Life satisfaction, worthwhileness of life and leisure activities among older people: assessing the mediating effect of self-reported health limitations

K.E. Hancock (✉ k.hancock@lboro.ac.uk)

School of Sport, Exercise and Health Sciences, Loughborough University <https://orcid.org/0000-0002-8453-2623>

L.B. Sherar

National Centre for Sport and Exercise Medicine, Loughborough University <https://orcid.org/0000-0002-9942-5433>

P. Downward

School of Sport, Exercise and Health Sciences <https://orcid.org/0000-0002-6374-4176>

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Abstract

What makes life worthwhile is an under-researched dimension of subjective wellbeing (SWB) but important for older people. Leisure participation is positively related to SWB, but SWB reduces with poor health, and health deteriorates with age. Drawing on pooled cross-sectional *Taking Part Survey* data on almost 7,000 English adults aged 50+ from 2016/17-2018/19, we investigated relationships between different leisure activities and life satisfaction and worthwhileness. The analyses further explored the mediating effects of limiting long-standing illness and/or disability.

Before accounting for health limitations, participating in exercise-related physical activity (i.e., sport and exercise) and a greater number of different leisure activities were positively associated with both SWB dimensions. Passive mental activities (e.g., TV-watching) were negatively associated with SWB. Other physical activities (i.e., activities of daily living, e.g., gardening, active travel); social activities; cultural activities (e.g., visiting museums, cinemas) and hobbies (e.g., handicrafts, music-making) were associated with worthwhileness. Using Structural Equation Modelling we showed the mediating effect of health limitations varied with SWB dimension and different leisure activities. Positive associations between social and culture/hobby activities and SWB were not mediated by poor health; neither was the negative association between passive mental activities and SWB. The positive association between exercise-related physical activity and SWB was mediated by health limitations more than other physical activities. Overall, poor health mediated the association between worthwhileness and leisure activities less than life satisfaction. Promoting a range of activities contributing to feelings of worthwhileness may provide a route to enhanced wellbeing, despite declining health among older people.

Declarations

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Availability of data and material – *Taking Part Survey* data was obtained from the UK Data Service.

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Code availability – Stata code written to manipulate and analyse the data is available from the corresponding author on request.

Authors' contributions - All authors contributed to the study conception and design. Material preparation, data extraction and analysis were performed by Karen Hancock. The first draft of the manuscript was written by Karen Hancock and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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Introduction

Finding meaning and purpose in life can become more challenging as people age. Time spent on career and family shrinks, physical strength and capabilities diminish, and social connections reduce (Mckenna et al., 2007). A strong sense of meaning and purpose in life has been associated with living longer, less disability (Ong & Patterson, 2016), better health-related quality of life (Steptoe & Fancourt, 2019), and other markers of successful ageing (Pinquart, 2002; Urtamo et al., 2019). Feeling that life is worthwhile and meaningful is a component of subjective wellbeing and one of the two evaluative dimensions of national wellbeing monitored by the UK's Office for National Statistics since 2011 (Office for National Statistics, 2013). The other evaluative dimension is life satisfaction (Office for National Statistics, 2018). Empirical research has focused primarily on the correlates and determinants of life satisfaction and an evaluative measure of happiness (Clark, 2018), much less so on the correlates and determinants of worthwhileness (Crespo & Mesurado, 2015; Dolan & Kudrna, 2016; What Works Centre for Wellbeing, 2021). Feelings about worthwhileness of life correspond broadly to the Aristotelean notion of "eudaimonia" or flourishing, i.e., living a life that has meaning and purpose that satisfies deeper psychological needs (Joshnloo, 2016; Ryff, 2017). Understanding the determinants of feelings of worthwhileness among older people alongside those that influence life satisfaction would – to the extent they differ from the determinants of life satisfaction – provide another route to improving older people's wellbeing and possibly health (Ong & Patterson, 2016; Steptoe & Fancourt, 2019).

Feeling that life is worthwhile is concerned with the things you do in life (Office for National Statistics, 2018). An individual has more agency over leisure activities compared with activities undertaken in other contexts, i.e., work, business, family obligations, and necessary activities of daily living like eating, sleeping and washing (Stebbins, 2005). Arguably choice of leisure activities can help people achieve a balance between pleasure and purpose in life (Dolan, 2014). There is now much research demonstrating that participation in different kinds of leisure activities brings a range of physical and mental health benefits for older people (see references in Fancourt et al., (2021), supporting the activity theory of ageing (Havighurst, 1961). However, it is important to recognise that health limitations and SWB are closely linked to age (Steptoe et al., 2015), and that individual responses to both ageing and health limitations vary (Ryff, 2017). Selection, optimisation, and compensation theory links choice of activities, age and successful ageing (Baltes & Carstensen, 2003; Freund & Baltes, 1998). The theory sees successful ageing as a lifelong process of maximising gains and minimising losses through actively employing selection, optimisation, and compensation strategies. Selection involves revising goals to reflect strengths and intact abilities (e.g., replacing employment with volunteering or substituting cycling for running as a sport); optimisation means acquiring goal-relevant means to maximise gains (e.g., joining volunteer or cycling organisations to enhance networks); compensation refers to processes that minimise losses (e.g., using spectacles to read). Thus, individuals who are ageing successfully are likely to choose different leisure activities and/or engage with them in different ways as an adaptive response to ageing. Understanding what leisure activities older people choose to help them feel that life is worthwhile despite health limitations can help inform services and programmes to promote successful ageing.

