Chapter 4
Predicting Relations Among Life Goals, Physical Activity, Health, and Well-Being in Elderly Adults: A Self-Determination Theory Perspective on Healthy Aging

Behzad Behzadnia, Edward L. Deci, and Cody R. DeHaan

Abstract Considerable research in aging has dealt with elderly people's health, the main purposes of which are to prevent chronic diseases and increase functional ability. However, psychological well-being is also important for the elderly, so it is crucial to identify psychological factors that would not only help manage health problems in these individuals but could also increase their psychological wellness. Within self-determination theory (SDT: Deci and Ryan in Psychol Inq 11:227–268, 2000; Ryan and Deci in Self-determination theory: basic psychological needs in motivation, development, and wellness. Guilford Publications, New York, NY, 2017), individuals' well-being is said to be facilitated when satisfaction of their basic psychological needs (viz. autonomy, competence and relatedness) is supported. This support can be provided in various ways which includes encouraging them to pursue goal contents that are more intrinsic (e.g., community contributions and healthy lifestyles) than extrinsic (e.g., wealth and fame). This chapter compares elderly persons' intrinsic versus extrinsic life goals and their satisfaction versus frustration of basic psychological needs, as these variables relate to health-relevant physical-activity behaviors, as well as physical and psychological well-being. A key hypothesis is that placing importance on intrinsic goals will relate positively to health and well-being via the mediating role of basic psychological needs satisfaction; whereas, placing importance on extrinsic goals will relate to ill-being via the mediating role of basic psychological needs frustration. Furthermore, basic psychological needs satisfaction will enhance intrinsic goals and promote healthy behaviors, whereas basic psychological needs frustration will promote extrinsic goals and diminish healthy behaviors.

B. Behzadnia (✉)
Department of Motor Behavior, Faculty of Physical Education and Sport Science, University of Tabriz, 29 Bahman Blv, Tabriz 5166616471, Iran
e-mail: behzadnia@tabrizu.ac.ir

E. L. Deci
Department of Psychology, University of Rochester, Rochester, NY, USA

University of Southeast Norway, Honefoss, Norway

C. R. DeHaan
Immersyve, Inc., Celebration, FL, USA

B. Ng and G. Ho (eds.), *Self-determination Theory and Healthy Aging*,
https://doi.org/10.1007/978-981-15-6968-5_4

4.1 Introduction

Seeking well-being has often been considered one of the important goals of human life. Children demonstrate this regularly through their play. They seek opportunities to explore and to learn; because they are intrinsically motivated to play and learn so that they generally experience well-being when they do (Deci, 1975). In their play, they easily make new friends, engage with their environments, and love others, especially their families. From a developmental perspective, well-being is a life-long process, for people have the possibility of behaving in ways that promote their own happiness and wellness, and, if they are fortunate, significant others may behave toward them in ways that facilitate their well-being. (Ryan, Huta, & Deci, 2008; Ryff, 2014). In other words, like children, adults and elderly individuals can also experience wellness by living in healthy ways and being supported by others who believe that the developmental processes function across the stages of life.

According to a United Nations' report (2015), there are currently approximately 900 million living people who are 60 years of age or over, and that population is likely to have grown by 56% by 2030. Research on aging, especially as it relates to the health and well-being of older individuals, is among the most important topics addressed for this population. Most health problems of the elderly have resulted from chronic diseases that can be effectively managed if their environments support them in terms of educating them either about healthy behaviors or about their human rights in terms of health (World Health Organization, 2015). As people age, among the most important roles of their societies and social-service programs are to create supportive environments to address the elderly persons' needs and rights, and to provide training and education programs to promote health and wellness for their later years. In addition, it is crucial to promote healthy and active behaviors for the elderly (Bauman, Merom, Bull, Buchner, & Fiatarone, 2016). Despite this global view on the importance of healthy aging, to our knowledge, the question of whether older people's life goals (intrinsic versus extrinsic) and social environments (need supportive versus need thwarting) would predict their healthy behaviors and well-being has received relatively little attention (Kasser & Ryan, 1999; Ferrand, Martinent, & Durmaz, 2014).

Previously, health problems in older people have tended to be related to the idea that human development occurs primarily between conception and late adolescence, and change after that would be characterized by increases in age and decreases in various aspects of wellness (Baltes, 1987). However, human development encompasses the entire life span; that is, development and transformation can occur from conception to later periods in one's life, and all stages of the lifespan can contribute to human development (Baltes, 1987; Baltes, Staudinger, & Lindenberger, 1999). Therefore, people's behaviors and environmental supports over time would affect older persons' health behaviors. According to self-determination theory (SDT; Deci & Ryan, 2000; Ryan & Deci, 2017), people's life goals (i.e., intrinsic versus extrinsic) and social contextual conditions (i.e., need supportive versus need thwarting) would contribute to their health and well-being. In this chapter, we initially provide research evidence on the

importance of physical activity among older adults for their health and well-being; next, through an SDT approach, we examine the relations of older people's life goals and basic psychological needs satisfaction (viz. autonomy, competence, and relatedness) with their well-being through the mediating role of physical activity over time; and finally, we discuss how SDT can provide an organized framework for the field of healthy aging.

4.1.1 Physical Activity and Healthy Aging

In a recent report from the World Health Organization (WHO), the functional ability of elderly people to maintain their wellness was said to be a crucial process for healthy aging (Beard et al., 2016). Research has shown that physical activity can help the elderly be healthier either in terms of reducing diseases (e.g., cardiovascular and non-communicable diseases) and sedentary behaviors or enhancing health behaviors and well-being in this population (Daskalopoulou et al., 2017; Koyanagi, Stubbs, Smith, Gardner, & Vancampfort, 2017). In other words, healthy aging can result from both reducing sedentary behaviors and enhancing health-related physical activities. However, a global view concerned mostly with healthy aging via prevention of diseases such as controlling high blood pressure, cancers, and diabetes (Bauman et al., 2016), indicates that nearly three-quarters of diseases related to deaths in older adults occur in low and middle-income countries and could be managed by regular participation in physical activity programs (WHO, 2014). It is recognized that moderate-intensity physical activities (e.g., swimming, housework, and brisk walking) for 150 min per week, and vigorous-intensity physical activities (e.g., fast dancing and garden digging) for 75 min per week would improve breathing and heart rate and would therefore diminish premature deaths and positively manage health conditions among older people (WHO, 2010b). Although there is clear evidence that physical activity is important for older adults (e.g., Bauman et al., 2016; WHO, 2010a), for many of them, their physical activity levels are below the recommendations (e.g., Hupin et al., 2015), indicating that they do not engage in sufficient physical activity either in high-income countries such as the United Kingdom (McPhee et al., 2016) and the United States (Watson et al., 2016), or in low-income countries such as Iran (Ahmadi, Amini Sanii, Bani, & Bakhtari, 2018; Naderi, Safania, & Amirtash, 2016). Research also shows that among the most important determinants of older persons' physical activity and successfully aging are education level, age, income, and negative health behaviors, such as smoking and alcohol (Ethisan, Somrongthong, Ahmed, Kumar, & Chapman, 2017). In addition to these factors, research has also shown that the psychological variables of life goals (Antunes et al., 2018; Gunnell, Crocker, Mack, Wilson, & Zumbo, 2014; Sebrie, Standage, & Vansteenkiste, 2009) and basic psychological needs can influence physical-activity behaviors (Kirkland, Karlin, Stellino, & Polus, 2011; Ng et al., 2012). In the current research, we therefore aim to investigate older adults in a lower-income country, Iran, and examine the role of life goals and basic psychological needs in predicting physical-activity behaviors and well-being.

