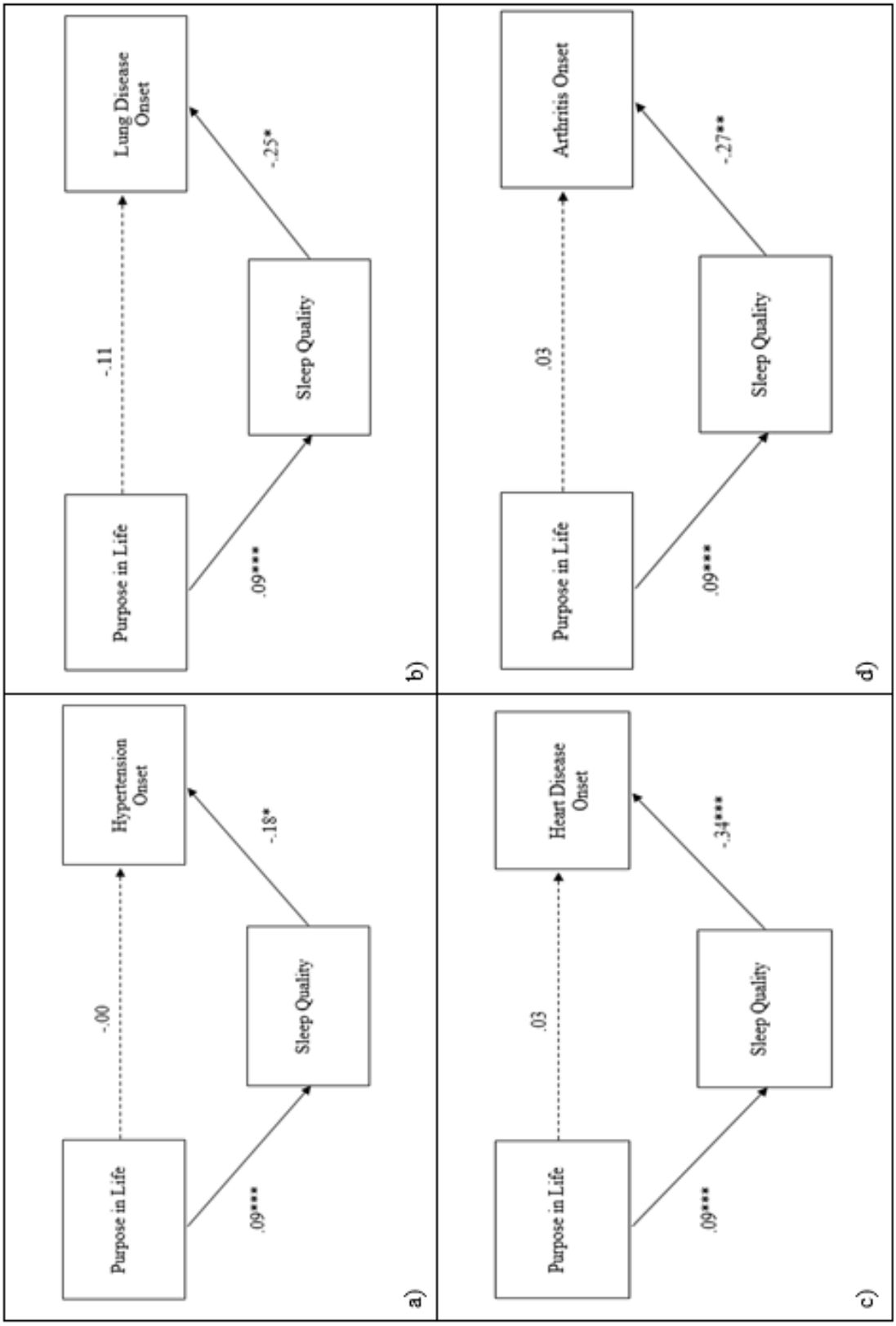
Health Self-Efficacy				-.013	.015	[-.051, .023]
Stroke						
Purpose in Life	-.181	.074	-2.465*			
Age	.018	.006	2.901**			
Sex	-.023	.132	-.174			
Race	.233	.167	1.399			
Education	-.026	.021	-1.272			
Total Indirect				-.026	.028	[-.122, .023]
Vigorous Activity				-.007	.013	[-.042, .024]
Moderate Activity				.001	.013	[-.038, .037]
Sleep Quality				-.009	.014	[-.049, .027]
Health Self-Efficacy				-.019	.022	[-.079, .043]
Arthritis						
Purpose in Life	.025	.053	.470			
Age	-.017	.004	-3.827***			
Sex	.247	.090	2.738**			
Race	.077	.118	.648			
Education	-.011	.015	-.731			
Total Indirect				-.001	.020	[-.049, .058]
Vigorous Activity				-.003	.008	[-.021, .016]
Moderate Activity				.012	.010	[-.011, .029]
Sleep Quality				-.027	.010	[-.056, -.003]**
Health Self-Efficacy				-.016	.017	[-.027, .063]

