Health and well-being profiles of older European adults

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Abstract The purpose of the present study was to identify health and well-being typologies among a sample of older European adults. Further, we examined various demographic, social, and health behaviour characteristics that were used to discriminate between such groups. The participants were 1,381 community-dwelling adults aged 65 years and above (M age = 73.65; SD = 7.77) from six European Union (EU) countries who completed

self-reported questionnaires. Hierarchical cluster analysis was initially conducted followed by a k means analysis to confirm cluster membership. Four clusters were identified and validated: ‘good health and moderate functioning’ (38.40%), ‘moderate health and functioning’ (30.84%), ‘obese and depressed’ (20.24%) and ‘low health and functioning’ (10.51%). The groups could be discriminated based on age, gender, nationality, years of education, social isolation and health behaviours (alcohol consumption and walking behaviour). The results of the study demonstrate heterogeneity with regard to the relationships between the variables examined. The information can be used in targeting older Europeans for health promotion interventions.

Keywords Cluster analysis · Functioning · Depression · Life satisfaction · Self-esteem · Health behaviours

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Introduction

Previous research with older adults indicates that the relationships between health and physical and psychological functioning is complex (Smith and Baltes 1997, 1998). For example, some older people with fragile health experience relatively high levels of life satisfaction, an important indicator of mental well-being. However, in other older adults, poor health is associated with limited physical and psychological functioning (Smith and Baltes 1998). Such research provides a platform for examining the notion that advancing age and its associated loss of health and functioning is not always related to decrements in psychological well-being.

In a series of studies, Smith and Baltes (1997, 1998) and Gerstorf et al. (2006) identified cluster profiles of German older adults based on variables representing health and functioning. The profiles incorporated measures from

various domains (e.g. functional capacity, social context and psychological functioning). Their results revealed nine different cluster groups demonstrating varying relationships between health and functioning. In describing demographic differences between the profiles, Smith and Baltes (1997) found that older age and female gender tended to be overrepresented in clusters classified as displaying relatively poor functioning.

In a study conducted with Swedish older adults, Borglin et al. (2006) examined cluster profiles. Borglin et al. (2006) described the cluster groups on a range of variables including self-rated health, health problems, physical activity (although it was unclear how this was measured) and social support. The authors identified three different groups varying in their levels of quality of life (high, intermediate and low). Their results showed that approximately one-third of the sample displayed relatively low levels of quality of life, and they tended to be older females with poor self-rated health and numerous health problems, and were less physically active than participants in the remaining cluster groups.

The aforementioned studies are important in indicating the presence of optimal and less optimal functioning in older adults. Whilst these studies have discriminated the identified clusters on a range of health, behaviours and personal characteristics, additional important variables both in terms of forming, validating and discriminating, the clusters need to be explored. Here, it may be particularly important to concentrate on modifiable characteristics that can be targeted in future lifestyle and wellness interventions. These variables include Body Mass Index (BMI), self-reported health and health conditions, functional limitations, depressive symptomatology, life satisfaction, self-esteem, social functioning and health behaviours (including alcohol consumption, smoking and walking behaviour).

BMI is important to include in a cluster solution as previous research has documented a negative relationship between BMI and indicators of physical functioning, such as the ability to carry out everyday tasks including lifting/carrying groceries, climbing several flights of stairs and walking several blocks (Fontaine and Barofsky 2001; Yan et al. 2004). However, there is inconclusive evidence with regard to the relationship between BMI and indicators of psycho-social well-being in older adults, largely due to the limited number of studies examining such relations.

Perceptions of health are one of the main factors influencing older adults' quality of life (Bowling 1995). Borglin et al. (2006) found that the presence of health conditions tended to cluster with poor health and low quality of life. Functional limitations may be a consequence of the existence of health problems and have also been shown to be related to psychological health, including depression (Gayman et al. 2008). With regard to depressive symptomatology, Smith and Baltes (1998) found that this

variable tended to cluster with anxiety, loneliness as well as physical frailty. These findings illustrate the likelihood of co-existence of low levels of physical and psychological functioning.

In contrast to the evidence suggesting that depressive symptomatology clusters with low levels of physical functioning, in their study with older German adults, Smith and Baltes (1998) identified that about 10% of participants (particularly men) experienced concurrent physical illness (cardiovascular disease) yet relatively high levels of life satisfaction. Their finding provides some empirical evidence for the notion that ageing-associated declines in physical health do not always equate with low levels of well-being in older adults.