4.1.2 Self-Determination Theory

4.1.2.1 Basic Psychological Needs

According to SDT (Deci & Ryan, 1985, 2000; Ryan & Deci, 2017, 2019), a broad and widely applied theory in the area of motivation and personality, every person has three basic psychological needs, namely autonomy, competence and relatedness, the satisfaction of which are essential nutrients for development, integrity, and well-being, regardless of the individual's gender, age, and socioeconomic status. Based on Basic Psychological Needs Theory (BPNT, Deci & Ryan, 1985; Ryan, 1995; Ryan & Deci, 2017), a mini-theory within SDT, the need for *autonomy* refers to the experience of volition, willingness, and choice while engaging in an activity; for example, in the workplace or in society more generally. If older persons perceive their surrounding environments to understand their perspectives and to fit with their interests and sense of choice in doing a task, they are likely to experience a sense of autonomy. The need for *competence* refers to the experience of effectiveness in dealing with challenging situations and feeling competent in successfully completing tasks; for example, if older persons feel effective in interacting with their environment, and feel capable in achieving outcomes, they are more likely to experience a sense of competence from doing so. Finally, the need for *relatedness* involves feeling connected with others and having the desire to be meaningfully connected with groups; for example, older persons' experiences of care by significant others and experiences of a warm feeling toward people around them with whom they spend time (Ryan & Deci, 2017). Research shows that the satisfaction of basic psychological needs enhances well-being, quality of life, and health-related exercise and physical-activity behaviors (Brown, Fry, & Moore, 2017; Ferrand, Martinent, & Durmaz, 2014; Ng et al., 2012; Ryan, Patrick, Deci, & Williams, 2008; Silva et al., 2010; Vanhove-Mariaux, Martinent, & Ferrand, 2018).

In contrast, when basic psychological needs are not satisfied or are frustrated, it results in negative behaviors, such as controlled behaviors (sense of obligation and pressure from internal and external resources to do the activities or behaviors), amotivation, unhealthy behaviors, and negative emotions (Ryan & Deci, 2017). That is, for example, when older persons feel conflict and pressure to do things they would not choose to do, they are likely to feel that their need for autonomy is frustrated; the frustration of competence involves older persons feeling a sense failure, incapability, and personal inadequacy; and relatedness frustration entails elderly adults' feeling disrespected, rejected, and lonely. That said, older individuals may feel forced to do things, excluded from groups and society, and insecure about their abilities, thus resulting in poorer psychological health, greater ill-being, and depression or isolation (Ryan & Deci, 2017; Vasnteenkiste & Ryan, 2013). Research in the areas of physical activities have generally shown that need frustration is related to unhealthy behaviors (e.g., disordered eating) and ill-being (Bartholomew, Ntoumanis, Ryan, Bosch, & Thogersen-Ntoumani, 2011; Behzadnia, Adachi, Deci, & Mohammadzaded, 2018) in both younger and older adults (Vanhove-Mariaux et al., 2018).

The distinction between need satisfaction and need frustration is therefore critical as the experience of satisfaction tends to relate to positive functioning, whereas the experience of frustration is likely to yield malfunctioning (Ryan & Deci, 2017, 2019; Vasnteenkiste & Ryan, 2013). Parallel to the distinction in need satisfaction and frustration, based on SDT, distinguishing between different lifestyles or personal aspirations may result in satisfaction and frustration, respectively (Deci & Ryan, 2000; Ryan & Deci, 2017). Below, we briefly discuss Goal Contents Theory (GCT, Deci & Ryan, 2000; Kasser & Ryan, 1996; Ryan & Deci, 2017), another mini-theory in SDT, consider how different life goals may shape different behaviors and attitudes, and how basic psychological needs satisfaction and frustration could impact those varied life goals.

4.1.2.2 Life Goals: Aspirations

An important aspect of SDT relates to the contents of the life goals that people value and pursue. Based on GCT (Deci & Ryan, 2000; Kasser & Ryan, 1996; Ryan & Deci, 2017), not all life goals are created equal; rather life goals fall into two broad categories: intrinsic life goals or aspirations and extrinsic life goals. Herein, we discuss the content of older adults' aspirations in order to promote their well-being.

Intrinsic life goals such as making community contributions, developing personally, building meaningful relationships, and engaging in physical activities are characterized by an "inward orientation" that focuses on inherent growth tendencies (Vansteenkiste, Soenens, & Duriez, 2008). That is, intrinsic goals are adaptive because they can facilitate satisfaction of the basic psychological needs (Ryan, Huta et al., 2008; Van Hiel & Vansteenkiste, 2009) and, in turn, foster wellness or "the good life" (Behzadnia & Ryan, 2018; Ryan, Huta et al., 2008). As an example, when leaving their professional careers, older persons may reduce their physically active lifestyles. However, if they value intrinsic life goals such as helping others, engaging in activities such as taking walks, or doing work around the house or garden, they may decide to engage in physical-activity health programs. This approach could help them develop new relationships and be more active on a regular basis, which can lead to feeling effective in satisfying their basic psychological needs and promoting their well-being. Likewise, satisfaction of basic psychological needs can lead older persons to experience stronger intrinsic life goals such that they contribute to the environment, help others, and develop as more caring and effective people (Deci & Ryan, 2000; Kasser, 2002; Kasser & Ryan, 2001; Ryan & Deci, 2017).

In contrast to intrinsic life goals are extrinsic goals such as pursuit of power, financial wealth, appealing appearances, and social recognition or fame. These extrinsic goals, characterized by an "outward orientation" focus on making impressions on others (Vansteenkiste et al., 2008). By way of illustration, extrinsic goal-orientated elderly persons want to achieve financial success, hide their signs of aging by showing their physical 'looks' rather than being physically active and healthy looking. Therefore, seeking extrinsic goals may not relate to the

satisfaction of basic psychological needs and may even distract from it. For example, some older adults may use hair dye, drugs, or anti-wrinkling creams to appear physically attractive. But that may be related negatively rather than positively to life satisfaction or happiness (Shin & Suh, 2018). Furthermore, the degree to which one places strong importance on pursuing extrinsic life goals such as attractiveness may be related to behaving in unhealthy ways and diminished wellness benefits (Deci & Ryan, 2000; Van Hiel & Vansteenkiste, 2009). In addition, it might be that some older people pursue extrinsic life goals such as wealth to feel good about themselves, perhaps because of their limited capabilities (Deci & Ryan, 2000; Kasser, 2002; Kasser & Ryan, 2001; Ryan & Deci, 2017). In other words, when environmental conditions do not provide support for satisfaction of basic psychological needs for autonomy, competence and relatedness, individuals tend to pursue extrinsic goals of admiration and wealth as a compensatory strategy to get at least some gratification. However, it eventually results in decreased needs satisfaction and well-being (Kasser, 2002).

Evidence has indicated that valuing and pursuing intrinsic life goals would typically satisfy basic psychological needs, which in turn, tend to foster well-being, whereas pursuing extrinsic life goals would typically frustrate needs and diminish need satisfaction, resulting in greater ill-being (Ryan & Deci, 2017). In addition, pursuing extrinsic rather than intrinsic life goals could gradually cause mental health problems such as substance use (e.g., tobacco abuse) or major depression (Kasser et al., 2014). While such research evidence suggests that life goals affect well-being among children, students, and adults, research is needed to examine how pursuing intrinsic and extrinsic life goals affects elderly persons' well-being.

4.1.3 SDT and Healthy Aging

Recently, a positive aging movement across the world has provided some insights and programs regarding aging, "to add more life to years, not just some years to life" (Vaillant, 2015, p. 596). In a new definition of healthy aging, WHO (2015) focus on "the process of developing and maintaining the functional ability that enables well-being in older age." Functional ability enables all people to use their intrinsic capabilities in interaction with their environment (for a review see WHO, 2015). Healthy aging suggests that older adults may prompt either psychological factors and individual traits or optimal functioning and positive social and community relationships in old age; that is, aging well is the main concept in positive or healthy aging rather than just increasing average life-expectancy (Hill, 2005). In order to promote the experience of healthy aging, one should focus on health promotion programs and actively participate in society or community (Minichiello & Coulson, 2005). Within this approach, cultural conditions with particular values or assumptions would shape, to some degree, positive versus negative aging (Gergen & Gergen, 2001). That is, instead of the traditional view that older people gradually lose their abilities and should depend upon others or live in residential/nursing homes, most elderly people would prefer to be respected

as autonomous individuals who are self-sufficient economically and feel intimacy with significant others (Gergen & Gergen, 2001), which would most probably occur in supportive societies.

Along with growing older, a highly important challenge of ageism in societies concerns promoting healthy aging; that is being both physically and psychologically healthy and vital (Katz, 2001). From an SDT perspective, compared to extrinsic life goals, pursuing intrinsic life goals would gradually promote more stable well-being through the mediating role of basic psychological needs satisfaction. If older persons place importance on pursuing intrinsic life goals, and social contexts promote satisfaction of the individuals' needs for autonomy, competence and relatedness, they are more likely to participate in the activities that for them may yield well-being. Therefore, healthy aging would result from pursuing intrinsic life goals and experiencing need satisfaction, which may provide a comprehensive approach regarding a way to have healthy aging.