Leisure Activities And Subjective Wellbeing Among Older People

A number of studies have found positive associations between the frequency and diversity of engagement in leisure activity in general and various measures of subjective wellbeing among older and/or retired people, as identified in the systematic review and meta-analysis of Kuykendall et al., (2015). The same review also found experimental evidence that interventions to enhance leisure satisfaction (wellbeing derived specifically from leisure activities) increased subjective wellbeing in elderly and disabled people, and meta-analytic support for a path model in which measures of leisure satisfaction mediated the relationship between leisure engagement and subjective wellbeing. However, although this review used health as a confounding variable to explain variation in subjective wellbeing measures and discussed possible spill-over effects between health and leisure satisfaction, the study did not explicitly model any links between leisure participation, health and subjective wellbeing. Some studies which do explicitly model such a link have found frequency of participation in leisure activities acts as a mediator between physical health and wellbeing in older people (Chang et al., 2014; Ihle et al., 2017; Paggi et al., 2016).

It is well established that physical activity is positively related to various measures of wellbeing in older people (Bae et al., 2017; Dolan et al., 2014; Fortier & Morgan, 2021; Rasciute & Downward, 2010; Zhang & Chen, 2019). Participation in social activities has also consistently been shown to be positively related to older people's life satisfaction (Adams et al., 2011; Lam & Garcia, 2019; Michèle et al., 2019; Ryu & Heo, 2018) and psychological wellbeing (Sharifian & Grünh, 2019), which aligns with evidence that good social relationships in old age are better for health (Musich et al., 2018; Tkatch et al., 2017), and that leisure activities can help mediate the association between social relationships and health (Chang et al., 2014). Other leisure activity types that have been shown to be positively related to SWB in older adults include volunteering (Ryu & Heo, 2018); and participating in community groups (Michèle et al., 2019) such as arts, education or music groups and church or religious groups (Fancourt & Steptoe, 2018a). One challenge with drawing general conclusions from this literature is the lack of standardisation in the definitions and scope of different leisure activities (Adams et al., 2011). Adams' (2011) critical review noted that most studies of the relationships between social and leisure activities and wellbeing in older people reported on two or three broad leisure activity domains, i.e., *informal/formal/solitary*, or *productive/leisure*.

Some general conclusions can be drawn from the aforementioned. First, the frequency and diversity of leisure engagement is associated with greater life satisfaction in older people, supporting activity theory, and leisure engagement reduces with physical limitations that increase with age. Second, leisure engagement may mediate the relationship between physical limitations and life satisfaction. There is most evidence for positive associations between physical and social activities and life satisfaction and some support for positive effects of cultural activities and hobbies (Brown et al., 2015), but these are rarely studied. Having good social relationships is also important for health, and leisure activities can also mediate this effect. Finally, there are a number of different mediation models proposed and investigated: leisure satisfaction mediates the link between leisure engagement and wellbeing; leisure participation mediates the link between physical activity and wellbeing; and leisure participation mediates the link between social relationships and health. Although there is some suggestion in these studies that there may be a link between reduced leisure engagement and age, the idea from selection, optimisation and compensation theory that older people might choose leisure activities to maintain their feelings of wellbeing in the face of health limitations that increase with age has not been investigated to our knowledge.

The empirical literature investigating the factors linked to eudaimonic wellbeing, flourishing or feeling that life is worthwhile is much smaller than that relating to life satisfaction (What Works Centre for Wellbeing, 2021). For older people, the number of leisure activities engaged in was associated with a measure of flourishing in a small Croatian study (Kaliterna Lipovčan, L., Brkljačić, T., Prizmić Larsen, Z., Brajša-Žganec, A., & Franc, 2018). In terms of specific activities, there is evidence from Korean adults of all ages that volunteering enhances eudaimonic and social well-being (but not hedonic well-being) (Son & Wilson, 2012). At least two studies link participation in learning and measures of eudaimonic wellbeing among older people (Jenkins & Mostafa, 2015; Narushima et al., 2013). The most comprehensive study of factors associated with feelings of worthwhileness among older people used longitudinal data on English over 50s to estimate regression models of worthwhileness (Steptoe & Fancourt, 2019). Although not specifically focusing on leisure activities, they found higher worthwhileness was associated both cross-sectionally and longitudinally with stronger personal relationships, wider social engagement (e.g., volunteering), greater income and wealth, better self-rated physical and mental health, better objective health indicators, better health behaviours, more time spent in social activities, working or volunteering and walking/exercising and less time spent alone or watching television. The finding that worthwhileness levels predicted a wide range of outcomes independent of baseline levels in the longitudinal analysis suggests that having higher worthwhileness may contribute to better health and more successful ageing. These results were strengthened in a follow-up study which found evidence for bi-directional relationships between health, activities, health behaviours and feelings of worthwhileness (Steptoe & Fancourt, 2020). The study is one of a few that links a eudaimonic measure of wellbeing to health outcomes (see also Musich et al., (2018)). None of these studies however sheds light on how health factors may be related to the choice of activities or use of leisure time, and thus to feelings of worthwhileness of life.