The role of self-esteem has not been considered previously when describing typologies of older adults based on function and well-being variables. This is despite evidence suggesting that self-esteem can protect against the development of depression in older adults (Murrell et al. 1991), while low self-esteem is a positive predictor of poor self-care in older people (Smits and Kee 1992) and poor health behaviours following illness in older people who have had a heart attack (Conn et al. 1992).

The older people become the more loneliness they are likely to suffer as a result of losing lifelong partners and friends (Victor et al. 2005). In addition, loneliness seems to display significant relationships with both the presence of physical illness, physical functioning and depression (Smith and Baltes 1998). In contrast, the presence of high levels of social support, as a positive indicator of social functioning, appears to be experienced by those older adults who also report high levels of quality of life (Borglin et al. 2006).

Engagement in health behaviours can be either determinants or outcomes (e.g. consuming alcohol to feel better) of well-being and functioning. With regard to alcohol consumption, research by Lang et al. (2007) suggests that moderate alcohol consumption (consuming up to two drinks per day), *not* abstinence, is associated with improved subjective well-being and lower levels of depressive symptomatology in a large group of British older adults. Whether such findings generalise to older adults from other nationalities is presently unknown. Further, smoking status and leading a physically active lifestyle (e.g. through walking) have been shown to be related to changes in health among older European adults (Haveman-Nies et al. 2003). Taken as a whole Haveman-Nies et al. (2003) showed that while self-rated health and self-care ability generally deteriorated over a 10-year period in all older adults, being a non-smoker and physically active delayed that deterioration in 70–75 years olds. However, it was also apparent that the results differed across gender groups. For women, only engagement in physical activity

was related to a delay in the onset of functional dependence, whereas for men, both lifestyle behaviours were important.

Finally, evidence also exists to support the notion that engagement in health behaviours tend to cluster, such that people are likely to engage in numerous behaviours concurrently (e.g. smoking and consumption of alcohol; Chou 2008). It has been suggested that engagement in several health risk behaviours may lead to an elevated risk of disease that is larger than what can be expected from the addition of the individual risk factors (e.g. Yusef et al. 2004). However, to date, the only study to consider the clustering of multiple health behaviours was conducted by Chou (2008) with a large representative sample of Hong Kong Chinese older people aged sixty and older. Chou (2008) revealed, for example, that males, older age groups and the more well educated were most likely to smoke and drink heavily, be physically inactivity and consume low levels of vegetables and fruits. Given the relative paucity of research in this area with older adults and the fact that the study by Chou (2008) was conducted using a sample of Chinese older adults, more research is needed using older adults from other parts of the world.

Apart from the range of modifiable characteristics described above, some demographic variables are also important to consider and were therefore included as variables used to discriminate between the clusters. These include age, gender, education and nationality. This is because previous research has documented the importance of considering each of these variables in assessments of health and functioning (Koster et al. 2006; Pinquart 2001; Smith and Baltes 1998; Zimmer and House 2003).

Extant research which has identified cluster groups of older adults in this area of work have used samples from individual nations (e.g. German older adults; Smith and Baltes 1997, 1998). Thus, it is currently unknown the extent to which certain typologies are more likely be identified in certain countries. Taking a European perspective, previous research has shown that older people in Southern Europe report more disabilities (Heslin et al. 2001) and depression (De Leo et al. 1998; Heslin et al. 2001) than their Northern European counterparts. Thus, it is possible that the distribution across health and well-being profiles may differ across Northern and Southern Europeans.

In view of the above, the purpose of the present study was to identify health and well-being typologies among a sample of European older adults and describe various demographic, social and health behaviour characteristics of such groups. We expected to identify groups differing with regard to health and functioning characteristics. We also expected at least one group of older adults would display concurrent high levels of both health, physical and

psychological functioning. Conversely, we hypothesised that at least one cluster would emerge characterised by concurrent poor health, physical and psychological functioning (H1). Second, based on previous research, we hypothesised the following characteristics to be overrepresented in relatively well functioning clusters: younger age groups, male gender, Northern Europeans, high levels of education, lack of social isolation, consumption of moderate amounts of alcohol, non-smoking status and relatively high levels of walking behaviour. The opposite pattern of results would be evident in cluster groups consisting of older adults displaying poorer functioning (H2).