Note: The values for the indirect pathways represent the product of the *a* and *b* pathways.

Purpose in life had a direct effect on risk of having a stroke over the eight-year follow-up, with more purposeful individuals being less likely to report a stroke during this time. This association was significant at the $\alpha = .05$ level ($p = .014$). Considering indirect effects, sleep quality was the only mediator found to be associated with illness risk. Sleep quality was found to mediate the relationship between sense of purpose and risk of developing heart disease and arthritis. Sleep quality also mediated the association between purpose and risk of hypertension, and purpose and lung disease at the .05-level. A summary of each of these mediation models in displayed in Figure 1. In each case, purpose was associated with better self-reported sleep quality, $b = .09$, p-values all $< .001$. Sleep quality had a small, negative association with risk of being diagnosed with hypertension, $b = -.18$, $p = .03$ (see Figure 1a). Small-to-moderate

associations were found between sleep quality and risk of onset of lung disease, $b = -.25$, $p = .03$, heart disease, $b = -.34$, $p < .001$, and arthritis, $b = -.27$, $p = .003$ (Figure 1b-d).

Figure 1. *Mediation Models Depicting Indirect Effects through Sleep Quality*



Note: Also included in these analyses were the covariates of age, gender, education, race/ethnicity, as well as the non-significant mediators of vigorous and moderate physical activity and health self-efficacy.

* $p < .05$, ** $p < .01$, *** $p < .001$

Discussion

The current study sought to extend a growing literature suggesting that a greater sense of purpose in life may reduce one's risk for chronic health conditions. Specifically, the association between sense of purpose in life and risk for developing seven chronic ailments—hypertension, diabetes, cancer, lung disease, heart disease, stroke, and arthritis—were explored over an eight-year follow-up period. Without the inclusion of covariates, purpose in life was found to be associated with risk for lung disease and stroke, with individuals who did not develop these conditions reporting significantly higher purpose at the initial time point compared to those who did develop these conditions. Next, with the inclusion of covariates and potential mediators in the model, a greater sense of purpose in life was found to be directly associated with a reduced risk for developing stroke, and indirectly associated with hypertension, lung disease, heart disease, and arthritis through its effects on sleep quality.

The present work provides insight into some behavioural mechanisms through which sense of purpose in life may influence risk for later health conditions. More purposeful individuals reported engaging more frequently in both moderate and vigorous physical activity, reported better sleep quality, and felt more control over their health compared to less purposeful counterparts. These findings are consistent with past work suggesting more purposeful individuals engage more frequently in a number of health-protective behaviours such as physical activity (Holahan et al., 2011; Hooker & Masters, 2014), preventative health care screenings (Kim et al., 2014), and experience better sleep quality (Kim et al., 2015). Furthermore, the current study also provides support for the notion that purpose is associated with greater feelings of control in the context of health. Similar findings have been noted in work by Zilioli and colleagues (2015) suggesting that purposeful individuals are more likely to report their health

being primarily determined by their own actions rather than by some external force. Overall, these findings support the notion suggested elsewhere (e.g., McKnight & Kashdan, 2009) that a greater sense of purpose in life may influence health by promoting health related behaviours, cognitions, and a more health oriented approach to life.