The Influence Of Health Limitations On Leisure Participation And Wellbeing

About 40 per cent of people in the UK over the age of 65 have a limiting long-term health condition, such as diabetes, heart disease, respiratory disease, cancer, arthritis or dementia (Alessi & Rashbrook, 2016). Many also suffer from musculo-skeletal problems and/or chronic pain that limits their activities. The probability of having a musculoskeletal condition increases monotonically with age such that more than half of those 65 and over are affected (Versus Arthritis, 2019). Health and physical limitations are often mentioned as an important barrier to physical activity and exercise among older people (Bethancourt et al., 2014; Biedenweg et al., 2014; Cox et al., 2006; Justine et al., 2013; Library Research Service, 2010; Moschny et al., 2011). Thus, despite the many beneficial effects for older people's health and wellbeing from leisure activities, particularly physical and social activities (see review in Fancourt et al., (2021)), health limitations are likely to affect the choice of, and manner of engagement with activities according to selection, compensation and optimisation theory. Several cross-sectional studies have shown that leisure engagement and participation is lower in people with poorer health, who are also usually older people (Galenkamp et al., 2016; Nilsson et al., 2017). However, there appear to be no studies that explore the mediating effects of health limitations on feelings of both life satisfaction and worthwhileness associated with participation in different leisure activities.

Research Questions

In summary, we argue it would be useful to understand which leisure activities are associated with feelings of life satisfaction and worthwhileness for older people and how those feelings are mediated by health limitations as these are research gaps identified in our survey of the literature, which, if filled, could help improve the effectiveness of policy and practice to improve the SWB of older people. The main research question addressed by this study is: how are different types of leisure activity associated with life satisfaction and worthwhileness? A second research question is does having health limitations mediate these relationships? Finally, following from this, the study addresses the question of whether any mediating effect of health limitations affects relationships between leisure activity participation and life satisfaction differently from relationships between leisure activity participation and feelings of worthwhileness. Figure 1 sets out the hypothesised links. It is expected that participation in most leisure activities is positively associated with each dimension of subjective wellbeing directly. However, health limitations seem likely to have a negative relationship with participation in at least some leisure activities, and also to have a negative relationship with

subjective wellbeing. These two negative links comprise the indirect or mediating effect of health limitations. They dampen the total effect of leisure participation on subjective wellbeing.

[Insert Fig 1 here]

Methods And Data

We used data from the Department for Digital, Culture, Media and Sport’s *Taking Part Survey* (TPS), which commenced in 2005 and collects information on participation in a wide range of leisure activities in England to investigate these issues (Department for Digital Culture Media and Sport, 2020). The TPS includes a large sample of adults, with information on both life satisfaction and worthwhileness of life, personal characteristics, and participation in a wide range of activities. Whilst a longitudinal sub-sample of the data is available, it suffers from high attrition rates. Therefore, in common with some other published studies (Downward et al., 2018; Rasciute & Downward, 2010), data from several years were pooled for this study. Waves 12 -14 (2016-2017 to 2018-2019) were selected as they include both life satisfaction and worthwhileness measures of SWB and data on household income, which has been found to be an important correlate of life satisfaction in previous studies (Dolan et al., 2008). The data were downloaded from the UK Data Service (Department for Culture Media and Sport, 2018, 2019, 2020). The total sample included 21,269 adults. Of these, 11,458 were aged 50+. Selecting out cases with missing values for any of the variables used in the analyses left a usable analytical sample of 6,839. Table 1 shows the distributions of the demographic and survey control variables used in the analyses for the original and analytical datasets for adults aged 50+.

The presence of a limiting long-standing illness or disability was used as a measure of health limitations, as this has been found to be a statistically significant measure of health relating to participation in leisure activities (Paggi et al., 2016). The question asked to elicit the presence of limiting long-standing illness uses the ONS harmonised wording (Nixon, 2020). Almost half the sample (45.1%) had a limiting long-standing illness or disability. The proportion increased monotonically with age-band from 31.4% among 50-54s to 63.2% among those aged 80+. Twelve demographic variables including age-band, gender, relationship status etc, were used to control for factors found to be related to the evaluative dimensions of SWB in previous studies (Dolan et al., 2008). Household income was equalised to take account of differences in household size and composition which affect the standard of living that can be afforded from a given income (see note a to Table 1). Finally, TPS-specific controls for year of survey and whether the fieldwork was carried out in winter (January-March) were included.

Table 1 Distributions of key variables from original dataset aged 50+ and analytical dataset