Methods

Participants and procedure

To represent the North–South divide in the EU, participants were selected from six European Union (EU) countries; England, Sweden, Finland, Estonia, Greece and Italy. Participants constituted a convenience sample from the largest or second-largest city in each country (i.e. Birmingham, Rome, Thessaloniki, Tallinn, Espoo and Gothenburg). To be included in the study, participants needed to be residing in an urban area, be aged 65 and above, physically mobile and be able to read and write in the official language of the country in which the questionnaire was administered.

The data were collected during the spring of 2008. Initially, the coordinator for each participating country drew up a list of places in the community they believed based on experience, older adults would frequent (e.g. social clubs for older adults, community centres, libraries, supermarkets, cafés and post offices). The list differed slightly across the participating countries as it was acknowledged that the list should be culturally sensitive (for example, social clubs for older adults are common in Greece and Finland only). The investigators also made use of personal contacts they had from previous research conducted using older adults. Based on the list constructed, trained research assistants (RA) in each participating country sought out at least five different sites from each location identified over 2 weeks between 10 a.m. and 2 p.m. and approached older adults in person. The RA introduced him/herself and explained the nature of the study. (S)he checked that each person approached fulfilled the inclusion criteria and only then asked them for their willingness to complete a questionnaire. All the participants provided written informed consent prior to taking part in the study. A small table was available for participants to use when completing the questionnaire, and the completion was supervised by the RA. Thus, the participants had opportunities to ask

questions. The ethical guidelines of psychological societies in each of the countries (similar to those produced by the British Psychological Society) were adhered to throughout.

The RA noted down the number of older adults approached who fulfilled the inclusion criteria and the number agreeing to complete the questionnaire to calculate the response rate (i.e. number of persons agreeing to participate * 100/number of persons approached who were eligible to participate). Taken as a whole, the response rate was 75.6% (England = 82.4%; Sweden = 43.9%; Finland = 73.6%; Estonia = 77.2%; Greece = 87.5%; Italy = 89.1%). The sample constituted 1,381 participants. Following the list-wise deletion of outliers ($n = 40$), the distribution across the various countries was: England: $n = 247$, Nordic countries (Sweden and Finland): $n = 205$, Estonia: $n = 175$, Greece: $n = 342$ and Italy: $n = 372$. The study had the approval of the University Ethics Committees for each participating country.

Participants had a mean age of 73.7 (SD = 7.8). Taken as a whole, females constituted 63.1% of the total sample. More than half of the participants (57.1%) were married, while 29.2% were widowed. We compared demographic characteristics (including gender, age and education) of our sample with those of previous representative data sets (e.g. Survey for Health Ageing and Retirement in Europe and the English Longitudinal Study on Ageing; see Table 1). The samples were broadly similar except that our sample somewhat overrepresented females, and the Estonian subsample was somewhat better educated compared to a sample from an existing representative survey (Pölluste et al. 2009).

Measures

While some instruments were already available in each of the languages (e.g. IPAQ; see *Measures*), the remaining were translated from English to the relevant language by researchers within the research team. In addition, another

person with expert knowledge of the relevant language and English translated the questionnaire back into English. Discrepancies between the translations were identified, and the wording was changed as necessary until consensus was reached.

Body mass index (BMI)

Self-reported height and weight was used to determine BMI using the standard formula weight (kg)/height (m)².

Health variables

Self-reported health was measured using one item with response options ranging from 'very bad' to 'very good'. Further, the participants were asked to indicate which of the following health conditions they had experienced in the past 12 months: high blood pressure, heart trouble, stroke, bronchitis, asthma, arthritis, diabetes, cancer, circulatory problems, emphysema, osteoporosis, cataracts and glaucoma. For the purpose of the main analysis, a simple count of health conditions was performed to be entered in the cluster analysis. The health conditions selected were those listed by Balfour and Kaplan (2002).