4.1.4 Current Research

Although there are data supporting these SDT propositions in the U.S. (e.g., Kasser et al., 2014; Ryan & Deci, 2017) and Belgium (Van Hiel & Vansteenkiste, 2009), there are no relative data from lower-middle income countries such as Iran. In the current research, we aim to investigate the importance of older people's life goals and the perceptions of basic psychological needs satisfaction and frustration in their society in relation to their physical activity levels in the past five years and at the current time. We also aim to investigate the fit of these models in relation to physical and psychological well-being.

It has been found that both intrinsic life goals and basic psychological needs satisfaction enhance health-related physical activity as well as psychological and physical wellness (Ryan & Deci, 2017). Furthermore, intrinsic life goals can either have a direct relation with wellness or a mediated relation via basic psychological needs satisfaction. Therefore, we first expected that intrinsic life goals would predict health-related physical activity behaviors, and in turn physical and psychological wellness (Hypothesis 1a); and we expected that extrinsic life goals would predict lower levels of physical activity behaviors, and in turn ill-being (Hypothesis 1b). We further expected that intrinsic life goals would predict health behaviors and wellness, mediated by satisfaction of the basic psychological needs (Hypothesis 2a); and extrinsic life goals would predict lower levels of physical activity behaviors and ill-being, mediated by frustration of the basic psychological needs (Hypothesis 2b). Our research aims to characterize the relationship between life goals and basic psychological needs with health-related physical activity and physical and psychological well-being in elderly people. Moreover, we aimed to examine these relations in the past five years and at the current time. We aimed to investigate individuals' reports of five years ago and the present because, as noted above, human development encompasses the entire life span. That is, we aimed to

figure out how older persons' life goals, basic psychological needs, and physical activity behaviors from the past five years relate to these variables at the current time, and how these would shape older people's physical and psychological well-being. According to SDT, goal contents and basic psychological needs during development may lead people to change their perspectives and experiences regarding these variables over time, and these subsequently may change their health and well-being. Therefore, it is important to explore how older persons' goal contents, basic psychological needs, and physical activity behaviors during a period of five years ago and at the current time shape their physical and psychological well-being.

4.2 Method

4.2.1 Participants

To test the hypotheses, we collected data ($N = 158$) from individuals 50 years old and older ($M_{age} = 59.93$, $SD = 7.24$) ages ranged between 50 and 84 in Iran. Of these, 103 were males and 55 were females. Participants were recruited from retirement societies and via social networks (Telegram App). The University of Tabriz Ethical Research Review Board approved the study protocol.

4.2.2 Procedure

To examine the study hypotheses, we asked participants to complete questionnaires reporting their levels of pursuing intrinsic and extrinsic life goals; their satisfaction and frustration of basic psychological needs; and their physical activity levels, at the current time and at a time five years earlier. Regarding older persons' current time, physical (i.e., BMI, systolic and diastolic blood pressure) and psychological (i.e., subjective vitality and depression) well-being were also measured. Internal consistency of each scale was calculated using Cronbach's alpha which is reported in Table 4.1.

4.2.3 Measures

4.2.3.1 Aspirations

The importance of intrinsic and of extrinsic life goals was measured through a short 14-item version (Martos & Kopp, 2012; Martos, Szabó, & Rózsa, 2006) of the Aspiration Index (AI; Kasser & Ryan, 1996). An intrinsic goals composite was

computed by averaging personal growth (example item, "To grow as a person and learn many new things"), meaningful relationships (example item, "To have deep enduring relationships"), community contributions (example item, "To work to make my community a better place"), and good health (example item, "To have a physically healthy lifestyle") subscales. An extrinsic goals composite was computed by averaging wealth (example item, "To have enough money to buy expensive possessions"), fame (example item, "To be famous"), and image (example item, "To have an image that others find appealing") subscales. Older persons indicated how much importance they placed on these intrinsic and extrinsic goals in the *current time* on a 5-point Likert scale, from 1 (*very little*) to 5 (*very much*). They also indicated how much importance they placed on these intrinsic and extrinsic goals at a period of *five years ago*. The English version of the AI was translated into Persian by two Iranian bilingual researchers fluent in English, and then back translations were done by a psychologist with expertise in SDT (and fluency in English). Non-equivalences were resolved by a discussion among a psychologist and two researchers.

4.2.3.2 Basic Psychological Needs

To measure basic psychological needs, the shortened 12-item version of the Basic Psychological Need Satisfaction and Need Frustration Scale (BPNSNFS; Chen et al., 2015) was used. This short version of the BPNSNFS has previously been used in the context of physical education college students by Behzadnia, Adachi, Deci, and Mohammadzadeh (2018). Each need was measured by two items for satisfaction (autonomy: "I feel a sense of choice and freedom in the things I undertake," competence: "I feel confidence that I can do things well," relatedness: "I feel close and connected with other people who are important to me") and two items for frustration (autonomy: "I feel pressured to do many things," competence: "I feel like a failure because of the mistakes I made," relatedness: "I have the impression that people I spend time with disliked me"). Minor wording changes were made to the items to focus on two times point, *at the current time*, and *during a period of five years ago*. Older persons responded to the BPNSNFS twice, and the stems were, "In general, to what extent do you feel each of the following statements *at the current time*…" and "In general, to what extent did you feel each of the following statements *during a period of five years ago*…". The items were rated from 1 (*not at all true*) to 7 (*very true*).

4.2.3.3 Physical Activity Levels

To measure older persons' health-related physical activity, we used the self-reported short 7-generic items version of the International Physical Activity Questionnaire (IPAQ; Booth, 2000; Craig et al., 2003), which was also used among younger Iranian samples (Vasheghani-Farahani et al., 2011). The IPAQ measures the level of physical

activity during the period of "the last 7 days" (see Craig et al., 2003, for a review), which the instructions labeled as the levels of vigorous-intensity physical activities, moderate-intensity physical activities, walking, and time spent sitting, that were measured separately in days, hours, and minutes. In this study, we asked participants to report their physical activity levels *at the current time* (during the period of "the last 7 days") and *during a period of five years ago.*

4.2.3.4 Wellness

To measure wellness, older persons were asked to respond to items from scales of subjective vitality and depression. The 5-items version of the Subjective Vitality Scale (SVS; Ryan & Frederick, 1997) was used (e.g., "I feel alive and vital"). The SVS has been used in Iranian samples (Behzadnia, Ahmadi, & Keshtidar, 2013). Depression was assessed with the 6-item version of the Center for Epidemiological Studies-Depression Scale (CES-D; Radloff, 1977) which had been widely used in previous studies (e.g., Deci, La Guardia, Moller, Scheiner, & Ryan, 2006) and among Iranian samples (Malakouti, Pachana, Naji, Kahani, & Saeedkhani, 2015). The means of 5 items and 6 items constituted subjective vitality and the risk for depression scores, respectively. In the current research, we also measured body mass index (BMI: kg/m^2, kg = person's weight in kilograms and m^2 = their height in meters squared) and blood pressure (systolic and diastolic) as physical well-being indices.

4.2.4 Data Analysis

Data were analyzed using IBM SPSS Statistics 24 and Mplus version 7.4 (Muthen & Muthen, 2012). As recommended by Allison (2003), multiple imputation was used to deal with missing values. To examine the proposed models (Hypotheses 1 and 2), a full path analysis was used to examine the role intrinsic and extrinsic goals has in predicting basic psychological needs satisfaction and frustration, health-related physical activity behaviors, and physical and psychological well-being.

