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ARTICLE

Identification of determinants of healthy ageing in Italy: results from the national survey IDAGIT

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Abstract
Healthy ageing is a public health problem globally. In Europe, the dependency ratio of the elderly is expected to increase by 21.6 per cent to 51.2 per cent in 2070. The World Health Organization (WHO) study on healthy ageing started in 2002 as a concept whereby all people of all ages should be able to live in a healthy, safe and socially inclusive way. The aim of this study is to present preliminary results of the project Identification of Determinants of Healthy Ageing in Italy (IDAGIT) that aimed to collect data on the active and healthy ageing of the Italian population aged over 18 using the conceptual framework of the WHO's ageing model. To link the determinants of the IDAGIT studies to those of the WHO model, we performed a confirmatory factor analysis which reported these variables as significant (in order of factor loading): smoking, cognition score, comorbidity, outdoor built environment, participation, working expertise and income. Considering comorbidity, 83.8 per cent of the sample declared not having any chronic diseases or to have only one, and regarding neurological diseases, only nine people had received a diagnosis of stroke. Regarding gender, the personal determinants and physical and social environments did not result in statistically significant differences, whereas we found statistical differences between the aged groups in all variables analysed. These results provide a first bio-psycho-social perspective on ageing in the Italian population.

Keywords: ageing; determinants; active ageing; healthy ageing

Introduction

The increase of the ageing population is the direct consequence of the increase in life expectancy due to economic, social, medical and technological changes. The global population aged over 60 years was around 962 million in 2017 and this number is projected to double in 2050, reaching 2.1 billion (United Nations Department of

Economic and Social Affairs, 2017). In particular, in Europe, the old-age dependency ratio (*i.e.* people aged 65 and above relative to those aged 15–64) is expected to increase from 29.6 per cent in 2016 to 51.2 per cent in 2070 (European Commission Directorate-General for Economic and Financial Affairs, 2018).

In this scenario, the study of ageing, defined as 'the process of optimizing opportunities for health, participation and security, so as to enhance quality of life' (World Health Organization (WHO), 2002: 12), is fundamental to determine what kind of measures are relevant for the ageing process and set the premises for the development of the active and healthy ageing model, which recently has turned into the so-called WHO healthy ageing model. Healthy ageing broadens the concept of active ageing, emphasising the need for action across multiple sectors and enabling older people to remain a resource to their families, communities and economies (WHO, 2015b). The WHO's conceptualisation of healthy ageing, reported in its Global Strategy and Action Plan on Ageing and Health, is in fact defined as 'a process of developing and maintaining the functional ability that enables well-being in older age' (WHO, 2015b: 28), and the WHO described how functional ability is 'determined by the intrinsic capacity of the individual, the relevant characteristics of their environment and the interaction between them' (WHO, 2015b: 73). These definitions derives from the concept of 'active and healthy ageing' that identified some variables, called determinants, related to this process. Indeed, the *World Report on Ageing and Health* (WHO, 2015a) was put on the WHO website, which highlights how the variables relating to the health of older people are not only genetic but also concern the physical and social environment that has also an important influence on the development and maintenance of health behaviours.

All these factors fit within the framework of the social determinants of health encompassing social, economic, environmental, political and cultural determinants of health as set out by the WHO Commission on Social Determinants of Health (2008), in line also with the bio-psycho-social framework of health and disability provided by the WHO's International Classification of Functioning, Disability and Health (WHO, 2001; Leonardi *et al.*, 2006).

Several studies have analysed each of the determinants proposed by the WHO, such as quality of diet, fitness and social participation, collecting data on the ageing population in different countries (Peel *et al.*, 2005; Sirven and Debrand, 2008; European Commission, 2014). However, there have been few empirical studies that described all the determinants together or that used valid and reliable outcome measures for cross-population analysis (Abdullah and Wolbring, 2013; Van Malderen *et al.*, 2013; Lassen and Moreira, 2014). Making a systematic analysis of all these variables, we found that they were included also in the previous ageing model developed by the WHO, called the active ageing model (WHO, 2002). In that model, different determinants were included in six domains: (a) health and social services, (b) behavioural determinants, (c) personal factors, (d) physical environment, (e) social environments and (f) economic determinants.

Two ageing studies were the first that considered the components of the ageing process relying on the WHO bio-psycho-social model, the WHO's Study on Global Ageing and Adult Health (SAGE; WHO, 2006; Kowal *et al.*, 2012) and the COURAGE in Europe project (Leonardi *et al.*, 2014). Subsequently, the

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Identification of Determinants of Healthy Ageing in Italy (IDAGIT) survey collected data on determinants of active and healthy ageing in Italy with the protocol developed and used in the SAGE and COURAGE in Europe surveys. Italy is one of the European countries where the rise of the survival rate is one of the fastest in the European area. The increase in the proportion of older people in Italy, as well as in many other European countries, is the result of unprecedented general changes that have made it possible to live a long and active life. In particular, in Italy, between 2017 and 2045, the population over 60 years is projected to increase from 22.3 to 33.5 per cent, and the mean age from 44.9 to 49.6 years (Italian National Institute of Statistics (ISTAT), 2018). Considering this background, the aim of the present study is to analyse the healthy ageing determinants using the data collected in the IDAGIT study. In detail, we analysed a group of selected items of the IDAGIT protocol in line with the WHO ageing model, in order to present results obtained from a sample of the Italian population.