Functional limitation

Based on Nagi's (1976) conceptualisation of functional limitations, the participants were asked to rate their levels of difficulty performing nine tasks. The tasks included pushing a large object, lifting a weight of more than 10 lb (or more than 4.5 kg), reaching the arms high above the shoulders, writing or handling small objects, stooping or crouching, getting up from a chair, standing in one place for more than 15 min, walking a quarter mile (or 0.4 km) and walking up a flight of stairs. Participants were said to have severe difficulty with a given task when they reported either a lot of difficulty or that he/she was unable to do the

Table 1 Comparing respondents' characteristics with established representative national samples

	Gender (% female)		Age (Mean)		Education (% primary school only)	
	Current sample	ONS	Current sample	ONS	Current sample	ONS
England	74.9	57.1 ^a	76.2	74.2 ^a	45.7	53.6 ^a
Sweden	67.4	51.6 ^b	73.8	75.5 ^b	17.4	–
Finland	72.3	58.9 ^c	75.4	76.60 ^c	36.5	–
Estonia	69.7	63.0 ^d	73.4	–	19.4	39.0 ^d
Greece	47.4	54.7 ^b	71.8	76.0 ^b	63.2	–
Italy	60.8	53.8 ^b	73.0	74.0 ^b	51.1	51.3 ^c

ONS other national sample

Superscripts refer to the ONS sources: ^a Chou (2007), ^b Börsch-Supan et al. (2005a, b), ^c Statistics Finland (2009), ^d Pölluste et al. (2009), ^e Italian National Institute of Statistics (2001)

task without help. The tasks in which the participants reported such severe difficulty were then summed to provide a score on functional limitation with higher scores representing more functional limitation. Such a calculation of functional limitation has previously been used by Balfour and Kaplan (2002). In the present study, the internal reliability coefficient for the scale was $\alpha = 0.88$.

Depressive symptoms

The Centre for Epidemiological Studies Depression scale (CES-D; Radloff 1977) was used to assess depressive symptoms in the past week. The scale consists of 20 items with overall scores ranging between 0 and 60. An example item includes 'I felt tearful'. This instrument has received support with regard to its validity and reliability in older populations (Beekman et al. 1997). The internal consistency was high ($\alpha = 0.85$) in this study.

Life satisfaction

The Satisfaction With Life Scale (SWLS; Diener et al. 1985) was used to measure global life satisfaction. This five-item questionnaire (e.g. 'I am satisfied with my life') is presented with scales ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). The questionnaire has been widely adopted, and high levels of reliability and validity have been reported (Diener et al. 1985). The internal reliability coefficient for the scale in the present study was $\alpha = 0.86$.

Self-esteem

Rosenberg's self-esteem scale (Rosenberg 1979) is a 10-item scale measuring global self-esteem. An example item is 'I feel that I'm a person of worth, at least on an equal plane with others' and items are scored on a four-point scale with response options ranging from 1 (*strongly agree*) to 4 (*strongly disagree*). The questionnaire is unidimensional (Marsh 1996), well validated (Byrne 1996) and previous research studies with older populations have identified adequate internal reliability coefficients (e.g. Diehl et al. 2001; McAuley et al. 2005). In the present study, the internal consistency of the scale was $\alpha = 0.82$.

Demographic characteristics

Apart from ticking a box representing their gender, the participants were asked to indicate their age by providing their date of birth. Further, a categorical variable was created in which the participants were asked to tick the response representing their highest level of education (primary, secondary or further/higher education).

Social isolation

One item was used as one measure of the structural aspect of social networks, based partly on the conceptualisation of Seeman and Syme (1987). In effect, this item measures the extent to which the participants could be classified as being socially isolated. Specifically, the participants were asked about the number of close friends and relatives seen (or talked to) at least once per month and response options included 'less than 2' and '2 or more'.

Health behaviours

Three different health behaviours were assessed: alcohol consumption, smoking status and physical activity (walking). Both alcohol consumption and smoking status were measured with single items. Specifically, to assess alcohol consumption, the participants were asked to indicate whether they consumed 'none', '1 per day or less' or 'more than 1 per day' each month. The item measuring smoking status was taken from Balfour and Kaplan (2002), in which the response options included 'non-smoker', 'former smoker' and 'current smoker'. Finally, with regard to walking behaviour, the relevant section from the short version of the International Physical Activity Questionnaire (Craig et al. 2003) was used. This questionnaire was chosen because it has been extensively validated across a range of general adult population groups (Craig et al. 2003) and, more recently, also in older adults (Deng et al. 2008; Kolbe-Alexander et al. 2006). Specifically, the participants are asked on how many days in the previous 7 days they have walked for at least 10 min at a time, and subsequently for those who respond 1 or more, they are asked for how many hours and/or minutes per day. A total walking score expressed as MET/minute per week is then calculated based on the formula: $3.3 * \text{minutes per day} * \text{days per week}$.