Although greater self-reported purpose in life was associated with each of the potential mediators, sleep quality was the only variable found to mediate the association between purpose and illness risk. There are a few possible explanations as to why sleep quality mediated this association above and beyond the other potential mechanisms explored. As mentioned previously, there is a substantial literature demonstrating the association between sleep and cardiovascular health. Sleep disturbances have been found to predict onset of ischemic stroke, hypertension, coronary heart disease, and other conditions affecting cardiovascular functioning (Bansil et al., 2011; Buman et al., 2013; Chandola, Ferrie, Perski, Akbaraly, & Marmot, 2010; Elwood, Hack, Pickering, Hughes, & Gallacher, 2006). In addition, sleep appears to be a critical period in regulating blood pressure and inflammation. Poor sleep quality and shorter sleep time have been linked to later increases in inflammatory markers such as C-reactive protein and interleukin-6 (Ferrie et al., 2013).

Moreover, high levels of inflammation have been shown to worsen sleep quality, which may in turn exacerbate cardiovascular dysregulation. Indeed, the association between sleep quality and inflammation appears to be bidirectional, with poor sleep quality promoting inflammation and greater presence of inflammatory factors worsening or preceding the onset of sleep disturbances (see Miller & Cappuccio, 2007 for a review). For example, treatments inducing acute inflammation, such as interferon-α therapy (a treatment in which pro-inflammatory cytokines are introduced into the body to trigger an acute immune response) have

been shown to reduce sleep quality and promote sleep disturbances in previously healthy individuals (Capuron et al., 2002; Sharpley, Cooper, Williams, Godlewska, & Cowen, 2016; Späth-Schwalbe, Lange, Perras, Fehm, & Born, 2000). Thus, sleep disturbances may represent an early symptom of dysregulation and accumulating insults in the immune and cardiovascular systems.

Another related explanation for why sleep quality mediated the associations between purpose and onset of several health conditions is the close association between stress and sleep quality. Though stress has long been known to impair sleep quality—sleep disturbances are a common diagnostic feature among anxiety and associated psychological disorders (Benca et al., 1997; Brown, Barlow, & Di Nardo, 1994)—the physiological and cognitive mechanisms behind this association are becoming more apparent. Pre-sleep cognitive activity characterized by negative emotion and persistent thoughts about stressors can delay sleep onset (Harvey, 2000). Moreover, acute activation of stress systems has been shown to alter heart rate variability and REM-NREM cycles during sleep, which may promote awakening and other disturbances during the night (Hall et al., 2004). Considering sense of purpose in life, more purposeful individuals may experience better sleep quality because they are less heavily impacted by stressful experiences.

A sense of purpose may allow individuals to better contextualize stressful events in the broader context of their purpose and lead them to be less prone to ruminate over stressors that are not particularly relevant to their purpose-driven goals (McKnight & Kashdan, 2009). Past work seems to support this notion that purpose may buffer the effects of stress and reduce its impact on affective and biological systems. For example, one study exploring the impact of ethnically diverse environments in passenger trains found that more purposeful individuals experienced less

distress in this diverse setting compared to their less purposeful counterparts (Burrow & Hill, 2013). One explanation is that purposeful individuals are less likely to perceive this diverse environment as a threat to their overarching life aims, leading these individuals to report less stress and anxiety related to these settings. In addition, work looking at daily secretion of the stress hormone cortisol has found a moderate negative relationship between purpose in life and daily cortisol levels, suggesting that more purposeful individuals may experience less activation of the stress response over the course of a day (Lindfors & Lundberg, 2002; Ryff et al., 2004). Related work has also shown less sympathetic nervous system activation during periods of induced stress in people reporting higher purpose in life (Ishida & Okada, 2006; 2011). These potentially stress-buffering effects are likely to carry over into nighttime, meaning that more purposeful individuals may be less likely to suffer from sleep impairment and its insalubrious effects.