4.3 Results

Table 4.1 presents means, standard deviations, Cronbach's alphas, and correlations between study variables. The results of correlation analysis showed that the importance of intrinsic and extrinsic goals during a period of five years ago highly correlated with the importance of these goals at the current time, respectively. Experience of needs satisfaction and needs frustration during a period of five years ago were also highly correlated with experienced needs satisfaction and needs frustration at the current time, respectively. The importance of intrinsic goals

Table 4.1 Descriptive statistics and correlations between study variables with different exercise intensities

	M	*SD*	1	2	3	4	5	6	7	8	9	10
1. Extrinsic goals (F)	4.22	1.48	(0.86)									
2. Extrinsic goals (C)	3.92	1.40	0.82	(0.85)								
3. Intrinsic goals (F)	5.98	0.87	0.16	0.10	(0.83)							
4. Intrinsic goals (C)	6.11	0.85	0.08	0.05	0.83	(0.85)						
5. Needs satisfaction (F)	5.59	0.89	0.21	0.10	0.66	0.56	(0.76)					
6. Needs satisfaction (C)	5.59	0.93	0.05	0.06	0.53	0.49	0.74	(0.79)				
7. Needs frustration (F)	3.27	1.31	0.20	0.22	−0.19	−0.26	−0.14	−0.19	(0.81)			
8. Needs frustration (C)	3.36	1.21	0.18	0.23	−0.15	−0.21	−0.12	−0.17	0.76	(0.75)		
9. Vitality	5.55	1.09	0.10	0.11	0.48	0.40	0.53	0.51	−0.19	−0.19	(0.89)	
10. Depression	2.95	1.60	0.13	0.09	−0.17	−0.17	−0.14	−0.10	0.48	0.53	−0.46	(0.91)
11. Vigorous (F)	1924.81	2560.78	−0.06	0.01	0.07	0.10	0.18	0.22	−0.18	−0.05	0.15	−0.19
12. Moderate (F)	739.87	1203.86	−0.16	−0.11	−0.07	−0.05	0.06	0.06	−0.10	−0.06	0.08	−0.22
13. Walking (F)	820.61	987.16	−0.13	−0.12	0.16	0.09	0.24	0.17	−0.03	−0.04	0.19	−0.09
14. Total PA (F)	3485.32	3631.28	−0.13	−0.06	0.07	0.08	0.21	0.22	−0.17	−0.07	0.18	−0.23
15. Vigorous (C)	1753.16	2593.04	−0.07	−0.02	0.02	0.11	0.08	0.10	−0.12	−0.11	0.24	−0.23
16. Moderate (C)	498.46	968.94	−0.11	−0.11	−0.06	0.04	0.03	0.01	−0.03	−0.02	0.12	−0.15

(continued)

Table 4.1 (continued)

	M	*SD*	1	2	3	4	5	6	7	8	9	10
17. Walking (C)	800.35	952.39	−0.07	−0.04	0.16	0.14	0.16	0.13	0.05	0.01	0.21	−0.13
18. Total PA (C)	3052.01	3678.42	−0.09	−0.05	0.04	0.12	0.11	0.11	−0.08	−0.08	0.25	−0.24
19. Age	59.93	7.24	−0.12	−0.10	−0.22	−0.29	−0.13	−0.22	0.30	0.23	−0.05	0.03
20. Systolic	12.55	1.28	0.11	0.12	−0.14	−0.12	0.03	−0.06	0.10	0.14	0.10	−0.01
21. Diastolic	8.14	1.05	0.07	0.08	−0.12	−0.16	−0.02	−0.11	0.11	0.15†	−0.09	0.06
22. BMI	26.59	3.72	0.03	−0.06	−0.09	−0.10	0.00	0.04	−0.01	−0.01	−0.03	−0.09
	11	12	13	14	15	16	17	18	19	20	21	
1. Extrinsic goals (F)												
2. Extrinsic goals (C)												
3. Intrinsic goals (F)												
4. Intrinsic goals (C)												
5. Needs satisfaction (F)												
6. Needs satisfaction (C)												
7. Needs frustration (F)												
8. Needs frustration (C)												
9. Vitality												
10. Depression												
11. Vigorous (F)	–											
12. Moderate (F)	0.46	–										

(continued)

Table 4.1 (continued)

	11	12	13	14	15	16	17	18	19	20	21	
13. Walking (F)	0.17	0.22	–									
14. Total PA (F)	0.90	0.71	0.47									
15. Vigorous (C)	0.45	0.29	0.18	0.47								
16. Moderate (C)	0.15	0.39	0.20	0.29	0.54							
17. Walking (C)	0.15	0.15	0.42	0.27	0.34	0.31						
18. Total PA (C)	0.40	0.35	0.29	0.47	0.94	0.73	0.58	–				
19. Age	−0.08	0.06	0.04	−0.03	−0.02	0.05	0.07	0.02	–			
20. Systolic	0.04	0.03	0.01	0.04	0.00	0.01	−0.05	−0.01	0.20	–		
21. Diastolic	0.04	−0.11	−0.18	−0.06	0.01	−0.06	−0.13	−0.04	0.01	0.48	–	
22. BMI	−0.06	0.02	0.04	−0.03	−0.18	−0.11	−0.01	−0.16	0.04	0.11	−0.05	–

Notes C = current time, F = five years ago, † $p = 0.069$. Values above 0.16 are significant at $p < 0.05$, values above 0.21 are significant at $p < 0.01$, and values above 0.25 are significant at $p < 0.001$. Values in the parentheses are Cronbach's alpha

during a period of five years ago positively correlated with both needs satisfaction and walking behaviors at the current time and during a period of five years ago, and vitality, and negatively correlated with need frustration during a period of five years ago, depression, and age. Intrinsic goals at the current time positively correlated with needs satisfaction, and vitality, and negatively correlated with needs frustration, depression, age, and diastolic blood pressure. In contrast, the importance of extrinsic goals during a period of five years ago positively correlated with intrinsic goals and needs satisfaction during a period of five years ago, both need frustration at the current time and during a period of five years ago, as well as negatively correlated with moderate-intensity of physical activity behaviors during a period of five years ago. Extrinsic goals at the current time only correlated with needs frustration both during a period of five years ago and at the current time. The results also showed that experience of needs satisfaction during a period of five years ago positively correlated with vitality, both walking behaviors at the current time and during the past five years ago, and vigorous-intensity and total physical activity behaviors five years ago. Experience of needs satisfaction at the current time positively correlated with vitality, and negatively correlated with needs frustration and age. In contrast, need frustration during a period five years ago positively correlated with depression and age, and negatively correlated with vitality and vigorous-intensity and total physical activity behaviors during the past five years ago. Basic psychological needs frustration at the current time negatively correlated with vitality and positively correlated with depression, age, and diastolic blood pressure (marginally, $p = 0.069$). In addition, older people's vitality negatively correlated with their depression and positively correlated with all kinds of physical activity behaviors either at the current time or during the past five years ago, except for moderate-intensity of physical activity at the current time and vigorous and moderate-intensity of physical activity behaviors during the past five years ago. In contrast, older people's depression negatively correlated with all kinds of physical activity behaviors either at the current time or during the past five years ago, except for moderate-intensity and walking behaviors at the current time and walking behaviors during the past five years ago.

Before running path analysis, we conducted an ANOVA to test for mean differences between males and females. The only significant difference was that males reported higher physical activity both during the past five years ago ($F_{(1, 157)} = 4.14$, $p = 0.04$) and at the current time ($F_{(1, 157)} = 9.86$, $p = 0.002$). Thus, we included gender in addition to age as covariates in the path model.

We also examined the differences in study variables from the past five years ago to the current time. Interestingly, the results of paired *t*-test showed that older persons' intrinsic life goals significantly increased from the past five years ago to the current time ($M = -0.14$, $t = -3.35$, $p < 0.001$), and their extrinsic life goals significantly decreased from the past five years ago to the current time ($M = 0.30$, $t = 4.28$, $p < 0.001$). There was no difference in basic psychological needs satisfaction, needs frustration, and physical activity behaviors from the past five years ago to the current time.

We next tested hypotheses 1 and 2 through a full path analysis. In hypothesis 1, we expected that intrinsic goals both during a period five years ago and at the current time to positively predict basic psychological needs satisfaction both during a period of five years ago and at the current time, respectively, which in turn, would predict physical activity behaviors both during the period five years ago and at the current time, vitality, and physical well-being (BMI, systolic and diastolic blood pressure; Hypothesis 1a). We also expected that extrinsic goals both during a period of five years ago and at the current time predict positively needs frustration both during a period of five years ago and at the current time, respectively, which in turn, would predict negatively physical activity behaviors both during a period of five years ago and at the current time, vitality, and physical well-being, and positively predict depression (Hypothesis 1b).