Data analysis

Cluster analysis is a standard analytical tool for identifying typologies (Hair et al. 1998). It is a useful tool in identifying distinct groups of people who are similar on selected variables and unlike those from other groups (Hair et al. 1998). This method has been effectively used in previous research with older adults (Smith and Baltes 1997, 1998; Borglin et al. 2006). To identify the typologies, we first conducted a hierarchical cluster analysis, followed by a k means confirmatory cluster analysis. In order to validate the final cluster solution, Aldenderfer and Blashfield (1984) suggested that the derived clusters should be compared on variables *not* used in the cluster solution. It is important here to choose measures that are important conceptually as

well as practically. Therefore, a one-way MANOVA was conducted with life satisfaction and self-esteem serving as the dependent variables and the cluster solution representing the independent group variable. Finally, we conducted a series of Pearson χ^2 analyses and a one-way ANOVA to examine demographic, social and lifestyle behaviour differences between the cluster groups.

Prior to the main analyses, all multivariate and univariate outliers were deleted ($n = 40$). The remaining cases were then standardised (Z scores; Hair et al. 1998). Initially, a hierarchical cluster analysis was conducted in order to explore the nature of the clusters. We used the Ward method because it avoids the problem of ‘chaining’ associated with other methods (Aldenderfer and Blashfield 1984). The similarity measure adopted was the squared Euclidean distance. The agglomeration schedule coefficients were examined to determine the number of clusters. Hair et al. (1998) have specified that small coefficients indicate that rather homogenous clusters are being merged, while large coefficients suggest that clusters with dissimilar members are being combined. Thus, fairly large increases in the coefficients between two adjacent sets were inspected to decide the number of clusters. In line with previous research (e.g. Weiss et al. 1997; Thøgersen-Ntoumani et al. 2008), we used z scores of ± 0.50 as the criterion for interpreting whether the participants scored relatively high or low on given variables compared to members of other clusters.

Results

The results of the hierarchical analysis suggested a four-cluster solution. In line with recommendations by Hair et al. (1998), the centroid values from the hierarchical analysis were used as the initial seed values for the confirmatory k means analysis. The results revealed final centroid values that were similar to those obtained from the hierarchical analysis. The results are depicted in Fig. 1. The four clusters were subjectively labelled ‘good health and moderate functioning’ (38.4%), ‘moderate health and functioning’ (30.8%), ‘obese and depressed’ (20.2%) and ‘low health and functioning’ (10.5%).

In order to validate the final cluster solution, Aldenderfer and Blashfield (1984) suggested that the derived clusters should be compared on variables *not* used in the cluster solution. It is important here to choose measures that are important conceptually as well as practically. Life satisfaction and self-esteem were chosen to represent the benchmark variables. A one-way MANOVA was conducted to examine differences between the four cluster groups in these variables (see Table 2). The MANOVA was significant (*Pillai's Trace* = 0.137; $F(6,2280) = 28.1$;

Fig. 1 k means analysis on health and functioning

$p < 0.001$; partial $\eta^2 = 0.07$). The univariate analysis revealed that the cluster groups differed significantly in both life satisfaction ($F(3,1140) = 52.5$; $p < 0.001$; partial $\eta^2 = 0.12$) and self-esteem ($F(3,1140) = 26.5$; $p < 0.001$; partial $\eta^2 = 0.07$). Specifically, post hoc tests revealed that the ‘good health and moderate functioning’ group had significantly higher levels of life satisfaction and self-esteem than the remaining groups. Further, the ‘moderate health and functioning’ cluster had higher levels of life satisfaction than the ‘obese and depressed’ and ‘low health and functioning’ groups as well as higher levels of self-esteem compared to the ‘low health and functioning’ cluster. Finally, the ‘obese and depressed’ had significantly higher scores on life satisfaction, but not self-esteem, than the ‘low health and functioning’ group.

In addition to identifying and validating the clusters, we examined differences between the cluster groups in age, gender profiles, countries of origin, education profiles, social isolation and health behaviour (alcohol, smoking and walking).

With regard to gender, a χ^2 analysis (Pearson $\chi^2(3) = 27.4$; $p < 0.001$) revealed that males were overrepresented in the ‘good health and moderate functioning’ and ‘moderate health and functioning’ clusters and underrepresented in the other two cluster groups. In contrast, females were underrepresented in the former two cluster groups but overrepresented in the ‘obese and depressed’ and ‘low health and functioning’ groups (see Table 3).