Variables

Table 2 shows definitions and descriptive statistics for the SWB variables and leisure activity participation measures used in the analysis. The life satisfaction and worthwhileness of life dimensions of SWB are measured using the same question wording as the comparable ONS measures of personal wellbeing (Office for National Statistics, 2018). Both are measured on a 0-10 scale, where 0 means “not at all satisfied” or “not at all worthwhile” and 10 is “completely satisfied” or “completely worthwhile”. The TPS measures engagement in a wide range of leisure activities across six sectors of policy interest to the Department of Culture, Media and Sport. The sectors comprise the arts; museums and galleries; archives; libraries; heritage and sport. The sport category includes all recognised sports, all types of dance, walking or cycling for sport or leisure, and any fitness activity, whether performed alone or in a class. Frequency of walking and cycling for purposes of travel (i.e., active travel) is measured separately. The survey also asks about participation in a range of free-time activities (e.g., eating out, giving to charity, watching TV etc). Some grouping of the many heterogeneous activities available in the TPS into ‘domains’ (Adams et al., 2011) was undertaken, as the expectation is that health limitations would pose more barriers to participating in some types of activities than others. Using prior assumptions about the nature of different activities, we grouped activities into *physical; mental; social; and culture/hobbies*. Physical activities were sub-divided into “exercise-related physical activity” (all active sports, including dance and fitness activities, plus recreational cycling and walking) for which the primary purpose is the activity itself, and “other physical activities” (gardening, DIY, shopping and active travel) where the physical effort is not the primary purpose of the activity (Caspersen et al., 1985). Mental activities were sub-divided into cognitively active (reading, writing, listening to music, playing computer games) and cognitively passive mental activities (watching TV and internet surfing) as previous research suggests more cognitively active mental activities are associated with higher SWB and healthier ageing than cognitively passive mental activities (Iizuka et al., 2019; Stenner & McFarquhar, 2011; Verghese et al., 2003). Social activities were subdivided into personal social (friends and family time, eating out and visiting pubs and clubs) and prosocial activities (volunteering and giving to charity). The culture/hobbies domain includes days out to places of interest, heritage sites, museums, archives or galleries; participating in or attending live arts or sporting events; and taking part in creative hobbies such as making music, art, photography, cookery, woodwork, or crafts for example. These seven sub-domains are similar to broad categories used in several previous studies on leisure participation and wellbeing in older people, e.g., (Brajša-Žganec et al., 2011; Hallmann et al., 2017; Lee et al., 2018; Ryu & Heo, 2018). By further disaggregation of the culture/hobbies and social domains, we also constructed a variable that is a count of the number of different types of leisure activity the participant engages in, up to a maximum of 11. This variable is intended to capture the central idea of activity theory (Havighurst, 1961) and more modern theories of successful ageing (Bowling & Dieppe, 2005) that participation in a greater number of different types of activity is a sign of a highly engaged and optimistic older person who is more likely to have higher SWB than one whose range of leisure activities is narrower. Activity participation frequency is measured in a variety of ways in the TPS. Questions relating to sport and active travel ask about frequency over the last 28 days. Questions relating to participation in arts and cultural activities, volunteering and giving to charity ask about frequency in the last 12 months. And questions about participation in non-DCMS target activities ask a binary question about whether the respondent participates in this activity (e.g., eating out, reading, DIY, gardening etc.) in their free time. In all cases, these frequencies were recoded into 0,1 dummy variables where 1 represents a frequency specific to the leisure activity type as shown in Table 2.

Table 2 Descriptive statistics for SWB and activities variables

Variable label	Variable name	Definition	Variable type	Value labels (if categorical)	Mean* Frequency	(s.d.*) (%)
Life satisfaction	SATIS	How satisfied are you with life nowadays? (0-10 scale), 0 = “not at all satisfied”; 10 = “completely satisfied”.	Continuous		7.83*	(1.88)*
Worthwhileness of life	WORTH	To what extent do you feel that the things you do in life are worthwhile? (0-10) scale. 0 = “not at all worthwhile”; 1 = “completely worthwhile”	Continuous		8.05 *	(1.80)*
No. activities	nacts	No. of different types of leisure activity (0-11)	Continuous		8.56*	(2.1)*
Exercise-related physical activity	ExPA	Structured PA for sport, fitness or leisure at least 3 times in last 28 days	Binary	1 = ‘yes’ ; 0= ‘no’	5,431	(79.4)
Other physical activity	NonExPA	PA incidental to daily activities including DIY, gardening, shopping or active travel in last 28 days	Binary	1 = ‘yes’ ; 0= ‘no’	6,303	(92.2)
Active mental	actmental	Cognitively active mental activities (reading, listening to music, playing video or computer games) in free time	Binary	1 = ‘yes’ ; 0= ‘no’	6,322	(92.4)
Passive mental	passmental	Cognitively passive mental activities (surfing internet, watching TV) in free time	Binary	1 = ‘yes’ ; 0= ‘no’	6,620	(96.8)
Social	social	Spending time with friends/family, eating out or visiting pubs and clubs in free time	Binary	1 = ‘yes’ ; 0= ‘no’	6,407	(93.7)
Prosocial	prosocial	Volunteering and/or giving to charity > twice in past year	Binary	1 = ‘yes’ ; 0= ‘no’	5,839	(85.4)
Culture/hobbies	culthobs	Going on days out in free time/participating in arts, culture or sporting event/visit/engaging in creative hobby > twice in past year	Binary	1 = ‘yes’ ; 0= ‘no’	6,204	(90.7)

Note: Analysis of pooled data from waves 12-14, *Taking Part Survey*

Estimation Strategy

To answer the first research question, we investigated how participation in each of the seven different leisure activity sub-domains, together with the number of different types of leisure activity was associated with life satisfaction and worthwhileness by estimating separate OLS regressions for each SWB dimension, without taking account of health limitations. Variables to control for demographic characteristics and the two survey control variables were also included in the regressions, resulting in 22 variables in each of the unrestricted models. As a number of the independent and control variables proved to be statistically insignificant, and many were highly likely to be collinear with one another, to reduce the risk of multicollinearity we used nested F-tests to test restrictions on sub-sets of the variables for the two models to yield a more parsimonious version of each, with potentially different subsets of independent variables for life satisfaction and worthwhileness. The second research question was answered by next investigating how poor health mediated the relationship between participation in different leisure activity sub-domains and the two dimensions of SWB by using structural equation modelling (SEM) to estimate eight structural equation models for each SWB dimension. Each model used a different leisure activity sub-domain as the independent variable and included one mediating variable (having a limiting long-standing illness or disability) and the subset of demographic control variables that were retained in each of the restricted OLS models for life satisfaction and worthwhileness. All analyses were performed using Stata/SE 14.2 (StataCorp, 2015).