These mechanisms may help to clarify the findings related to onset of specific health conditions in the present study. Sleep was found to be the primary mediating factor linking purpose with hypertension, heart disease, arthritis, and lung disease. The chronic activation of stress systems can deplete immune resources and increase one's risk for infectious diseases and promote inflammation, factors known to increase one's risk for a number of chronic conditions (Glaser & Kiecolt-Glaser, 2005). Given the association between chronic inflammation and risk for cardiovascular conditions in particular, this may explain why sleep mediated the association of purpose in life with hypertension and heart disease onset in the present findings. This mechanism may also explain why purpose was indirectly associated with reduced risk for arthritis, a condition characterized by chronic inflammation of the joints. Furthermore, stressful periods are also known to promote flare-ups and worsen symptoms in arthritis patients (Affleck,

Pfeiffer, Tennen, & Fifield, 1987). With these numerous health benefits, sleep quality likely represents a major pathway through which one's purpose may influence physiological functioning.

A recent review by Boehm and Kubzansky (2012) proposed a model outlining the mechanisms through which positive psychological wellbeing is associated with cardiovascular disease. Although many of the components of psychological wellbeing discussed in their review may be less stable in the long-term, purpose likely influences illness risk through similar processes. In this model, the authors suggest that psychological wellbeing influences cardiovascular health by promoting health behaviours such as physical activity and sleep quality and by supporting biological function (e.g., reduced presence of inflammatory factors, decreased blood pressure). In addition to these mechanisms, positive wellbeing is believed to reduce stress onset and buffer against the negative effects of stress, which would similarly reduce the presence of negative biological risk factors. Taken together, these effects serve to promote restorative biological processes while reducing deteriorative processes. With respect to the present findings, sleep quality likely embodies a number of the physiological and psychological mechanisms outlined in this model including inflammation, blood pressure, stress, and circadian cardiac regulation. As such sleep quality may represent a broader pathway linking purpose with physiological functioning and illness risk in general.

Considering the other potential mediators, past research has found health self-efficacy to be related to numerous health outcomes, though this was not replicated in this study. Although some past research has found more general feelings of control to predict later illness risk (e.g., Bosma et al., 1997), health-specific self-efficacy has been more commonly discussed as a factor which may precede health behaviour engagement (see Strecher et al., 1986 for a review) and its

direct association with chronic illness onset is less clear. The present study replicated this past work, finding significant associations between health self-efficacy and the health behaviours of sleep quality, and moderate and vigorous physical activity. However, health self-efficacy was not associated with risk for any of the chronic health conditions after controlling for the effects of physical activity and sleep quality, indicating that much of the effect of health self-efficacy on illness risk may be subsumed within the effect of health behaviours more broadly.

In addition to elaborating on the mechanisms connecting purpose with health risk, these findings extend the literature concerning purpose and risk for onset of specific ailments. Notably, the current study adds support to the notion that having a sense of purpose in life is protective against cardiovascular conditions. These findings replicate past work which has demonstrated a reduced risk for stroke and myocardial infarction in more purposeful individuals (Kim, Sun, Park, Kubzansky, & Peterson, 2013; Kim, Sun, Park, & Peterson, 2013). The current study builds upon this work by Kim and colleagues by also demonstrating that a greater sense of purpose in life is associated with reduced risk for developing heart conditions in general; including, but not limited to heart attack, coronary heart disease, angina, and congestive heart failure. The results also provide evidence for an association between purpose and longitudinal risk for developing hypertension; an additional risk factor for the cardiovascular conditions listed above.

In addition to the association with cardiovascular disorders, the current study is the first to explore the relationship between sense of purpose and risk for arthritis, lung disease, cancer, and diabetes. Sense of purpose was associated with a reduced risk of arthritis through its effects on sleep quality. This finding builds upon past work which has linked sense of purpose in life with better functional ability in individuals recovering from osteoarthritis-related knee surgery,

as well as a reduced risk for physical disability in older adults (Boyle, Buchman, & Bennett, 2010, Smith & Zautra, 2004). As expected, purpose was not associated with cancer risk. This may be attributed to the wide range of non-controllable risk factors associated with cancer including genetic predisposition and exposure to environmental toxins. Similar findings were noted in work by Weston and colleagues (2014) in which cancer was the only condition not predicted by the Big Five personality factors. Interestingly, sense of purpose also did not predict diabetes risk. Though diabetes risk may be influenced by some controllable factors such as obesity and poor diet, it is also influenced by a number of non-controllable risk factors including genetics and early childhood experiences (e.g., Sladek et al., 2007). Thus, these two conditions are less likely to be influenced by potential behavioural and physiological benefits of purpose.