The differences in distribution between the countries were uneven (Pearson $\chi^2(12) = 136.2$; $p < 0.001$; see Table 3). Specifically, the British subsample was overrepresented in the ‘good health and moderate functioning’ cluster but also slightly in the ‘low health and functioning’ group. This sample was underrepresented in the other two

Table 2 Validation of the *k* means cluster solution

Variable (score ranges)	Good health and moderate functioning (38.4%)			Moderate health and functioning (30.8%)			Obese and depressed (20.2%)			Low health and functioning (10.5%)		
	<i>Z</i>	<i>M</i>	<i>SD</i>	<i>Z</i>	<i>M</i>	<i>SD</i>	<i>Z</i>	<i>M</i>	<i>SD</i>	<i>Z</i>	<i>M</i>	<i>SD</i>
Life satisfaction (1–7)	0.4	5.3 ^a	1.2	0.01	4.8 ^b	1.3	−0.3	4.3 ^c	1.4	−0.6	4.0 ^d	1.3
Self-esteem (1–4)	0.3	3.3 ^a	0.4	−0.1	3.1 ^b	0.4	−0.2	3.0 ^{b,c}	0.5	−0.4	3 ^c	0.5

Note: Superscripts with the same letter in the same row do not differ at $p < 0.05$

Table 3 Differences between cluster groups in gender profiles, countries of origin, education profiles, social isolation, alcohol behaviour and smoking status

	χ^2	df	Good health and functioning		Moderate health and functioning		Obese and depressed		Low health and functioning	
			Observed <i>N</i>	Expected <i>N</i>	Observed <i>N</i>	Expected <i>N</i>	Observed <i>N</i>	Expected <i>N</i>	Observed <i>N</i>	Expected <i>N</i>
Gender	27.4**	3								
Male			175	160.5	148	128.9	74	84.6	21	43.9
Female			267	281.5	207	226.1	159	148.4	100	77.1
Countries of origin	136.2**	12								
United Kingdom			121	78.3	43	62.9	15	41.3	25	21.4
Nordic countries			87	67.2	57	54.0	24	35.4	7	18.4
Greece			94	95.2	50	76.5	82	50.2	22	26.1
Italy			114	141.7	135	113.8	74	74.7	46	38.8
Estonia			26	59.5	70	47.8	38	31.4	21	16.3
Education	59.7**	6								
Primary			123	168.2	134	137.6	117	88.0	65	45.3
Secondary			192	180.4	159	147.6	81	94.4	39	48.6
FE/HE			119	85.4	62	69.9	29	44.7	13	23
Social isolation	11.1*	3								
Less than 2 close friends/family			29	43.2	43	34.7	22	22.4	18	11.7
2 or more close friends/family			413	398.8	312	320.3	207	206.6	102	108.3
Alcohol	46.6**	6								
None			160	208.3	182	165.1	121	108.6	75	56
1 per day or less			237	202.9	150	160.8	101	105.8	36	54.5
More than 1 per day			42	27.9	16	22.1	7	14.5	7	7.5
Smoking status	10.0	6								
Current smoker			40	49.6	48	39.8	31	26.1	10	13.5
Former smoker			99	105.4	92	84.5	58	55.5	25	28.6
Non-smoker			300	283.9	212	227.7	142	149.4	84	77

FE further education, HE higher education

* $p < 0.05$; ** $p < 0.01$

clusters (i.e. ‘moderate health and functioning’ and ‘obese and depressed’). Participants in the Nordic countries seemed to demonstrate the most favourable profile as they had a higher than expected count in the ‘good health and functioning’ and ‘moderate health and functioning’ clusters, while being underrepresented in the ‘obese and depressed’ and the ‘low health and functioning’ groups. A

higher than expected count of Greek older adults belonged to the ‘obese and depressed’ cluster, but fewer than expected in the ‘low health and functioning’ and ‘moderate health and functioning’ groups. In contrast, the Italian older adults were overrepresented in the ‘low health and functioning’ and the ‘moderate health and functioning’ cluster, while being underrepresented in the ‘good health and

moderate functioning' cluster. The Estonian older adults displayed a similar profile to the Italians, except that they were also slightly overrepresented in the 'obese and depressed' cluster.