Methods

Study design, sample size and participants

IDAGIT is a cross-sectional study conducted on a stratified probabilistic sample representative of the non-institutionalised Italian population aged over 18. The stratification was performed by geographical area (North, Central and South Italy), age group (18–49 and 50+), residential context (urban and rural) and gender. According to the Organisation for Economic Co-operation and Development (OECD) definitions (Storti, 2000), rural areas are municipalities with population density <150 inhabitants per square kilometre (km^2), while urban areas are cities with population density ⩾150 inhabitants per km^2. Names of participants to be interviewed were extracted from the registry lists of the 12 selected municipalities, using a simple random methodology (further details on stratification methods are reported in the online supplementary material).

Data collection began in December 2015 and finished in March 2017, with an overall duration of 15 months.

Out of 1,200 planned subjects, a total of 526 participants completed the questionnaire (percentage of enrolled subjects is 44%).

The IDAGIT questionnaire

To collect data on the Italian population, the IDAGIT project used the questionnaire developed in the COURAGE in Europe project (Leonardi *et al.*, 2014), translating it from the English to the Italian language and adapting it to the Italian context. In detail, this process was made by two expert researchers (native-Italian speakers), who participated in the COURAGE project also, independently translating each item of the original questionnaire from the English version into the Italian language. A third person (native Italian-speaker and fluent English-speaking/English-language teacher) combined the two versions of the translated questionnaires, debating with the two translators only the items whose translations seemed to be different.

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Table 1. World Health Organization (WHO) bio-psycho-social determinants of ageing

Determinants	Variables
Behavioural	• Tobacco use • Physical activity • Healthy eating • Oral health • Alcohol • Medication • Iatrogenesis • Adherence
Personal	• Biology and genetics • Psychological factors
Physical environments	• Physical environments • Safe housing • Falls • Clean water, clean air, safe food
Social	• Social support • Violence and abuse • Education and literacy
Economic	• Income • Social protection • Work
Health and social service systems	• Health promotion and disease prevention • Curative services • Long-term care • Mental health services

Note: Theoretical reference model: WHO (2002).

The IDAGIT questionnaire was composed of five parts (Introduction, IDAGIT Individual Questionnaire (IIQ), Proxy Questionnaire, Built Environment Outdoor Checklist and Appendix) and each one was composed of different sections and tools (a list of the sections is in the online supplementary material).

The IIQ was composed of self-rate questions and tools to measure some individual performances (*e.g.* the anthropometric and cognitive measures as described in the next sections) in a standard manner. The IIQ has four sub-sections called the Household, the Social Cohesion and Social Network Questionnaires, the Quality of Life and Subject Well-being subsection and the Built Environment Self-reported Questionnaire (which is different from the Built Environment Outdoor Checklist because in this part of the IDAGIT questionnaire external raters, not the interviewed, analysed the environment around the house of each subject interviewed using a standard checklist as described in the next section). The mean time for the administration of the IDAGIT protocol was one hour and twenty minutes.

Table 1 reports the contents for each of the active ageing variables according to the WHO model. To apply the WHO model to our Italian IDAGIT study, we tried

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to populate all the contents of the determinants by exploring their availability among the IDAGIT variables. The following section presents the findings of the matching exercise.

Description of determinants

Behavioural determinants

Health behaviours included in the analysis were:

- Smoking status: respondents were classified as current daily smokers, current but not daily smokers, past smokers or those who had never smoked.
- Physical activity: the level of physical activity was based on the second version of the Global Physical Activity Questionnaire (GPAQ v2; Bull et al., 2009), that differentiates between work and leisure, and recreational and sport-related activities, and records the frequency (number of days) and duration (minutes or hours) of each activity undertaken in the preceding seven days. The levels of physical activity were created (WHO, 2015b) using conventional cut-off points: high, moderate and low.
- Fruit and vegetable consumption: sum of daily servings of fruit and vegetables was dichotomised according to the conventional cut-off (five servings per day) (WHO, 2003).
- Oral health: good oral health was defined as absence of problems with mouth, teeth or swallowing.
- Alcohol consumption: responders were grouped into two groups – lifetime abstainers and drinkers. Lifetime abstainers are those who had never consumed an alcoholic beverage or had not consumed alcohol in the last 30 days (WHO, 2000).