The results of path analysis initially were not satisfactory, $\chi^2(57) = 83.86$, $p = 0.012$, CFI = 0.95, RMSEA = 0.11 (0.037, 0.111), SRMR = 0.05. Thus, we adjusted the proposed model based on modification indices. The modification indices suggested several paths in order to increase fit indices, for example, direct and positive path from intrinsic goals during a period of five years ago to physical activity behaviors during a period of five years ago; direct and negative path from intrinsic goals during a period of five years ago to needs frustration at the current time; direct and positive path from extrinsic goals during a period of five years ago to depression, and direct and negative path from extrinsic goals at the current time to depression (see Fig. 4.1). These modifications were also theoretically aligned with SDT propositions (Ryan & Deci, 2017). After adding paths to the model the fit indices yielded a good model, χ^2 (48) = 53.29, $p = 0.28$, CFI = 0.99, TLI = 0.97, RMSEA = 0.037 (0.000, 0.085), SRMR = 0.04 (see Fig. 4.1). As shown in Fig. 4.1, intrinsic goals positively strongly predicted basic psychological needs satisfaction and negatively predicted needs frustration during a period of five years ago. Intrinsic and extrinsic life goals during a period of five years ago positively predicted intrinsic and extrinsic life goals at the current time, respectively. Extrinsic goals at the current time positively predicted needs frustration at the current time. Basic psychological needs satisfaction and needs frustration at the current time were predicted by their needs satisfaction and needs frustration during a period of five years ago, respectively. Basic psychological needs satisfaction during a period of five years ago also negatively predicted basic psychological needs frustration at the current time. Interestingly, the results showed that physical activity behaviors during a period of five years ago were predicted positively by intrinsic goals, and that of physical activity behavior negatively predicted needs frustration at the current time. Subjective vitality and depression were predicted by needs satisfaction and needs frustration at the current time, respectively. More interestingly, older persons' extrinsic goals during a period five years ago positively predicted their depression, but their extrinsic goals at the current time negatively predicted depression. Older persons' physical activity behaviors at the current time, as well as systolic and diastolic blood pressure and BMI were not predicted by the study variables.

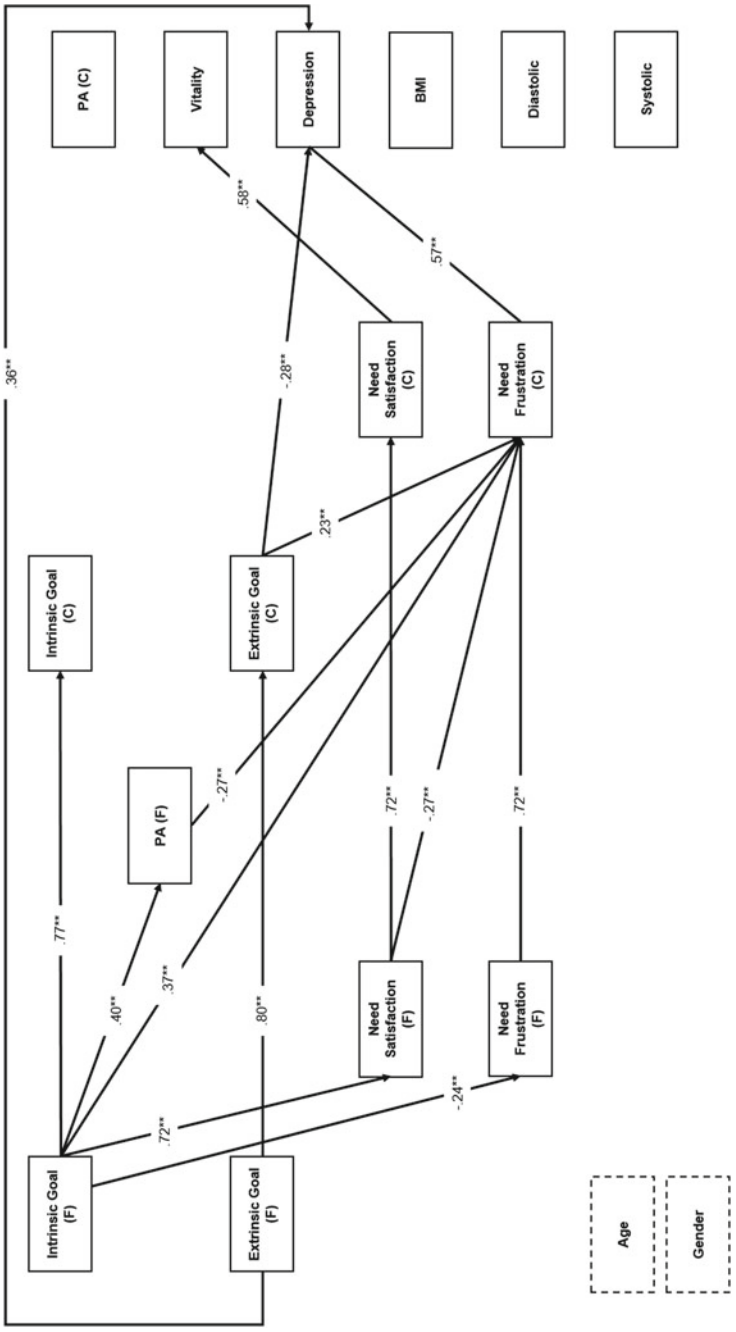

Fig. 4.1 The path model assessing the predictive effects of older persons' intrinsic and extrinsic goals on their outcomes via needs satisfaction and frustration (Hypotheses 1a, b). The covariates of age and gender are indicted with dashed lines. Only standardized regression weights and significant paths were reported due to model complexity. F = five years ago, C = current time, PA = physical activity behaviors

Next, we examined the indirect effects of life goals on health-related physical activity, and outcomes of physical and psychological well-being via the mediating roles of basic psychological needs. That is, we expected that intrinsic goals both during a period five years ago and at the current time would predict health behaviors and wellness, mediated by satisfaction of the basic psychological needs either during a period five years ago or at the current time (Hypothesis 2a); and extrinsic goals both during a period five years ago and at the current time would predict lower levels of physical activity behaviors and ill-being, mediated by frustration of the basic psychological needs either during a period five years ago or at the current time (Hypothesis 2b; see Table 4.2). Consistent with hypothesis 2a, intrinsic goals during a period five years ago via the mediating role of needs satisfaction both during a period five years ago and at the current time predicted vitality. Interestingly, intrinsic goals during a period of five years ago also, via the mediating role of needs satisfaction during a period of five years ago and needs frustration at the current time, negatively predicted depression. This is an exploratory finding of the current research that how both basic needs satisfaction and needs frustration would play mediational roles between intrinsic goals and ill-being concurrently, which also expected by GCT. Moreover, intrinsic goals during a period of five years ago via the mediating role of needs frustration both during a period of five years ago and at the current time negatively predicted depression. Interestingly, intrinsic goals during a period of five years ago negatively predicted depression via the mediating role of physical activity behaviors during a period of five years ago and needs frustration at the current time. In contrast, and consistent with Hypothesis 2b, extrinsic goals during a period of five years ago through the mediating roles of extrinsic goals and needs frustration at the current time predicted depression. Extrinsic goals also indirectly predicted depression via the frustration of basic psychological needs (see Table 4.2).

Table 4.2 Indirect effects of life goals on older persons' outcomes through needs satisfaction and frustration

Indirect effect	B	95% CI
Intrinsic goals (F) → needs satisfaction (F) → needs satisfaction (C) → vitality (Hypothesis 2a)	0.30 $p < 0.001$	0.23, 0.74
Intrinsic goals (F) → needs satisfaction (F) → needs frustration (C) → depression (Hypothesis 2a)	−0.11 $p = 0.015$	−0.39, −0.09
Intrinsic goals (F) → needs frustration (F) → needs frustration (C) → depression (Hypothesis 2a)	−0.10 $p = 0.043$	−0.37, −0.06
Intrinsic goals (F) → physical activity behaviors (F) → needs frustration (C) → depression (Hypothesis 2a)	−0.06 $p = 0.04$	−0.15, −0.01
Extrinsic goals (F) → extrinsic goal (C) → needs frustration (C) → depression (Hypothesis 2b)	0.11 $p = 0.03$	0.03, 0.26
Extrinsic goals (C) → needs frustration (C) → depression (Hypothesis 2b)	0.13 $p = 0.03$	0.04, 0.31

Notes F = five years ago, C = current time. Bias-corrected 95% confidence intervals (bootstrap samples = 5000). Only significant indirect effects were reported

4.4 Discussion

As people get older, an important question for them is how to live and place value in different goal contents to experience greater well-being. There is some indication that focusing on huge amounts of money, for example, is not an effective way of attaining well-being, but that pursuing and obtaining other goals may provide effective paths (Ryan & Deci, 2000). Still, there has been relatively little understanding about how and why older people pursue different life goals in attempt to experience well-being, either in a short-term period or a long-term period.