Results

We first compared the restricted OLS models excluding the health variable for each SWB dimension (columns (3) and (4), Table 3) to answer our main research question. Participating in a greater number of different leisure activities, and in exercise-related and other physical activity were positively associated with both life satisfaction and worthwhileness. Passive mental activities were negatively associated with both SWB dimensions. However, participation in social activities and culture/hobbies were positively associated with greater worthwhileness, but not with life satisfaction. Thus, there was some overlap in the covariates of the two dimensions of SWB, but also some factors unique to feelings of worthwhileness, notably additional leisure sub-domains. We argue that there is therefore value in understanding feelings of worthwhileness of life, in addition to the more usually studied life satisfaction dimension of SWB.

Table 3 Unrestricted and restricted OLS models of life satisfaction and worthwhileness of life without controlling for health limitations

	UNRESTRICTED MODELS		RESTRICTED MODELS	
	(1) Life Satisfaction	(2) Worthwhileness	(3) Life Satisfaction	(4) Worthwhileness
<u>Types of leisure activity participated in</u>				
No. different types	0.122*** (5.73)	0.134*** (6.51)	0.112*** (6.14)	0.121*** (6.40)
Exercise-related	0.207** (3.26)	0.126* (2.03)	0.215*** (3.42)	0.143* (2.33)
physical activity	0.0359 (0.40)	0.383*** (4.36)	0.0420 (0.47)	0.394*** (4.50)
Other physical activity	-0.464*** (-3.72)	-0.443*** (-3.65)	-0.458*** (-3.68)	-0.434*** (-3.58)
Passive mental	-0.115 (-1.28)	-0.154 (-1.77)		
Active mental	0.179 (1.73)	0.244* (2.42)	0.181 (1.76)	0.251* (2.49)
Social	-0.005 (-0.07)	0.045 (0.67)		0.060 (0.90)
Prosocial	0.0967 (1.06)	0.196* (2.21)	0.102 (1.13)	0.209* (2.37)
Culture & hobbies				
<u>Age-band (age 50-54 = base)</u>				
55-59	0.0596 (0.78)	0.162* (2.17)	0.0580 (0.77)	0.162* (2.23)
60-64	0.112 (1.39)	0.262*** (3.32)	0.111 (1.40)	0.271*** (3.56)
65-69	0.113 (1.20)	0.239** (2.62)	0.110 (1.19)	0.249** (2.82)
70-74	0.190 (1.91)	0.380*** (3.94)	0.189 (1.94)	0.392*** (4.19)
75-79	0.357** (3.26)	0.376*** (3.52)	0.360** (3.33)	0.392*** (3.79)
80+	0.431*** (3.92)	0.336** (3.13)	0.431*** (3.99)	0.351*** (3.38)
<u>Other demographic controls</u>				
Equivalent income (£000 p.a.)	0.00374** (2.80)	-0.000698 (-0.55)	0.00395** (2.99)	
Living in a couple	0.612*** (13.44)	0.403*** (9.09)	0.615*** (13.59)	0.416*** (9.57)
Not male gender	0.0207 (0.47)	0.115** (2.69)	0.0199 (0.46)	0.113** (2.68)
Practising religion	0.120* (2.52)	0.175*** (3.79)	0.121* (2.55)	0.176*** (3.81)
1+ child at home	0.0751 (0.07)	0.0491 (0.54)		
Has degree	-0.0707 (-1.53)	-0.0232 (-0.52)		
Home-owner	0.216*** (4.42)	0.0766 (1.62)	0.215*** (4.42)	
Non-white ethnicity	0.0751 (0.66)	0.179 (1.57)		
Lower socio-eco -mic status	0.0672** (2.74)	0.0315 (1.32)	0.0650** (2.66)	
Urban resident	-0.0488 (-0.87)	0.0372 (0.74)		
English not first language	0.0320 (0.24)	-0.316* (-2.42)		-0.214 (-1.86)
<u>Employment status (in employment, education or training = base)</u>				
Unemployed/perm.	-1.421*** (-14.11)	-1.031*** (-10.52)	-1.430*** (-14.24)	-1.036*** (-10.82)
Sick/ disabled	0.177** (2.55)	-0.0899 (-1.33)	0.181** (2.62)	-0.0720 (-1.09)
Wholly retired	-0.536*** (-3.90)	-0.215 (-1.61)	-0.530*** (-3.85)	-0.197 (-1.48)
Home carer				
<u>Survey year and quarter dummies (base = year 12; not winter quarter)</u>				
13 = 2017/18	0.176** (2.90)	0.210*** (3.55)	0.153** (2.68)	0.199*** (3.58)
14 = 2018/19	0.208*** (3.50)	0.245*** (4.24)	0.183*** (3.29)	0.234*** (4.33)
winter	-0.0266 (-0.56)	-0.038 (-0.82)		
Constant	5.889***	5.706***	5.784***	5.720***