An additional point that should be addressed is the fact that indirect effects show up for heart disease, arthritis, and hypertension despite the absence of a direct association with purpose prior to the addition of mediating variables. Statistically speaking, indirect effects can be observed without the presence of a statistically significant direct effect (Hayes, 2009; Rucker et al., 2011). Such an occurrence may be especially common in cases where the direct effect is weaker than the associations between the mediator and independent and dependent variables. Thus, while some may approach these results with caution, it is perfectly reasonable to observe significant indirect effects in this situation.

The above findings provide some insight into the mechanistic links between sense of purpose and numerous health conditions, yet it is still unclear why purpose is associated with a reduced risk for stroke. Individuals who did not have a stroke over the eight-year follow-up were found to be significantly higher in sense of purpose at the initial time point. With the inclusion of covariates, purpose was directly associated with a reduced stroke risk, though this association

was marginally significant with the use of the more stringent alpha criterion. As with the other health conditions, it is likely that sense of purpose influences risk for stroke through a number of pathways. Similar work to the present study has found the association between purpose and stroke holds above and beyond potential behavioural, biological, and psychological mechanisms (Kim, Sun, Park, & Peterson, 2013). With the addition of each group of covariates, the association between purpose and stroke diminished slightly, but remained significant. However, with the inclusion of all the covariates the association was marginally significant, suggesting that no single group of covariates accounted for a significant portion of the variance in this association. The present study built upon this work by testing additional potential mechanisms connecting purpose to stroke risk including sleep quality and perceived control over health, similarly finding that the association between purpose and stroke held above and beyond these mechanistic accounts.

Indeed, stroke is influenced by a number of psychosocial, behavioural, and biological factors and thus work bridging across these disciplines is likely needed to clarify the mechanisms linking purpose with stroke risk. One recent study utilizing a large, international sample of hospital admitted stroke patients suggested that ten biological and psychosocial risk factors collectively account for the majority of stroke risk (O'Donnell et al., 2010). Although some of these factors are accounted for in the present study (e.g., physical activity), several of these leading risk factors were not available for the present analyses, including diet, smoking and alcohol use, and expression of apolipoprotein genes. Though it is likely that purpose in life is linked to a number of these risk factors, many of these potential mechanisms require collection of biological samples and as such, extend beyond the scope of the present work.

Limitations and Future Directions

Though the current study built upon past work by utilizing a large longitudinal sample of adults followed over an eight-year period, it is limited in some regards. A primary limitation of the current study is that each measure of disease onset relied on participants' self-reporting this information. Though this approach has been used in numerous past studies (e.g., Hill et al., 2014; Kim, Sun, Park, & Peterson, 2013; Weston et al., 2014), self-report measures are not ideal as they rely on participants correctly recalling and reporting diagnoses, which may be impacted by participant biases or differences in memory ability. As such, future work may benefit from more objective measures such as physician reports or medical records that would provide more detailed information about time of disease onset. Another concern is that information on other health behaviours such as participants' dietary habits and smoking and alcohol consumption were not available for a large portion of the present sample. Despite dietary habits having been assessed in a subsample of HRS participants in a 2013 questionnaire, the smaller sample size and short time period between this assessment and the 2014 follow-up were not ideal for testing whether these mediated the risk for onset. Future work could benefit from exploring dietary habits as a mediating factor between purpose and illness onset, especially for conditions such as heart disease and type II diabetes. In addition, data on smoking and alcohol use at the 2006 wave were not available for the majority of the present sample, severely limiting the ability to test these as mediators. Future longitudinal work should look to test these associations using reliable, validated smoking and alcohol measures. Similarly, minimal data was available on participants' preventative health care utilization, a factor which is likely to influence illness diagnosis. Future work should consider these potential mechanisms when exploring purpose and illness risk.