Personal determinants

Genetic, biological and psychological factors (including intelligence and cognitive capacity) are strong predictors of active ageing and longevity (Kirkwood, 1996; Smits *et al.*, 1999):

- Cognitive functioning was assessed by evaluating (Miret *et al.*, 2014): verbal fluency (with the animal-naming technique) (Morris *et al.*, 1989), immediate and delayed verbal recall (with the Consortium to Establish a Registry for Alzheimer Disease Word List Memory) (Morris *et al.*, 1989) and short-term memory (with digit span backward and forward tests from the Weschler Adult Intelligence Scale) (WAIS III; Wechsler, 2002). A confirmatory factor analysis (CFA) verified that the listed cognitive tests represented one dimension and the obtained factor loadings allowed the estimation of the cognition score. The score was normalised using the Min–Max method, on a 0–100 scale with higher scores indicating better cognitive functioning. The participant's perception of his or her memory was also assessed both as current status and as change in the last year.
- Presence of chronic conditions was based on the question: 'Has a health care professional ever told you, you have…?'

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- Comorbidity was defined as presence of at least two of the following eight conditions: arthritis, stroke, angina, diabetes, lung disease, asthma, depression and hypertension.
- The belief people have in their capacity to exert control over their lives was used as proxy variable of the individual self-efficacy.

Physical environments

The built environment helps to understand when features of the neighbourhood environment have either a positive or negative impact on the accessibility of neighbourhoods for healthy ageing. It was assessed using two different perspectives: the interviewer's point of view, collected using the COURAGE Built Environment Outdoor Checklist (CBE-OUT) (Quintas *et al.*, 2014), and the respondent's one, using the COURAGE Built Environment Self-reported Questionnaire (CBE-SR) (Raggi *et al.*, 2014).

The CBE-OUT is composed of 128 items that can be recorded in the evaluated neighbourhood environment (when present); its score ranges from 0 (negative environment) to 100 (positive).

The respondent's point of view was collected through the CBE-SR which comprises 19 items grouped into four scores: 'usability of the neighbourhood environment', 'easiness of the walkable environment', 'easiness of use of public buildings, places and facilities' and 'risk of accidents and usability of the living place'. Each of the four scores ranges between 0 and 100, with higher scores revealing a perceived environment more usable and easy to use.

Household and neighbourhood barriers to a person's motion may increase the risk of falling, so also the number of falls in the last 12 months was included in the analysis.

Safe, adequate housing and neighbourhoods are essential to the wellbeing of people, therefore the participant's feeling of safety both at home and in the neighbourhood and his or her living arrangements were also taken into consideration.

Social determinants

The WHO recognises social support, opportunities for education and lifelong learning, peace, and protection from violence and abuse as key factors of the social environment that may enhance health, participation and security as people age (WHO, 2002).

- Perceived social support and loneliness were measured as the mean of the three items of the validated OSLO-3 Social Support Scale (Dalgard *et al.*, 2006) and UCLA Loneliness Scale (Hughes *et al.*, 2004), respectively.
- The trust score was created through a CFA on five items: one item is dichotomous and relates to general trust towards people; four items, measured with five-point Likert scale responses, concern with the extent of trust towards people from the neighbourhood, work, strangers and family members (Tobiasz-Adamczyk *et al.*, 2017).
- Social participation was assessed as a factor score of eight items measured on a five-point Likert scale (from never to daily) concerning the frequency of attendance at public meetings, meeting with a community leader, attendance

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at any group or organisational meeting, sport clubs, competitions or doing sport with someone else, work with people from the neighbourhood to fix or improve something, inviting friends to your home, visiting or hosting someone who lives in a different neighbourhood and getting out to take part in social meetings (Tobiasz-Adamczyk *et al.*, 2017).

- Older people who are frail or live alone may feel particularly vulnerable to crimes such as theft and assault, so the experience of being a victim of a violent crime was included in the model.
- The education variable was recorded as the highest educational qualification obtained, classified as secondary or less, high school and graduate/post-graduate.

Economic determinants

Income, work and social protection are three aspects of the economic environment that have a particularly significant effect on active ageing (WHO, 2002). To describe them, four variables were investigated: the ownership of private/voluntary health insurance coverage; the fruition of institutional financial or in-kind support; the level of working expertise (distinguishing between high, middle-low and never worked, according to the profession classification of ISTAT, 2013); and the highest household income among salaries, pensions, benefits and investments.

Health and social service systems

The WHO's active ageing model recognises the need for health systems focused on health promotion, disease prevention, and equitable access to quality primary health care and long-term care.

Unfortunately, given the different aim for which it was developed, the IDAGIT questionnaire does not include information on these issues, with the exception of disease prevention for a sub-sample of respondents. Due to the lack of data available for the whole sample, this active ageing determinant was not developed in this paper.

Statistical analysis

Categorical variables are presented as percentages; continuous variables as mean and standard deviation (SD) or median and interquartile range (IQR), according to the normality assumption, which was tested through the Shapiro–Wilk test. In order to test the viability of the WHO's bio-psycho-social framework, a CFA was conducted on each of the above-described determinants. The process of score estimation started with the full-item model; then nested models were tested to improve the fit of the model according to selected goodness-of-fit criteria (normal fit index (NFI), the goodness-of-fit index (GFI) and the standardised root mean square residual (SRMR)). The obtained score was normalised using the Min–Max method, on a 0–100 scale with higher scores indicating the better conditions.