The present findings indicate that when older people place importance on intrinsic goals, they feel more satisfaction of their basic psychological needs resulting in higher health-related physical activity behaviors and greater well-being. In contrast, when older persons place importance on extrinsic goals, it results in feeling frustration of basic psychological needs and increased depression, and therefore has costs for well-being. Thus, supporting the SDT (Deci & Ryan, 2000; Ryan & Deci, 2017) proposition, the more an older person values and prioritizes intrinsic goals relative to extrinsic goals, the higher will be his or her well-being. In contrast, the more elderly people place relative importance or value on extrinsic goals, the lower will be their well-being, and the higher will be their ill-being.

In alignment with SDT's propositions (Ryan & Deci, 2017), we found that the positive relation between intrinsic life goals and well-being was largely a function of satisfaction of basic psychological needs. Interestingly, we found that when people value intrinsic goals, it resulted in more satisfaction of basic psychological needs, and therefore, decreases in ill-being (i.e., depression). Thus, the current finding adds to the literature in SDT and aging (Kasser & Ryan, 1996; Niemiec, Ryan, & Deci, 2009; Niemiec, Ryan, Deci, & Williams, 2009; Van Hiel & Vansteenkiste, 2009), indicating that valuing intrinsic goals was associated with greater well-being via the satisfaction of basic psychological needs. Also of interest is that when older people felt their social contexts provided environments that are likely to increase satisfaction of basic psychological needs, it resulted in greater healthy behaviors and wellness. In contrast, we found that the relation between extrinsic life goals and ill-being was a function of the frustration of basic psychological needs. This finding also adds to the current literature in SDT and aging (Kasser, 2002; Niemiec, Ryan, Deci, & Williams, 2009; Van Hiel & Vansteenkiste, 2009; Unanue, Dittmar, Vignoles, & Vansteenkiste, 2014). That is, pursuing extrinsic life goals would associate with ill-being through the frustration of basic psychological needs.

In addition, we found that older adults' extrinsic life goals significantly decreased from the past five years to the current time, and that, intrinsic goals significantly increased over the past five years. Specifically, older persons' extrinsic goals five years ago positively related to their depression, but with getting older, the older adults' extrinsic goals at the current time negatively related to their depression. This is an important result from this research: with increasing age, people place less importance or value on extrinsic goals. In other words, it seems that with increasing age, people tend to put importance or value more on intrinsic goals versus extrinsic goals, and this

pattern should relate to decreases in their ill-being. Research also showed that people change their life goals or aspirations over time, and these changes were mediated by basic psychological needs (Kasser et al., 2014). Furthermore, and importantly, in terms of aging, this research highlighted that older people tend to change their pursuits of intrinsic and extrinsic life goals, and over time they tend to contribute to their societies, personally develop and learn many new things, form new or close relationships, and pursue healthy habits, rather than chase fame, money, or physical appearance.

4.4.1 An SDT Approach to Healthy Aging

Healthy aging emphasizes aging *well* through the promotion of psychological factors as well as positive social and community contribution (Hill, 2005). In this SDT-based research, we provided a more comprehensive way not only to age healthily through the effects of physical activity behaviors on wellness but also to age positively; that is, valuing intrinsic life goals (e.g., pursue healthy life style or community contribution) rather than valuing extrinsic life goals (e.g., to be admired by others) would increase elderly people's health behaviors and well-being through the satisfaction of basic psychological needs. In other words, if older people place more value or importance on intrinsic life goals, they would likely experience greater psychological well-being, and experience less ill-being and even less diseases related to sedentary or physically inactive behaviors. At the same time, when older people place relatively less value or importance on extrinsic goals, they more likely experience less ill-being, as a result of feeling less frustration of their basic psychological needs.

Although we found relations between life goals and well-being, we did not find a relation of study variables with physical well-being symptoms (i.e., BMI and systolic blood pressure). We only found negative relations between intrinsic life goals at the current time and diastolic blood pressure. This, however, is a very important result as it suggested placing more value on intrinsic goals in order to have lower (and more normal) diastolic blood pressure. In other words, when older adults put greater importance on intrinsic goals, they experienced greater diastolic blood pressure, an important indicator of physical health. The results also showed that older adults' basic psychological needs frustration at the current time marginally positively correlated with diastolic blood pressure ($p = 0.069$). This is also an important result that highlighted needs frustration's role in increasing diastolic blood pressure, an indicator of increased physical illness. This important result is consistent with related previous research, showing that increased autonomy-supportive behaviors from partners was associated with lower diastolic blood pressure (Weinstein, Legate, Kumashiro, & Ryan, 2016). This result is important because high blood pressure, can damage blood vessel walls over time, and result in coronary artery diseases. As one gets older, systolic and diastolic blood pressure are among the most important predictors of death related to coronary heart diseases (e.g., Pinto, 2007). Therefore, in this research we found initial evidence that not only do intrinsically-orientated life goals relate to the

satisfaction of basic psychological needs, health-related physical activity behaviors, and psychological well-being (e.g., vitality), but also to better physical health (e.g., diastolic blood pressure). This research provides an initial map in relation to SDT and healthy aging: Pursuing intrinsic life goals provides pathways toward an active and healthy aging process.

4.4.2 Practical Implications

This research examined the relation of older persons' life goals and basic psychological needs with health-related physical activity behaviors and physical and psychological well-being. The rationale of this research is that older adults' life goals and basic psychological needs are key factors in predicting health and well-being outcomes (Ryan & Deci, 2017, 2019). Hence, the value or importance that older persons place on different life goals and their experience of basic psychological needs satisfaction are important regarding health variables. By examining the predictive role of life goals and basic psychological needs, the emphasis is on elderly persons' health and well-being outcomes, and how to experience healthy and positive aging process. These important findings can be considered as a crucial social-contextual and lifestyle contribution that adds to the current research literature of SDT and aging.

Current findings clearly showed that valuing the importance on intrinsic life goals is likely to influence older adults' needs satisfaction, health-related physical activities, and physical and psychological wellness. However, it is important to note that older people put differing importance on each type of life goal, and this importance on both life goals would relate initially to their basic psychological needs satisfaction, but pursuing intrinsic goals constantly would result in needs satisfaction and wellness over time, and in contrast, pursuing extrinsic life goals would result in frustration of basic psychological needs and ill-being over time. Pursuits of extrinsic goals would also incur costs to elderly persons' physical well-being. Therefore, enhancing older people's awareness of the importance of intrinsic life goals relative to extrinsic life goals would likely increase health-relevant physical activity behaviors and experiences of wellness.

4.4.3 Limitations and Conclusion

The present research has a number of noteworthy limitations. First, this research is cross-sectional, so it is impossible to make casual conclusions. Methodologically, in order to make more trust-worthy conclusions, casual data are needed. Although we suggested that older people's placing importance on intrinsic or extrinsic goals would relate differently to their basic psychological needs satisfaction or frustration, and in turn to their health and wellness, it is important to investigate older people's beliefs about the likelihood of attaining each type of goals in relation

to their basic psychological needs satisfaction, and their physical and psychological wellness outcomes (Deci & Ryan, 2000). Furthermore, we only tapped a small set of indicators of psychological well-being and ill-being (vitality and depression), and it will also be important to examine other well-being outcomes that are important in aging research, such as older people's *meaning in life*, as meaning in life is an important lifelong process at every point of the life course (Wong, 2012).

SDT would also argue that culture would play an important role in people's goal contents and the experience of needs satisfaction versus needs frustration (Ryan, Di Domenico, Ryan, & Deci, 2017). This culture would shape healthy aging through particular values (Gergen & Gergen, 2001). Therefore, we suggest that future research investigate the effect of culture; that is, examine how social contexts (by way of need-supportive versus need-thwarting environments) would determine both elderly persons' intrinsic and extrinsic life goals and their basic psychological needs satisfaction and needs frustration, as well as their healthy behaviors and wellness.

In addition, based on SDT, the continuum from autonomous motivation to controlled motivation and amotivation are important mediators in the relations between life goals and basic psychological needs with outcomes of health and wellness (Ryan & Deci, 2017). More importantly, how people motivationally (autonomous vs. controlled) place value or importance on intrinsic and extrinsic life goals would provide crucial findings relevant to their basic psychological needs and outcomes. For example, whether older adults pursue intrinsic goals for controlled reasons or whether they pursue extrinsic goals for more autonomous reasons, and how each would relate to their outcomes are important questions to examine. It is also important to do longitudinal studies, for example, investigating older persons in a 10-year period, from age 50 to 60 years old, or from 60 to 70 years old or older, with data collected at mid-points as well. In addition, longitudinal studies are needed to examine changes in life goals related to social contexts, and how social contexts by supporting versus thwarting of basic psychological needs would affect elderly people's value of life goals and outcomes of well- and ill-being. By examining these, it is possible to know how physical activity behaviors would be influenced by each type of life goals, as well as whether motivational self-regulations (autonomous vs. controlled motivation) would mediate the relation between life goals and basic psychological needs with physical activity behaviors.