A further limitation of the present study is that the sample consists entirely of American adults and may not be generalizable to other cultures or groups of differing demographic

characteristics. Despite this limitation, past studies have linked purpose to positive health outcomes in other cultures. For instance, the Japanese construct of "ikigai" is considered by many to be conceptually related to purpose in life (e.g., Koizumi et al., 2008), and has been similarly linked with factors such as reduced stress reactivity and decreased heart disease and mortality risk (Ishida & Okada, 2006; 2011; Tanno et al., 2009). Despite this, it may be beneficial for future work to investigate whether purpose may be influenced by racial, ethnic, economic, and educational characteristics. For instance, past work has demonstrated that the effect of perceived control on mortality risk is dependent on education level, with control showing the strongest protective effect in individuals with low education (Turiano, Chapman, Agrigoroaei, Infurna, & Lachman, 2014). Purpose may be similarly moderated by socioeconomic status and race/ethnicity; a question which should be addressed in future work utilizing a more diverse sample.

Finally, given that the variables tested as mediators were assessed at the same time point as purpose in life, results pertaining to the directionality of this relationship should be interpreted with caution. Though purpose has been shown in past work to longitudinally predict physical activity and sleep (Hooker & Masters, 2014; Kim et al., 2015), the nature of the current design makes it difficult to test this order of causality. Thus, an additional direction for future work may be to test the association between purpose and health behaviours using longitudinal or experimental designs which could allow researchers to more accurately assess directionality.

The current findings support the relevance of sense of purpose in life in the health psychology literature and should serve as a future target for health promotion research and interventions. Future work could expand on this research by investigating how the diagnosis of a major illness would impact a patient's sense of purpose in life long-term. One would expect

potentially life-threatening conditions or those that lead to impairment to challenge one's sense of direction given the uncertainties of their future. However, this may not be the case for all individuals, as some may be resilient to such declines in purpose or may even benefit from a re-evaluation of their life, finding new direction elsewhere. Thus, future work is needed to explore differences in change patterns in purpose after diagnosis with a chronic health condition. Particularly, investigating factors such as personality, social support, and the content of participants' purpose itself could allow researchers to better understand who is at risk for declining purpose after diagnosis and who may be more resilient to such changes. This work would add to the literature in the area by permitting clinicians to identify who is at risk for declining sense of purpose after a diagnosis and implement interventions to support their treatment.

The present study suggests that purpose in life is a protective factor in terms of long-term illness risk. As such, a future direction for research in this field is to explore the potential for purpose-promoting interventions to enhance health-related behaviours. Specifically, given the myriad of health promoting effects of sleep quality, exploring the potential for purpose interventions to promote sleep quality should serve as a key direction for future work. Though to date purpose interventions have not been explored in the context of health, past work has shown promise in promoting purpose using relatively brief interventions. Several studies have suggested that reflecting upon one's purpose in the form of writing may confer at least short-term benefits on sense of purpose (e.g., Burrow & Hill, 2013; Chippendale & Boltz, 2015). Likewise, small group discussion about purpose and goal setting have also shown promise in boosting adolescent students' purpose and perceived control over the course of an academic semester (Pizzolato, Brown, & Kanny, 2011). With regard to sleep quality, future studies could explore how similar

interventions influence various aspects of sleep including sleep onset, maintenance, and REM-NREM cycles. Additionally, purpose interventions could be used in conjunction with existing sleep intervention techniques to improve the efficacy of such programs. For instance, the reflection and goal setting programs utilized in past work to promote purpose salience could be easily integrated into programs involving cognitive behavioural therapy which have shown success in reducing sleep disturbances (Yang et al., 2015).