Lastly, the effect of age class (18–49, 50+) and gender on the estimated factor scores was examined using the exact Wilcoxon two-sample test, given the non-normality distribution.

Weighted data have been used to account for sampling design.

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Potential biases have been assessed during the analysis if the percentage of missing data was higher than 5 per cent.

All the statistical analyses were performed using the SAS 9.4 software (SAS Institute, Cary, NC, USA).

Results

Participants were enrolled in the North (N = 241), Central (N = 105) and South (N = 180) regions and divided into two age groups, 18–49 (N = 247) and 50+ (N = 279).

The 18–49 group is balanced for gender (49.9% males), and has a predominance of never married (61.0%) and employed (87.4%). In the 50+ group, the majority of interviewees are female (55.2%), married or co-habiting (66.5%) and not employed (64.5%).

Focusing on health perception, most of the respondents aged 18–49 reported good or very good health (85.6%), while for those 50+ this was 57.0 per cent.

Based on the division in context as urban or rural, 89.9 per cent of the 18–49 group in urban places perceived their health status to be 'very good' or 'good', while only 65.2 per cent of the same group in rural places expressed the same health status.

In the 50+ group in urban contexts, 59.3 per cent of respondents expressed a 'very good' or 'good' health status, while for the same group in rural contexts this was 46.8 per cent.

The matching exercise, through CFA, between the determinants of the WHO ageing model and the IDAGIT questionnaire, allowed a correspondence between behavioural, personal, physical environments, social and economic determinants, and personal factors to be identified.

Regarding health and social service systems, the determinant not included in the CFA, the IDAGIT questionnaire collected data on medications (treatment for arthritis, stroke, heart attack, diabetes, respiratory diseases, tuberculosis, asthma, depression, hypertension, oral problems), that represents around 31.5 per cent of the total sample (10.4% of the 18–49 group and 53.9% of the 50+ group), and on hospitalisation in the last three years: 80.7 per cent of the total sample did not have any hospitalisation both in the public and private health-care structures. Moreover, for the health-care assistance variable, the majority of the sample (64.4%) declared having had health assistance in the last 12 months.

Observing the data on health status, 83.8 per cent of the total sample declared that they did not have any chronic diseases or had only one. Indeed, for example, the case of neurological diseases reveals that even when their average age varies between 55 and 88 years, only nine people received these diagnoses.

Regarding the variables included in the CFA for each determinant, we found a correspondence with: smoking, fruit and vegetable consumption, alcohol consumption, cognition score, comorbidity, control over things, current memory status, memory change, CBE-OUT, 'usability of the neighbourhood environment', 'easiness of the walkable environment', 'easiness of the use of public buildings, places and facilities', 'risk of accidents and usability of the living place', social support, loneliness, trust, participation, education, private/voluntary health insurance

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coverage, received institutional financial or in-kind support, working expertise and income. The descriptive statistics of the variables included in the CFA are reported in Table 2.

Figure 1 shows the standardised factor loadings for each variable, their statistical significance and the associated determinants. In detail, the variables that obtained the highest scores were: smoking for the behavioural determinants, cognition score for personal determinants, CBE-OUT for physical environment, participation for the social determinants and working experience for the economic determinants.

Regarding behavioural determinants, the variable that had the highest weight was smoking. For this variable, the majority of people were non-smokers both age groups. People who were daily smokers were less than 20 per cent of the total sample. Considering personal factors, the cognition score was more than 50 per cent in both age groups even if it was higher (78.7) for the people aged 18–49 than for the 50+ group. The CBE-OUT score was the variable with the highest weight for the physical environment determinants, and the CBE-OUT median scores were similar for both age groups. It is interesting to note that the variables with the highest score for this determinant were the variables of CBE-SR 'usability of neighbourhood environment', 'easiness of use of public buildings, places and facilities' and 'risk of accidents and usability of the living place'. Comparing the social determinants variables, the 'participation' median value obtained the greatest weight in the CFA (in the 18–49 group this is 45.4% while in the 50+ group this is 37.6%). Finally, the economic determinant 'working expertise' had the highest weight in the CFA. Observing the descriptive statistics in Table 2, the majority of the sample has high or middle-low working expertise while 17.5 per cent of the total sample has never worked (almost 25% of the sample aged 18–49).

Table 3 reports the median scores for each determinant, by age group and gender. There is a statistically significant difference between the two age groups for all five determinants, whereas analysing the differences between gender groups, the personal determinants, the physical environments and and the social environments were not statistically significant.

Since for single-variable analysis the percentage of missing values was less than 5 per cent, the presence of possible biases have not been assessed. While, regarding the determinants created through the factors analysis, the only one that had a relevant percentage of missing cases (>5%) was the physical environment factor. The presence of possible biases was examined by comparing the socio-demographic characteristics of the group of respondents with a missing value in that factor with those with a valid value. No statistically significant difference was found.