With regard to education profiles, the distribution among the clusters was likewise uneven (Pearson $\chi^2(6) = 59.7$; $p < 0.001$; see Table 3). Specifically, participants with primary education were overrepresented in the 'obese and depressed' and the 'low health and functioning' clusters, while they were underrepresented in the remaining cluster groups. The opposite pattern was evident for those with secondary education, so that the 'good health and moderate functioning' and 'moderate health and functioning' participants were more likely to have secondary education than those in the other clusters. Finally, those who had taken Further/Higher Education were overrepresented in the 'good health and functioning' group but underrepresented in the other groups.

While most participants reported relatively low levels of social isolation, the distribution among the cluster groups was unequal (Pearson $\chi^2(3) = 11.1$; $p < 0.05$; see Table 3). Specifically, more participants in the 'moderate health and functioning' and the 'low health and functioning' groups tended to see less than two close friends or family members per month, while participants in the 'good health and moderate functioning' cluster group were more likely to report low levels of social isolation.

With regard to alcohol consumption, again the distribution was uneven (Pearson $\chi^2(6) = 46.6$; $p < 0.001$) with less than expected participants in the 'good health and functioning' group consuming no alcohol, while more than expected in the remaining groups reporting to consume no alcohol (see Table 3). In contrast, participants in the 'good health and functioning' cluster were overrepresented in the one per day or less and the more than one alcoholic unit per day group. The participants in the remaining cluster groups were less likely to consume any alcohol.

No significant differences emerged in smoking status between the cluster groups (Pearson $\chi^2(6) = 10.0$; $p > 0.05$; see Table 3).

For age, the ANOVA was significant ($F(3,1091) = 24.1$; $p < 0.001$; partial $\eta^2 = 0.06$). Post hoc tests revealed that the 'moderate health and functioning' participants were significantly older ($M = 74.5$; $SE = 0.4$) than participants

in the 'good health and moderate functioning' ($M = 72.0$; $SE = 0.4$) and the 'obese and depressed' ($M = 71.9$; $SE = 0.5$) clusters. Further, and not unexpectedly, the 'low health and functioning' participants ($M = 77.8$; $SE = 0.7$) were significantly older than participants in the other groups.

Finally, to examine differences in walking behaviour between the cluster groups, a one-way ANOVA was conducted. The ANOVA was significant ($F(3,1001) = 10.7$; $p < 0.001$; partial $\eta^2 = 0.03$). As expected, the post hoc test results revealed that the 'low health and functioning' cluster engaged in significantly lower levels of walking than the remaining groups (see Table 4).

Discussion

The cluster analysis conducted in the present study allowed us to identify older adults who were more or less well functioning in different ways. The findings revealed four distinct clusters which were externally validated by examining differences in well-being variables not used to create the cluster solutions. In support of H1, both physically and psychologically well-functioning, and low functioning, clusters were identified. These clusters were distinguished on levels of life satisfaction and self-esteem. The results demonstrate heterogeneity with regard to health and physical and psychological functioning in older adults. Although some different variables were used in the series of studies by Smith and Baltes (1997, 1998) and Gerstorf et al. (2006), these authors identified levels of differential ageing, for example, by identifying clusters that had positive (e.g. in terms of health, social functioning and personality), average and a mix of negative and positive characteristics (see Gerstorf et al. 2006). This is consistent with the results of our study. However, their studies were conducted using a sample of German adults aged 70 and over, 14% of whom were institutionalised. One of the main contributions of the current study to extant literature is that we used a sample of European community-dwelling adults and we thus provided a more international perspective to profiles of differential ageing.

In contrast to previous research, we included BMI as a cluster variable. Interestingly, our results showed that depression was related to BMI, which adds to the limited

Table 4 Differences between cluster groups in walking behaviour

	Good health and moderate functioning		Moderate health and functioning		Obese and depressed		Low health and functioning	
	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>
Walking METS/min/week	1760.3 ^a	89.3	1613.1 ^a	97.8	1608.0 ^a	125.7	661.3 ^b	173.8

Note: Superscripts with the same letter in the same row do not differ at $p < 0.05$

research evidence relating BMI with psycho-social health in older adults. It could be argued that participants in the ‘obese and depressed’ cluster represented the second least favourable group with regard to overall functioning, given not only their overweight and levels of depression, but also their low levels of life satisfaction and self-esteem. However, curiously, this cluster group did not seem to be struggling with poor perceived health or limitations in physical functioning. This is not wholly consistent with prior research suggesting that obesity is associated with poorer physical functioning (Friedman et al. 2001; Yan et al. 2004) and lower levels of physical health (e.g. Turner Goins et al. 2003) in older adults. This result clearly demonstrates heterogeneity with regard to functioning in obese older adults.