Though the effect sizes observed in the present study are small, it should be noted that they are fairly similar in magnitude to related work predicting risk for chronic illness onset from personality and social support (Hill et al., 2014; Weston et al., 2014). Further, these findings should also be considered in the broader context of the more manifold benefits of purpose on health and psychological well-being. Broadly speaking, past research suggests that purpose is an adaptive trait associated with factors such as greater positive affect and decreased negative affect and depressive symptoms (Ryff & Keyes, 1995), decreased stress reactivity (Ishida & Okada, 2006, Ryff et al., 2004), preventative health care use (Kim, Strecher, & Ryff, 2014), and decreased mortality risk (Hill & Turiano, 2014). Concerning the potential for purpose interventions, it may be more beneficial to promote purpose concurrently with other established health interventions (e.g., physical activity) rather than considering purpose as a sole intervention target. For instance, as mentioned above, integrating purpose interventions with cognitive behavioural therapy may allow such programs to more effectively promote health behaviour than if conducted separately. Therefore, future investigators should test for synergistic interactions between purpose and established health-related interventions.

Another important direction for future work is to clarify why purpose promotes engagement in health behaviours. Although the effect of purpose on health self-efficacy may

help to explain this, more work is needed to clarify the motivational processes which may promote health behaviours. McKnight and Kashdan (2009) suggest that purposeful individuals are directed to engage in behaviours relevant to their larger life aims, of which good health is often a prerequisite. As such, one important question for future research is whether purposeful individuals more frequently endorse health related goals. Further integration of work on purpose in life with research on goal selection and motivation may help to clarify these health-promoting mechanisms.

In summary, sense of purpose in life was found to be directly associated with a reduced risk for onset of stroke after an eight-year follow-up and indirectly associated with heart disease, hypertension, lung disease, and arthritis through the effects of sleep quality. Given these findings and past work linking purpose to reduced risk for Alzheimer's disease (Boyle et al., 2012), physical disability (Boyle, Buchman, & Bennett, 2010), and cardiovascular health (Koizumi et al., 2008; Kim, Sun, Park, & Peterson, 2013; Kim, Sun, Park, Kubzansky, & Peterson, 2013), it is clear that purpose represents a dispositional trait that is conducive to long-term health across a number of bodily systems. The present study also highlights the importance of considering sleep quality as a mechanism in research linking individual difference with health outcomes.

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Appendix A: Ryff Measures of Psychological Wellbeing

Purpose Subscale (Ryff, 1989)

Please say how much you agree or disagree with each of the following statements. (Mark (X) one box for each line.)

a) I enjoy making plans for the future and working to make them a reality.

Strongly disagree	Somewhat disagree	Slightly disagree	Slightly agree	Somewhat agree	Strongly agree

b) My daily activities often seem trivial and unimportant to me.

Strongly disagree	Somewhat disagree	Slightly disagree	Slightly agree	Somewhat agree	Strongly agree

c) I am an active person in carrying out the plans I set for myself.

Strongly disagree	Somewhat disagree	Slightly disagree	Slightly agree	Somewhat agree	Strongly agree

d) I don't have a good sense of what it is I'm trying to accomplish in life.

Strongly disagree	Somewhat disagree	Slightly disagree	Slightly agree	Somewhat agree	Strongly agree

e) I sometimes feel as if I've done all there is to do in life.

Strongly disagree	Somewhat disagree	Slightly disagree	Slightly agree	Somewhat agree	Strongly agree

f) I live one day at a time and don't really think about the future.

Strongly disagree	Somewhat disagree	Slightly disagree	Slightly agree	Somewhat agree	Strongly agree

g) I have a sense of direction and purpose in my life.

Strongly disagree	Somewhat disagree	Slightly disagree	Slightly agree	Somewhat agree	Strongly agree

Appendix B: Jenkins Sleep Questionnaire (1988)

a) How often do you have trouble falling asleep?

   i. Most of the time

   ii. Sometimes

   iii. Rarely or never

b) How often do you have trouble with waking up during the night?

   i. Most of the time

   ii. Sometimes

   iii. Rarely or never

c) How often do you have trouble with waking up too early and not being able to fall asleep again?

   i. Most of the time

   ii. Sometimes

   iii. Rarely or never

d) How often do you feel really rested when you wake up in the morning?

   i. Most of the time

   ii. Sometimes

   iii. Rarely or never