Discussion

In the IDAGIT study, we collected data on different variables that might influence the process of ageing in Italy.

We were able to analyse different variables using a CFA to measure the statistical linkage between the selected variables with the healthy ageing model factors.

In detail, the variables confirmed in the CFA were for the *behavioural* determinants (in order) smoking, alcohol consumption, and fruit and vegetable consumption. This result is in line with several studies that demonstrate an increase in

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Table 2. Descriptive statistics of the variables included in the confirmatory factor analysis

Determinants	Variables	Total	Aged 18–49	Aged 50+
			Percentages	
Behavioural determinants	Smoking[a]	N = 526	N = 247	N = 279
	Never	53.3	57.5	48.8
	Ex-smoker	23.6	11.7	36.1
	Not daily smoker	5.1	9.1	0.8
	Daily smoker	18.0	21.6	14.2
	Physical activity	N = 526	N = 247	N = 279
	High	38.9	35.0	43.1
	Moderate	36.2	41.0	31.1
	Low	24.9	24.0	25.8
	Fruit and vegetables[a]	N = 524	N = 245	N = 279
	Five or more servings per day	24.9	14.2	36.3
	Less than five servings per day	75.1	85.8	63.7
	Oral health:	N = 526	N = 247	N = 279
	No oral problem	69.7	76.1	62.9
	Oral problem	30.3	23.9	37.1
	Alcohol[a]	N = 526	N = 247	N = 279
	Abstainer	30.1	22.5	38.2
	At least one drink in the last 30 days	69.9	77.5	61.8
	One drink	78.3	81.6	73.8
	Two drinks	16.5	13.4	20.5
	Three or more drinks	5.2	5.0	5.7
Personal determinants	Cognition score[a]	N = 526	N = 247	N = 279
	Median (IQR)	69.8 (27.8)	78.7 (19.7)	61.1 (19.4)
	Comorbidity[a]	N = 526	N = 247	N = 279
	None	60.6	84.1	35.8
	One	23.2	13.4	33.5
	Two or more	16.2	2.5	30.7
	Control over things[a]	N = 526	N = 247	N = 279
	Very often	24.1	15.9	32.7
	Fairly often	42.8	51.2	33.9

(*Continued*)

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Table 2. (*Continued.*)

Determinants	Variables	Total	Aged 18–49	Aged 50+
	Sometimes	25.7	27.7	23.6
	Almost never	6.3	5.3	7.5
	Never	1.1	0.0	2.3
	Current memory status[a]	N = 526	N = 247	N = 279
	Very good	16.4	24.1	8.36
	Good	38.2	42.9	33.1
	Moderate	30.9	26.7	35.4
	Bad	14.2	5.7	23.2
	Very bad	0.3	0.5	0.0
	Memory change: current *versus* last year[a]	N = 526	N = 247	N = 279
	Better	5.9	10.2	1.5
	Same	78.8	79.9	77.6
	Worse	15.3	9.9	20.9
Physical environmental	CBE-OUT[a]	N = 526	N = 247	N = 279
	Median (IQR)	51.7 (9.2)	50.3 (10.4)	52.6 (8.0)
	CBE-SR – usability of the neighbourhood environment[a]	N = 517	N = 242	N = 275
	Median (IQR)	91.4 (32.3)	82.0 (45.1)	95.9 (29.8)
	CBE-SR – easiness of walkable environment[a]	N = 501	N = 235	N = 266
	Median (IQR)	67.2 (53.7)	71.6 (54.2)	62.3 (47.3)
	CBE-SR – easiness of use of public buildings, places and facilities[a]	N = 507	N = 238	N = 269
	Median (IQR)	91.0 (33.3)	87.7 (37.8)	94.2 (23.1)
	CBE-SR – risk of accidents and usability of the living place[a]	N = 522	N = 244	N = 278
	Median (IQR)	100.0 (5.6)	100.0 (10.3)	100.0 (4.7)
	Safe at home	N = 526	N = 247	N = 279
	Not safe at all	2.1	1.4	2.7
	Slightly safe	6.6	2.6	10.9
	Moderately safe	26.2	20.5	32.3
	Very safe	39.3	44.0	34.3

(*Continued*)

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Table 2. (*Continued.*)