Finally, the findings in this research provide an initial mapping of an important area; how older people's intrinsic and extrinsic life goals as well as their basic psychological needs satisfaction or frustration would shape their physical and psychological wellness. More specifically, the evidence suggests that when older adults place importance on intrinsic life goals, it results in enhancing healthy behaviors and their physical and psychological wellness, whereas, when they place importance on extrinsic life goals, it results in decreasing physical well-being and increasing depression. Moreover, experiences of psychological needs satisfaction in the society would enhance healthy behaviors and physical and psychological wellness; whereas, experiences of needs frustration would increase ill-being and decrease physical well-being.

References

Ahmadi, B., Amini Sanii, N., Bani, F., & Bakhtari, F. (2018). Predictors of physical activity in older adults in Northwest of Iran. *Elderly Health Journal, 4*(2), 75–80.

Allison, P. D. (2003). Missing data techniques for structural equation modeling. *Journal of Abnormal Psychology, 112*(4), 545–557.

Antunes, R., Couto, N., Monteiro, D., Moutão, J., Marinho, D., & Cid, L. (2018). Goal content for the practice of physical activity and the impact on subjective well-being in older adults. *Journal of Aging Science, 6*(1), 1–6.

Baltes, P. B. (1987). Theoretical propositions of life-span developmental psychology: On the dynamics between growth and decline. *Developmental Psychology, 23*(5), 611–625.

Baltes, P. B., Staudinger, U. M., & Lindenberger, U. (1999). Lifespan psychology: Theory and application to intellectual functioning. *Annual Review of Psychology, 50*(1), 471–507.

Bartholomew, K. J., Ntoumanis, N., Ryan, R. M., Bosch, J. A., & Thøgersen-Ntoumani, C. (2011). Self-determination theory and diminished functioning: The role of interpersonal control and psychological need thwarting. *Personality and Social Psychology Bulletin, 37*(11), 1459–1473.

Bauman, A., Merom, D., Bull, F. C., Buchner, D. M., & Fiatarone Singh, M. A. (2016). Updating the evidence for physical activity: Summative reviews of the epidemiological evidence, prevalence, and interventions to promote "active aging." *The Gerontologist, 56*(S2), S268–S280.

Beard, J. R., Officer, A., de Carvalho, I. A., Sadana, R., Pot, A. M., Michel, J. P., ..., Thiyagarajan, J. A. (2016). The World report on aging and health: A policy framework for healthy aging. *The Lancet*, *387*(10033), 2145–2154.

Behzadnia, B., Adachi, P. J., Deci, E. L., & Mohammadzadeh, H. (2018). Associations between students' perceptions of physical education teachers' interpersonal styles and students' wellness, knowledge, performance, and intentions to persist at physical activity: A self-determination theory approach. *Psychology of Sport and Exercise, 39,* 10–19.

Behzadnia, B., Ahmadi, M., & Kashtidar, M. (2013). The relationship between perceptions of parent autonomy-supportive with indices of well-being in athlete male students: A self-determination theory approach. *Journal of Research on University Sport, 1*(3), 93–108.

Behzadnia, B., & Ryan, R. M. (2018). Eudaimonic and hedonic orientations in physical education and their relation with motivation and wellness. *International Journal of Sport Psychology, 49*(5), 363–385.

Booth, M. (2000). Assessment of physical activity: An international perspective. *Research Quarterly for Exercise and Sport, 71*(sup2), 114–120.

Brown, T. C., Fry, M. D., & Moore, E. W. G. (2017). A motivational climate intervention and exercise-related outcomes: A longitudinal perspective. *Motivation Science, 3*(4), 337–353.

Chen, B., Vansteenkiste, M., Beyers, W., Boone, L., Deci, E. L., Van der Kaap-Deeder, J., ..., Ryan, R. M. (2015). Basic psychological need satisfaction, need frustration, and need strength across four cultures. *Motivation and Emotion, 39*(2), 216–236.

Craig, C. L., Marshall, A. L., Sjöström, M., Bauman, A. E., Booth, M. L., Ainsworth, B. E., ..., Oja, P. (2003). International physical activity questionnaire: 12-country reliability and validity. *Medicine & Science in Sports & Exercise, 35*(8), 1381–1395.

Daskalopoulou, C., Stubbs, B., Kralj, C., Koukounari, A., Prince, M., & Prina, A. M. (2017). Physical activity and healthy aging: A systematic review and meta-analysis of longitudinal cohort studies. *Aging Research Reviews, 38,* 6–17.

Deci, E. L. (1975). *Intrinsic motivation.* New York: Plenum Press.

Deci, E. L., La Guardia, J. G., Moller, A. C., Scheiner, M. J., & Ryan, R. M. (2006). On the benefits of giving as well as receiving autonomy support: Mutuality in close friendships. *Personality and Social Psychology Bulletin, 32*(3), 313–327.

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum Press.

Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry, 11*(4), 227–268.

Ethisan, P., Somrongthong, R., Ahmed, J., Kumar, R., & Chapman, R. S. (2017). Factors related to physical activity among the elderly population in rural Thailand. *Journal of Primary Care & Community Health, 8*(2), 71–76.

Ferrand, C., Martinent, G., & Durmaz, N. (2014). Psychological need satisfaction and well-being in adults aged 80 years and older living in residential homes: Using a self-determination theory perspective. *Journal of Aging Studies, 30,* 104–111.

Gergen, M. M., & Gergen, K. J. (2001). Positive aging: New images for a new age. *Aging International, 27*(1), 3–23.

Gunnell, K. E., Crocker, P. R., Mack, D. E., Wilson, P. M., & Zumbo, B. D. (2014). Goal contents, motivation, psychological need satisfaction, well-being and physical activity: A test of self-determination theory over 6 months. *Psychology of Sport and Exercise, 15*(1), 19–29.

Hill, R. D. (2005). *Positive aging: A guide for mental health professionals and consumers.* New York: WW Norton.

Hupin, D., Roche, F., Gremeaux, V., Chatard, J. C., Oriol, M., Gaspoz, J. M., ..., Edouard, P. (2015). Even a low-dose of moderate-to-vigorous physical activity reduces mortality by 22% in adults aged $\geq$ 60 years: A systematic review and meta-analysis. *British Journal of Sports Medicine, 49*(19), 1262–1267.

Kasser, T. (2002). Sketches for a self-determination theory of values. In E. L. Deci & R. M. Ryan (Eds.), *Handbook of self-determination research* (pp. 123–140). Rochester, NY: University of Rochester Press.

Kasser, T., Rosenblum, K. L., Sameroff, A. J., Deci, E. L., Niemiec, C. P., Ryan, R. M., ..., Hawks, S. (2014). Changes in materialism, changes in psychological well-being: Evidence from three longitudinal studies and an intervention experiment. *Motivation and Emotion, 38*(1), 1–22.

Kasser, T., & Ryan, R. M. (1996). Further examining the American dream: Differential correlates of intrinsic and extrinsic goals. *Personality and Social Psychology Bulletin, 22*(3), 280–287.

Kasser, T., & Ryan, R. M. (2001). Be careful what you wish for: Optimal functioning and the relative attainment of intrinsic and extrinsic goals. In P. Schmuck & K. M. Sheldon (Eds.), *Life goals and well-being: Towards a positive psychology of human striving* (pp. 116–131). Ashland, OH, US: Hogrefe & Huber Publishers.

Kasser, V. G., & Ryan, R. M. (1999). The relation of psychological needs for autonomy and relatedness to vitality, well-being, and mortality in a nursing home. *Journal of Applied Social Psychology, 29*(5), 935–954.

Katz, S. (2001). Growing older without aging? Positive aging, anti-ageism, and anti-aging. *Generation, 25*(4), 27–32.

Kirkland, R. A., Karlin, N. J., Stellino, M. B., & Pulos, S. (2011). Basic psychological needs satisfaction, motivation, and exercise in older adults. *Activities, Adaptation & Aging, 35*(3), 81–196.

Koyanagi, A., Stubbs, B., Smith, L., Gardner, B., & Vancampfort, D. (2017). Correlates of physical activity among community-dwelling adults aged 50 or over in six low-and middle-income countries. *PLoS ONE, 12*(10), e0186992.