	(27.86)	(27.16)	(29.79)	(33.04)
Observations	6839	6839	6839	6839
Adjusted R-squared	0.149	0.119	0.149	0.119

Note: t statistics in parentheses

Note: * p<0.05, ** p<0.01, *** p<0.001

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To answer the second research question concerning possible mediating effects of health limitations, SEM models were estimated using bootstrapped standard errors with 1,000 re-samples because the dependent variables (life satisfaction and worthwhileness) are ordered categorical variables (Finney & DiStefano, 2006). Relative goodness of fit of the models was evaluated using five goodness-of-fit indices (Shi et al., 2019). The model chi-square assesses overall fit and the difference between the sample and fitted covariance matrices. The null hypothesis is that the model fits the data exactly, so better fit is indicated by a test statistic closer to accepting the null hypothesis. As the chi-square statistic is inflated by larger sample size, four additional fit indices were also employed to assess the models. These included the equation-level R-squared; the root mean square error of approximation (RMSEA), which indicates a good fit if it has values smaller than 0.08; the comparative fit index (CFI) which indicates a good fit if it exceeds 0.9; and the Tucker-Lewis index which indicates a good fit if it exceeds 0.95.

Table 4 shows the results from eight SEM models for life satisfaction, and Table 5 shows similar results for worthwhileness. Each model has a different leisure activity sub-domain as an independent variable; having a limiting long-standing illness is the mediating variable in all models. Demographic control variables included from the restricted OLS models but not shown for reasons of space included: age-band, living in a couple, employment status, practising a religion and year of survey (for both life satisfaction and worthwhileness models); together with household equivalent income, socio-economic status and being a homeowner (for life satisfaction models); and being not male and not having English as a first language (for worthwhileness models). Figures 2 and 3 illustrate the results in path diagrams for models 1 and 9 from Table 4, also with confounding variables suppressed. The goodness-of-fit statistics suggested that the models were compatible with the data on most recommended criteria (Shi et al., 2019). Overall, the life satisfaction models fit the data

Table 4 Summary of life satisfaction health-mediated SEM model results for eight leisure variables

Model no.	Independent variable (IV)	Effects of IV on life satisfaction				Effects on life satisfaction via health variable as mediator		Equation-level R-squared	Goodness-of-fit statistics and cut-offs ^a			
		Direct	Indirect	Total	Direct/total %	IV to health (path 1)	Health to life satisfaction (path 3)		model vs saturated (p >)	Comparative Fit Index (CFI) (Cut-off for good fit ≥ 0.90)	Tucker-Lewis Index (TLI) (Cut-off for good fit ≥ 0.95)	Root Mean Square Error of Approximation (RMSEA) (Cut-off for good fit <0.08)
1.	No. of different leisure activities	0.161***	0.009***	0.171***	94.7	-0.018***	-0.516***	0.189	4.280* (0.369)	1.000	0.999	0.003
2.	Exercise-related physical activity	0.515***	0.102***	0.617***	83.1	-0.207***	-0.492***	0.194	6.687* (0.153)	0.998	0.991	0.010
3.	Other physical activity	0.550***	0.051***	0.600***	91.5	-0.092***	-0.548***	0.168	4.060* (0.390)	1.000	1.000	0.010
4.	Social	0.771***	.007	0.779***	98.9	-0.012***	-0.562***	0.169	0.915* (0.882)	1.000	1.000	0.000
5.	Prosocial	0.377***	-0.017	0.377**	100.0	0.030	-0.571***	0.160	1.233* (0.745)	1.000	1.000	0.000
6.	Active mental	0.362***	-0.005	0.356***	>100.0	0.009	-0.565***	0.162	5.201 (0.267)	0.999	0.995	0.007
7.	Passive mental	-0.121	-0.039*	-0.121	n.s.	0.069*	-0.564***	0.160	1.233* (0.0745)	1.000	1.000	0.000
8.	Culture and hobbies	0.707***	0.025*	0.732***	96.8	-0.045*	-0.552***	0.165	1.072* (0.784)	1.000	1.000	0.000

Note: (Shi et al., 2019)

Notes: * p<0.05, ** p<0.01, *** p<0.001. n.s. = not statistically significant. Demographic controls and constant term suppressed for space reasons

Table 5 Summary of worthwhileness health-mediated SEM results for eight leisure variables