Determinants	Variables	Total	Aged 18–49	Aged 50+
	Completely safe	25.8	31.5	19.8
	Safe in the neighbourhood	N = 526	N = 247	N = 279
	Not safe at all	3.9	2.4	5.4
	Slightly safe	9.5	3.3	16.2
	Moderately safe	24.1	23.4	24.8
	Very safe	36.6	39.1	34.0
	Completely safe	25.9	31.8	19.6
	Living arrangement	N = 526	N = 247	N = 279
	With someone	81.6	85.4	77.5
	Falls:	N = 526	N = 247	N = 279
Social determinants	Social support[a]	N = 526	N = 247	N = 279
	Median (IQR)	81.8 (22.1)	81.8 (18.2)	72.7 (18.2)
	Loneliness[a]	N = 526	N = 247	N = 279
	Median (IQR)	100.0 (33.3)	100.0 (33.3)	100.0 (33.3)
	Trust[a]	N = 526	N = 247	N = 279
	Median (IQR)	64.5 (34.0)	61.2 (37.0)	61.5 (30.4)
	Participation[a]	N = 526	N = 247	N = 279
	Median (IQR)	40.9 (22.0)	45.4 (21.3)	37.6 (25.4)
	Victim of a violent crime:	N = 526	N = 526	N = 279
	No	97.7	96.8	98.6
	Yes	2.3	3.2	1.4
	Education[a]	N = 526	N = 526	N = 279
	Graduate and post-graduate	39.7	52.4	26.2
	High-school	35.8	39.2	32.2
	No	96.3	98.6	93.9
	Yes	3.7	1.4	6.1
	Alone	18.4	14.6	22.5
	Secondary or less	24.5	8.5	41.6
Economic determinants	Private/voluntary health insurance coverage[a]	N = 526	N = 247	N = 279
	No	89.2	88.5	89.9
	Yes	10.8	11.5	10.1

(*Continued*)

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Table 2. (*Continued.*)

Determinants	Variables	Total	Aged 18–49	Aged 50+
	Received institutional financial or in-kind support[a]	N = 526	N = 247	N = 279
	No	97.2	95.9	98.5
	Yes	2.8	4.1	1.5
	Working expertise[a]	N = 526	N = 526	N = 279
	High	42.3	42.9	41.7
	Middle-low	40.1	32.4	48.3
	Never worked	17.5	24.7	10.0
	Income (€)[a]	N = 520	N = 246	N = 274
	Median (IQR)	15,500 (20,000)	12,500 (20,000)	18,500 (21,000)

Notes: IQR: interquartile range. CBE-OUT: COURAGE Built Environment Outdoor Checklist. CBE-SR: COURAGE Built Environment Self-reported Questionnaire.
[a]Variables resulted statistical significant and were included in the CFA.

chronic diseases and death in people who smoked and with alcohol consumption (Ferrucci *et al.*, 1999; Holley-Moore and Beach, 2016). In parallel, our data confirmed that higher fruit and vegetable consumption is an important variable, as reported also by Gehlich *et al.* (2018) who demonstrated that fruit and vegetable consumption improved mental and cognitive health in ageing populations.

In contrast to previous results in the Italian population (Ferrucci *et al.*, 1999), in our analysis the variables *physical activity* and *oral health* were not linked to the behavioural determinant. Ferrucci *et al.* (1999) reported that physical activity is significantly associated with an increase in life expectancy and in the study of Ramsay *et al.* (2018) poor oral health results strongly linked to a physical frailty too. Probably, the differences between these results and ours could be due to the fact that more than 70 per cent of the IDAGIT sample reported high or moderate levels of physical activity. These data could indicate a sample composed of people with a health status which allows them to perform good physical activity with a low level of comorbidities, explaining the differences between the IDAGIT and the other samples. Moreover, the presence of a large percentage of people with high or moderate levels of physical activity both in the 18–49 and 50+ groups determined a low level of variance in our dataset which could be the cause for the variable not being confirmed in the CFA.

Considering the *personal* factors, all the variables were confirmed in the CFA and were, in order, cognition, memory status, comorbidity, memory change and control over things. In line with this result, recent studies (Rizzuto *et al.*, 2012; Wang *et al.*, 2012; Sposito *et al.*, 2015) that explored the relationship between cognitive performance, advanced activities of daily living (AADL) and the ageing process showed an association between intellectual and social AADLs with higher