In support of H2, our results demonstrated that more well-functioning cluster groups (‘Good health and moderate functioning’ and ‘Moderate health and functioning’) generally displayed demographic, social and lifestyle characteristics which other previous research has shown to be associated with health and well-being (Berkman 1995; de Leo et al. 1998; García et al. 2005; Haveman-Nies et al. 2003; Heslin et al. 2001; Lang et al. 2007; Minicuci et al. 2002; Smith and Baltes 1997, 1998; Strawbridge et al. 1996).

With regard to national differences, our results were concordant with previous research, demonstrating that older adults from Northern Europe generally display fewer functional limitations and disabilities (Heslin et al. 2001) and lower levels of depression (De Leo et al. 1998; Heslin et al. 2001) than their Southern European counterparts. Taking a critical lens to these results, it might be important in future research to ascertain to what extent such discrepancies between nations may be due to differences in cultural perceptions and reporting of symptoms. Indeed, one of the main limitations of the present study is that we relied on self-report data to measure elements of functioning.

The fact that participants in the least well-functioning cluster group (low health and functioning) were generally older than those in the other cluster groups is also consistent with H2, and with previous research demonstrating that older groups are at greater risk of displaying poorer psychological and physical functioning (e.g. Mroczek and Spiro 2005; Smith and Baltes 1997) than their younger older peers. Further, females greatly outnumbered males in this low functioning cluster and thus provides support to previous findings showing that women tend to experience greater levels of depressive symptomatology and display poorer self-rated health than men as they grow older (Minicuci et al. 2002; Zunzunegui et al. 2007).

With regard to other socio-demographic factors, the majority of the participants in the ‘low functioning’ cluster

had only elementary school education and were more socially isolated compared to participants in the other cluster groups; thus displaying unfavourable socio-economic profiles as expected based on the results of previous research (García et al. 2005; Strawbridge et al. 1996).

The participants in the ‘low health and functioning’ cluster also tended to report alcohol abstinence, non-smoking status, and low levels of walking behaviour. With regard to alcohol abstinence and low reported walking, prior research findings suggest that these levels are associated with poorer functioning among groups of older adults (Lang et al. 2007; Haveman-Nies et al. 2003). However, the results are not consistent with regard to smoking behaviour. Thus, while previous research with other groups of older adults has shown that health risk behaviours tend to cluster together (e.g. Chou 2008 with a sample of Chinese older individuals), the results for the present sample did not fully support this idea. This is encouraging as other research has demonstrated a synergistic effect of lifestyle risk factors on deterioration in functioning (Yusef et al. 2004). However, researchers should consider including more detailed measures of alcohol consumption and smoking status in future research. In addition, ideally, in future, researchers should attempt to incorporate objective measures of walking (e.g. pedometers).

Strengths and limitations

The study builds on previous research in three main ways: (a) by the inclusion of a *range* of physical and psychological function variables in the cluster solution and examine how these interact with BMI, (b) using a sample of older adults from a range of EU countries (specifically representing a North–South divide) and (c) by the consideration of a range of demographic, social and health behaviour characteristics of each of such taxonomies. Taken together, this information can be used to inform the design of interventions aimed at enhancing quality of life in older adults across Europe.

However, apart from the limitations associated with self-report data and possible differences in cultural interpretations of symptoms across nations, other limitations should be taken into account in interpreting the findings of the present study. First, we did not include a random sample of older European adults. While this would have been ideal, comparisons with existing representative surveys and national statistics showed that our sample was broadly similar to such data. However, women were generally overrepresented in our dataset, which limits the generalisability of our findings. Further, due to the cross-sectional design of the present study, it is not possible to delineate the stability of cluster membership over time. In

addition, we are not able to infer causality between perceptions of physical and psychological functioning. Indeed, previous research has documented evidence that physical function may predict depressive symptomatology (Gayman et al. 2008; van den Brink et al. 2006), but also that levels of depression may affect risks of decline in physical functioning (e.g. Penninx et al. 1998).

Conclusions

The results suggest that distinct health and well-being typologies can be identified among European older adults and that such groups differ with regard to socio-demographic and lifestyle behaviour characteristics. It would be particularly useful to examine in future interventions the extent to which the typologies identified in the present study would respond differently to various interventions designed to enhance physical and psychological functioning in older adults.

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