Model no.	Independent variable (IV)	Effects of IV on worthwhileness				Effects on worthwhileness via health variable as mediator			Goodness-of-fit statistics and cut-offs ^a			
		Direct	Indirect	Total	Direct/total %	IV to health (path 1)	Health to worthwhileness (path 3)	Equation-level R-squared	model vs saturated (p >)	Comparative Fit Index (CFI) (Cut-off for good fit ≥ 0.90)	Tucker-Lewis Index (TLI) (Cut-off for good fit ≥ 0.95)	Root Mean Square Error of Approximation (RMSEA) (Cut-off for good fit <0.08)
9.	No. of different leisure activities	0.203**	0.007***	0.210***	96.7	-0.018***	-0.364***	0.173	15.465 (0.017)	0.993	0.975	0.015
10.	Exercise-related physical activity	0.601***	0.076***	0.677***	88.6	-0.207***	-0.366***	0.162	36.224 (0.000)	0.978	0.914	0.027
11.	Other physical activity	0.992***	0.039***	1.023***	96.2	-0.092***	-0.425***	0.144	40.363 (0.000)	0.972	0.891	0.029
12.	Social	1.029***	.006	1.034***	99.5	-0.012***	-0.450***	0.139	39.833 (0.000)	0.971	0.889	0.029
13.	Prosocial	0.538***	-0.014	0.524***	>100.0	0.030	-0.462***	0.132	39.770 (0.000)	0.9710	0.884	0.029
14.	Active mental	0.497***	-0.004	0.493***	>100.0	0.009	-0.459***	0.126	45.555 (0.000)	0.963	0.866	0.031
15.	Passive mental	0.046*	-0.032*	0.018	n.s.	0.069*	-0.046***	0.122	50.882 (0.000)	0.957	0.836	0.033
16.	Culture and hobbies	0.957***	0.019*	0.976***	98.5	-0.045*	-0.433***	0.144	33.246 (0.000)	0.977	0.913	0.026

Note: a (Shi et al., 2019)

Notes: * p<0.05, ** p<0.01, *** p<0.001. n.s. = not statistically significant. Demographic controls and constant term suppressed for space reasons

[Insert Figure 2 here]

slightly better than the worthwhileness models, since equation-level R-squareds were higher; the results of model chi-squared tests were statistically significant at the 5% level; comparative fit and Tucker- Lewis indices were higher and root mean square error of approximations were lower. The worthwhileness models did not meet the recognised criteria for the model chi-squared tests nor, for some specifications, for the Tucker Lewis index, but did meet the cut-offs for the comparative fit index and the root mean square error of approximation. Overall, therefore, the models appear to fit the data reasonably well.

Including a measure of poor health as a mediating variable in the analyses affected the relationships between different leisure activity sub-domains and the two dimensions of SWB differently. Having a limiting long-standing illness or disability was consistently associated with lower life satisfaction and worthwhileness across all the leisure activity sub-domains (path 3, Tables 4 and 5 and figures 1 and 2). The absolute size of the negative coefficient on the health variable was in all models larger for life satisfaction than for feelings of worthwhileness of life. The sizes of the path 1 coefficients varied by type of leisure activity, but were identical across the two SWB dimensions, as expected, given the dependent variable plays no role in that part of the indirect pathway. The degree of mediation is given by the ratio of the direct effect of a leisure activity on SWB as a proportion of the total effect. Mediation is greater where the direct effect of the activity on the measure of SWB is a lower percentage of the total effect. The mediating effect of having a limiting long-standing illness was always greater on life satisfaction than worthwhileness for any given any given leisure activity. The path diagrams illustrate how the impacts of participating in a greater number of different types of leisure activity on the two measures of SWB (models 1 and 9) were mediated by having a limiting long-standing illness or disability. Tables 4 and 5 show that the mediating effect of having a limiting long-standing illness or disability on SWB was greatest for both types of physical activity, although the mediating effect was greater for exercise-related physical activity (models 2 and 10) than

for other physical activity (models 3 and 10), and greater for life satisfaction than for worthwhileness of life. This finding is consistent with many studies in which older people most often report health as the main barrier to physical activity (Bethancourt et al., 2014; Justine et al., 2013; Library Research Service, 2010; Moschny et al., 2011; Schutzer & Graves, 2004).

Health limitations mediated the effect of participating in a larger number of different leisure activities on both measures of SWB to a modest degree of only about 5% (figures 1 and 2, and models 1 and 9, Tables 4 and 5). The SWB benefits of participating in cultural activities and hobbies were mediated to an even more modest degree by health limitations (models 8 and 16). In the cases of social and prosocial activities, the indirect effects were not statistically significant, so were calculated from the direct and total effects. They were very close to zero, which suggests that health limitations do not impair the SWB older people get from social (e.g., friends and family time) and prosocial (volunteering and giving to charity) activities. In the case of prosocial activities, the direct effect exceeded the total effect for worthwhileness (model 13), and the coefficient for path 1 (from the independent variable to the health variable) was also not statistically significant. This suggests that the positive effects of prosocial activities on feelings of worthwhileness may be amplified in the presence of a limiting long-standing illness. There was no significant mediation of the negative relationship between passive mental activities and both measures of SWB, nor of the positive relationship between active mental activities and SWB. The mediating effects of health limitations on feelings of worthwhileness of life associated with all of the sub-domains of leisure activity investigated were less than those for life satisfaction. The direct effects of incidental physical activity, social and prosocial activities and culture and hobbies on feelings of worthwhileness of life are noticeably larger than for life satisfaction.