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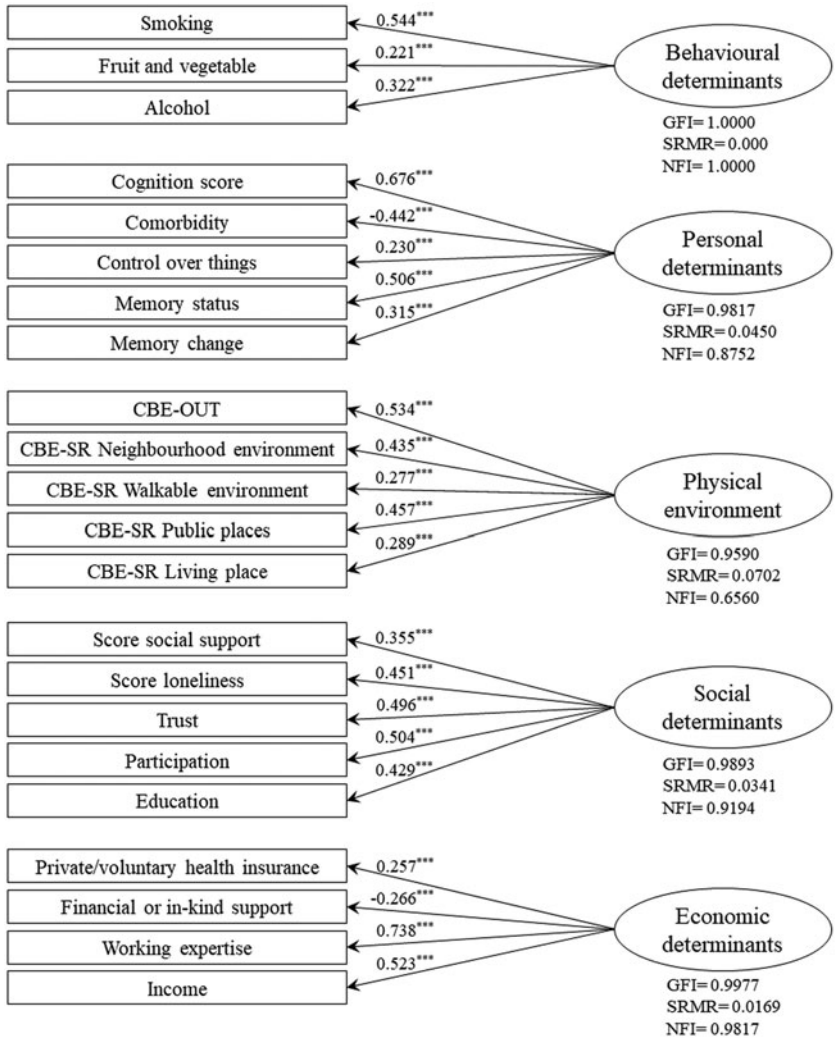

Figure 1. Confirmatory factor analysis.
Notes: GFI: goodness-of-fit index. SRMR: standardised root mean square residual. NFI: normal fit index. CBE-OUT: COURAGE Built Environment Outdoor Checklist. CBE-SR: COURAGE Built Environment Self-reported Questionnaire. *Significance level*: *** $p < 0.001$.

cognitive performance, suggesting that healthy and active ageing can provide opportunities to attenuate cognitive decline. In fact, engagement in these activities brings benefits to health, autonomy, functioning and wellbeing, and reflects good functioning in several cognitive domains, and this could be a concern for future policies to support ageing.

Regarding the *physical environment* determinants, the variables confirmed in the CFA were the CBE-OUT score and the CBE-SR scores related to (in order) neighbourhood environment, walkable environment, public places and living places.

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Table 3. Statistical differences between the two ageing groups and between gender groups for each determinant

		Age group			Gender		
	Total	18–49	50+	*p*	Male	Female	*p*
Behavioural determinants:							
N	523	244	279		196	327	
Median (IQR)	60.7 (36.2)	60.7 (40.5)	60.7 (39.3)	<0.0001	56.4 (20.2)	60.7 (43.6)	<0.0001
Personal determinants:							
N	526	247	279		196	330	
Median (IQR)	64.6 (25.3)	74.9 (16.5)	52.9 (22.0)	<0.0001	63.1 (27.3)	66.5 (22.6)	0.2301
Physical environments:							
N	472	219	253		179	293	
Median (IQR)	72.5 (17.3)	69.4 (17.5)	75.6 (13.9)	<0.0001	71.8 (19.3)	72.9 (15.8)	0.1617
Social determinants:							
N	526	247	279		196	330	
Median (IQR)	62.6 (24.8)	67.9 (19.0)	55.9 (24.4)	<0.0001	63.2 (24.7)	62.5 (22.8)	0.2990
Economic determinants:							
N	520	246	274		195	325	
Median (IQR)	36.2 (20.1)	34.1 (28.5)	36.3 (18.6)	0.0022	39.5 (19.9)	33.2 (20.2)	0.0004

Note: IQR: interquartile range.

These results are in line with a study (Zhou *et al.*, 2017) which illustrated how the built environment, such as the liveliness of an apartment building in proximity to functional spaces and the social network of apartment neighbours, helped to increase physical activity and so enhanced the ageing process. In addition, other studies highlighted the relationship between the built environment and public health in order to promote a positive effect on the general population. Indeed, a problem with housing accessibility could determine a lower level of social participation which implies isolation, higher health-care needs and the poor self-management of ageing people (Greiman and Ravesloot, 2015; Granbom *et al.*, 2016).

Regarding the *social* determinants analysed in the IDAGIT study, the variables confirmed in the CFA were (in order) participation, trust, loneliness, education and social support. These data are in line with a study on social participation (Ichida *et al.*, 2013) suggesting that people who spent their time in the built environment open to the community reported a significant improvement in self-rated health. Regarding the loneliness score, different studies have indicated its positive relationship with depression: individuals with a higher score for loneliness showed more negative emotions (Hawkley and Cacioppo, 2010; Liu *et al.*, 2016). This result suggests that adjustments to public health initiatives on social support can contribute to weaken the link between loneliness and depression. Analysing both physical and social determinants, the previous COURAGE in Europe project (Leonardi *et al.*, 2014) suggested that social policy should focus on developing social networks and intensify interventions in terms of built environment to preserve a better health status of ageing people.