Malakouti, S. K., Pachana, N. A., Naji, B., Kahani, S., & Saeedkhani, M. (2015). Reliability, validity and factor structure of the CES-D in Iranian elderly. *Asian Journal of Psychiatry, 18,* 86–90.

Martos, T., & Kopp, M. S. (2012). Life goals and well-being: Does financial status matter? Evidence from a representative Hungarian sample. *Social Indicators Research, 105*(3), 561–568.

Martos, T., Szabó, G., & Rózsa, S. (2006). Az Aspirációs Index rövidített változatának pszichometriai jellemz}oi hazai mintán (Psychometric characteristics of the shortened aspiration index in a national sample). *Mentálhigiéné és Pszichoszomatika, 7*, 171–192.

McPhee, J. S., French, D. P., Jackson, D., Nazroo, J., Pendleton, N., & Degens, H. (2016). Physical activity in older age: Perspectives for healthy aging and frailty. *Biogerontology, 17*(3), 567–580.

Minichiello, V., & Coulson, I. (2005). *Contemporary issues in gerontology: Promoting positive aging.* London: Allen & Unwin.

Muthen, L. K., & Muthen, B. (2012). *1998–2012. Mplus User's Guide (7th ed.).* Los Angeles, CA: Muthen & Muthen

Naderi, A., Safania, A. M., & Amritash, A. M. (2016). Determinant of the implementation of physical activities in elderly in Tehran. *Journal of Gerontology, 1*(2), 66–79.

Ng, J. Y., Ntoumanis, N., Thøgersen-Ntoumani, C., Deci, E. L., Ryan, R. M., Duda, J. L., & Williams, G. C. (2012). Self-determination theory applied to health contexts: A meta-analysis. *Perspectives on Psychological Science, 7*(4), 325–340.

Niemiec, C. P., Ryan, R. M., & Deci, E. L. (2009). The path taken: Consequences of attaining intrinsic and extrinsic aspirations in post-college life. *Journal of Research in Personality, 73*(3), 291–306.

Niemiec, C. P., Ryan, R. M., Deci, E. L., & Williams, G. C. (2009). Aspiring to physical health: The role of aspirations for physical health in facilitating long-term tobacco abstinence. *Patient Education and Counseling, 74*(2), 250–257.

Pinto, E. (2007). Blood pressure and aging. *Postgraduate Medical Journal, 83*(976), 109–114.

Radloff, L. S. (1977). The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement, 1*(3), 385–401.

Ryan, R. M. (1995). Psychological needs and the facilitation of integrative processes. *Journal of Personality, 63*(3), 397–427.

Ryan, R. M., & Deci, E. L. (2000). When rewards compete with nature: The undermining of intrinsic motivation and self-regulation. In C. Sansone & J. M. Harackiewicz (Eds.), *Intrinsic and extrinsic motivation: The search for optimal motivation and performance* (pp. 13–54). San Diego, CA: Academic Press.

Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory: Basic psychological needs in motivation, development, and wellness*. New York, NY: Guilford Publications.

Ryan, R. M., & Deci, E. L. (2019). Brick by brick: The origins, development, and future of self-determination theory. *Advances in Motivation Science, 6,* 111–156.

Ryan, R. M., Di Domenico, S. I., Ryan, W. S., & Deci, E. L. (2017). Pervasive influences on wellness and thriving: Cultural, political, and economic contexts and the support of basic psychological needs. In F. Guay, H. W. Marsh, D. McInerney, & R. Craven (Eds.), *Self: Driving positive psychology and well-being* (Vol. 6, International Advances in Self Research). Charlotte, NC: Information Age Press.

Ryan, R. M., & Frederick, C. (1997). On energy, personality, and health: Subjective vitality as a dynamic reflection of well-being. *Journal of Personality, 65*(3), 529–565.

Ryan, R. M., Huta, V., & Deci, E. L. (2008). Living well: A self-determination theory perspective on eudaimonia. *Journal of Happiness Studies, 9*(1), 139–170.

Ryan, R. M., Patrick, H., Deci, E. L., & Williams, G. C. (2008). Facilitating health behavior change and its maintenance: Interventions based on self-determination theory. *The European Health Psychologist, 10*(1), 2–5.

Ryff, C. D. (2014). Psychological well-being revisited: Advances in the science and practice of eudaimonia. *Psychotherapy and Psychosomatics, 83*(1), 10–28.

Sebire, S. J., Standage, M., & Vansteenkiste, M. (2009). Examining intrinsic versus extrinsic exercise goals: Cognitive, affective, and behavioral outcomes. *Journal of Sport and Exercise Psychology, 31*(2), 189–210.

Shin, J. E., & Suh, E. M. (2018). Does waist-to-hip ratio (WHR) predict happiness? Belief about a person's essence matters. *Personality and Individual Differences, 131,* 149–155.

Silva, M. N., Vieira, P. N., Coutinho, S. R., Minderico, C. S., Matos, M. G., Sardinha, L. B., & Teixeira, P. J. (2010). Using self-determination theory to promote physical activity and weight control: A randomized controlled trial in women. *Journal of Behavioral Medicine, 33*(2), 110–122.

Unanue, W., Dittmar, H., Vignoles, V. L., & Vansteenkiste, M. (2014). Materialism and well-being in the UK and Chile: Basic need satisfaction and basic need frustration as underlying psychological processes. *European Journal of Personality, 28*(6), 569–585.

United Nations. (2015). Department of Economic and Social Affairs, Population Division. *World population aging.* Retrieved from https://www.un.org/en/development/desa/population/publications/.

Vaillant, G. E. (2015). Positive aging. In S. Joseph (Ed.), *Positive psychology in practice: Promoting human flourishing in work, health, education, and everyday life* (2nd ed., pp. 596–611). Hoboken, NJ: Wiley.

Van Hiel, A., & Vansteenkiste, M. (2009). Ambitions fulfilled? The effects of intrinsic and extrinsic goal attainment on older adults' ego-integrity and death attitudes. *International Journal of Aging and Human Development, 68*(1), 27–51.

Vanhove-Meriaux, C., Martinent, G., & Ferrand, C. (2018). Profiles of needs satisfaction and thwarting in older people living at home: Relationships with well-being and ill-being indicators. *Geriatrics & Gerontology International, 18*(3), 470–478.

Vansteenkiste, M., & Ryan, R. M. (2013). On psychological growth and vulnerability: Basic psychological need satisfaction and need frustration as a unifying principle. *Journal of Psychotherapy Integration, 23*(3), 263.

Vansteenkiste, M., Soenens, B., & Duriez, B. (2008). Presenting a positive alternative to strivings for material success and the thin ideal: Understanding the effects of extrinsic relative to intrinsic goal pursuits. In S. J. Lopez (Ed.), *Praeger perspectives. Positive psychology: Exploring the best in people, Vol. 4. Pursuing human flourishing* (pp. 57–86). Westport, CT: Praeger Publishers/Greenwood Publishing Group.

Vasheghani-Farahani, A., Tahmasbi, M., Asheri, H., Ashraf, H., Nedjat, S., & Kordi, R. (2011). The Persian, last 7-day, long form of the international physical activity questionnaire: Translation and validation study. *Asian Journal of Sports Medicine, 2*(2), 106–116.

Watson, K. B., Carlson, S. A., Gunn, J. P., Galuska, A. D., O'Connor, A., Greenland, J. K., & Fulton, E. J. (2016). Physical inactivity among adults aged 50 years and older—United States, 2014. *Morbidity and Mortality Weekly Report, 65*, 954–958.

Weinstein, N., Legate, N., Kumashiro, M., & Ryan, R. M. (2016). Autonomy support and diastolic blood pressure: Long term effects and conflict navigation in romantic relationships. *Motivation and Emotion, 40*(2), 212–225.

Wong, P. T. (Ed.). (2012). *The human quest for meaning: Theories, research, and applications.* NY Routledge: New York.

World Health Organization. (2010a). *Global recommendations on physical activity for health.* World Health Organization.

World Health Organization. (2010b). *Physical activity and older adults: Recommendation levels of physical activity for adults age 65 and above.* Retrieved from https://www.who.int/dietphysicalactivity/factsheet_recommendations/en/.

World Health Organization. (2014). *Global status report on noncommunicable diseases 2014.* World Health Organization. Retrieved from https://apps.who.int/iris/handle/10665/148114.

World Health Organization. (2015). *World report on aging and health.* Geneva: World Health Organization. Retrieved from https://www.who.int/aging/events/world-report-2015-launch/en/.