Discussion

We found, in answer to our first research question about the unmediated associations between different leisure activities and the two SWB dimensions that passive mental activities had a negative relationship with both SWB dimensions, consistent with evidence that TV viewing time is negatively associated with mental wellbeing in adults (Dempsey et al., 2014). It was also observed that participating in a greater number of different types of leisure activity and exercise-related physical activity were positively associated with both dimensions of SWB. The first result is consistent with the activity theory of ageing. Worthwhileness was observed to also be positively associated with participation in social and culture/hobby activities, which is consistent with existing research (Fancourt & Steptoe, 2018b; Steptoe & Fancourt, 2019). In answer to our second research question of whether health limitations mediate relationships between leisure activity participation and SWB, we observed different results depending on the type of leisure activity. The positive association of prosocial and active mental activities and the negative association of passive mental activities with both dimensions of SWB appeared unaffected by health limitations. For active mental activities, the positive association with SWB was slightly amplified by having a limiting long-standing illness or disability, as was the positive association of prosocial activities with worthwhileness. Of all the leisure activity sub-domains, participation in social activities had the largest positive direct effect on feelings of worthwhileness and life satisfaction with very small mediation effects from having a limiting long-standing illness. Participation in culture/hobbies was also associated directly with higher worthwhileness and life satisfaction with only small mediation effects from having health limitations. At the other extreme, the SWB associated with physical activities was most impaired by having health limitations that are more common with age. However, it is encouraging that one quarter of our sample were still participating in exercise-related physical activity and 45% in other physical activity, despite having health limitations. Many models of successful ageing describe a process of selective optimisation with compensation as a way of proactively adapting to the limitations posed by ageing but still enjoying life (Baltes & Carstensen, 2003; Carpentieri et al., 2017; Freund & Baltes, 1998). Those who continue to participate in sport and exercise may have found new activities to replace the ones they can no longer do, and/or adapted how they participate in some way, such as enjoying lower-impact activities like cycling, walking or swimming (Davison & Cowan, 2020), or specially adapted sports such as walking football (Cholerton et al., 2020) and netball.

Finally, the study addressed the question of whether health limitations affected relationships between leisure activity participation and life satisfaction differently from relationships between leisure activity participation and feelings of worthwhileness. Our results showed that participating in any form of leisure activity had a greater direct effect on worthwhileness after accounting for health limitations than on life satisfaction, which accords with the meaning of worthwhileness as deriving mainly from what you do, whether for work or leisure (Office for National Statistics, 2018). There is also some support for activity theories of successful ageing in the presence of health limitations from the positive direct relationship found between the total number of different leisure activities engaged in and both life satisfaction and worthwhileness, supporting others' calls for efforts to increase participation in social leisure activities of those with health problems (Galenkamp et al., 2016; Galenkamp & Deeg, 2016).

Strengths And Limitations

A key strength of the study is the relatively large sample size, with good coverage of the English population in terms of demographic characteristics. The dataset used contains a rich set of variables on the personal characteristics of participants and leisure activities. The study also used common validated instruments for measuring both dimensions of SWB, and having a limiting long-standing illness or disability, as

developed by the ONS. The main novelty of this study is the use of structural equation modelling to examine how health limitations affect two dimensions of subjective wellbeing derived from participation in a range of leisure activity sub-domains. Most previous studies of older peoples' subjective wellbeing and choice of leisure activities focus on either life satisfaction or – less frequently - worthwhileness of life alone, and none we could find model health limitations as a mediating factor between leisure participation and SWB. This study is the first to compare the mediation effects for both life satisfaction and worthwhileness of life and note different effects for any given leisure activity sub-domain. The study has a number of limitations. It is an observational study using cross-sectional data, and so causal links cannot be discerned. The dataset does not allow the inclusion of controls for social or environmental context for leisure activities, which are known to be important influences on the enjoyment of and motivation for different activities (Finlay et al., 2015; Hancock et al., 2020). The measures of participation are binary, so a dose-response relationship between frequency of participation and SWB cannot be estimated. TPS participation data relies on recall of the survey participants which can be unreliable, especially in older people, whose short-term memory is more likely to be impaired (Verhaeghen, 2013), and finally the survey does not include older people living in care homes and hospitals, whose leisure activities and SWB are likely to exhibit different patterns from adults living in the community.

Conclusion

These results suggest that deepening understanding of the role that leisure activities play in generating feelings of worthwhileness for those with limiting long-term health conditions could help with the design of programmes and policies to improve the lives of older people. The main contribution of this study is to confirm that older people can continue to lead lives they feel are worthwhile, despite health limitations, through participating in a range of types of leisure activity, and that such participation is more important for worthwhileness than for life satisfaction. Although physical activity is an important public health priority because it helps people remain healthy and independent as they age, focusing policy and provision on additional activities that contribute to feelings of worthwhileness of life for older people is likely to help improve their wellbeing and contribute to successful ageing, despite declining health. With the lengthening of life expectancy, the importance of ensuring access to a wide range of leisure activities – especially those that provide social and prosocial opportunities - for older people's wellbeing must not be overlooked. Future research should examine what role unequal access to leisure opportunities may play in the growing gap in healthy life expectancy between the richest and poorest older people in the UK (Marmot et al., 2020).

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Figures

Figure 1

Hypothesised structural relationship between leisure activity participation, health limitations and subjective wellbeing

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
 Note: Demographic controls suppressed for clarity

Figure 2

Structural equation models predicting life satisfaction and worthwhileness as a function of the number of different types of leisure activity and having a limiting long-standing illness in adults aged 50+