Curiously, in our analysis, the section related to 'victim of a violent crime' does not fit the CFA and probably this was due to the small number of interviewees who reported this crime. This issue has been studied very little because incidence and victimisation of crimes were considered worrying mostly for young people. However, a study conducted by Ziegler and Mitchell (2003) has revealed an interesting paradox: although older adults are less likely to be victims, they report a greater fear of crime than younger adults. But, after an experimental study, they found that viewing a video on a crime is not relevant for determining which age group is more conditioned. So this variable, which was included in the WHO model in relation to particular social contexts around the world, should be studied better in the future to understand the link between social security and healthy ageing.

Finally, for the *economic* determinants, the CFA comprises working expertise, income, private/voluntary health insurance and financial or in-kind support that correlate in a negative way. This analysis supports previous data on the relation between general income and ageing. For example, a study conducted in 2017 on a population with compulsory health insurance programmes (Lin *et al.*, 2017) found evidence to indicate that people with low personal income can have high ageing difficulties, considering ageing-related diseases.

Despite the results of the CFA, we considered the median scores for each determinant, by age group and gender, finding that the age-group variable was important for all the determinants analysed, whereas the gender variable showed statistically significant results in the behavioural and economic determinants only.

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In the WHO bio-psycho-social ageing model, gender is considered as a cross-cutting variable included in a group of 'lens through which to consider the appropriateness of various policy options and how they will affect the well-being of both men and women' (WHO, 2002: 20). In this context, the WHO noted, for example, that women have lower social status and less access to resources while men were engaged in more risk-taking behaviour and unnecessary exposure to the risk of injury in many societies.

The fact that, in our study, personal determinants, physical environment and social determinants were not different between male and female groups is new information in the area of ageing research and requires discussion. Searching in the scientific literature, we noted that gender differences were found mainly in the analysis of single variables (*e.g.* test scores) linked to a general determinant rather than in analysis made considering the determinant itself (*e.g.* considering the factor score). For example, a review about the gender issue in ageing (Kryspin-Exner *et al.*, 2011) underlined that there was a well-established gender difference in cognition throughout the lifecourse: it was found that women generally attained better results than men in perceptual speed and verbal fluency tasks. On the other hand, men obtained better scores than women in tasks of visuo-spatial skills and mathematical reasoning (Maylor *et al.*, 2007). In addition, gender differences were clear in spatial cognition: in map-reading tasks men seemed to perform better than women (Kimura, 1992). All these variables are included in the personal determinants of the WHO model, but a factor analysis was not made in that research and so a comparison in a hypothetical cognition factor between male and female groups was lacking.

The same reason was found in the 'social environments'. Indeed, we noted several results showed differences between male and female groups in ageing, such as women showed larger networks with lower density and higher communication levels (each of these variables was considered singularly) than men (McDonald and Mair, 2010). Moreover, women had a greater variety in their networks, maintaining connections to family, friends and neighbours, than men, who, in contrast, seemed to show that they are more likely to maintain connections with co-workers (Shaw, 2007), and were more affected by loss of contacts following retirement (McDonald and Mair, 2010; Harling *et al.*, 2018). All these results seem to suggest that the differences between male and female groups in the ageing process are really heterogeneous. Probably, the fact that in our analysis the personal determinants, physical environments and social factors did not show differences linked to gender could be explained by the general notion that when variables were analysed all together the statistical significances appeared lower than when they were analysed individually. In future the gender issue should be studied better considering the important role of gender differences in neurobiological process linked to the ageing process highlighted in the last decade.

This study has some limitations. The low sample size allowed us to carry out a CFA only and not an exploratory analysis. Another limitation is the fact that we used the last WHO model on ageing published in 2017 (WHO, 2017). Therefore, this model was available only after the development of the final IDAGIT questionnaire. This did not let us include the same variables proposed by the WHO and, therefore, the variables related to health and social services systems could not be

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included in the analysis. However, we obtained good agreement with the WHO model overall and we also reported data on other variables related to health that we described in the text about medications and hospitalisations.

In conclusion, our study confirms the relationships between selected items of the IDAGIT questionnaire and the WHO model of ageing. In detail, the results support the idea that behavioural, personal, physical, social and economic determinants have to be monitored carefully, and actions that impact on the statistically significant variables included in the determinants are fundamental for the healthy ageing of the Italian population. Moreover, we found that, in our sample, gender differences were particularly important only for the behavioural and economic determinants.

Supplementary material. The supplementary material for this article can be found at https://doi.org/10.1017/S0144686X20001671

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Ethical approval. The present study was conducted after approval of the local Ethics Committee and was performed in accordance with the Declaration of Helsinki. Written informed consent was obtained from all persons involved.

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