

SUCCESSFUL AGEING: CRITERIA AND PREDICTORS

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Successful ageing: Criteria and predictors. The last forty years have seen the consolidation of the successful ageing concept in the Anglophone scientific literature. Nevertheless, several terms have been used as synonymous, including healthy, active, productive, optimal and positive ageing. But although all of these terms have been described through a broad set of bio-psycho-social factors, research in this field usually reduces successful ageing to daily life functioning and physical health. Also, despite the fact that authors consider the determinants of successful ageing to be potentially multi-domain, empirical research usually reduces them to lifestyles. Obviously, the prevalence of this kind of ageing found empirically is not very consistent, and research on its determinants or predictors refers to biomedical conditions. In this study, we examined data on 458 participants (170 males and 288 females; mean age 66.47, range: 55-75) from the ELEA (Longitudinal Study on Active Ageing). The results show (depending on the simple or multidimensional definitions used) a very wide range of proportions of successfully ageing older persons, as well as a large number of multi-domain predictors of successful ageing, including psychological characteristics related to intelligence, personality and motivation.

En la literatura científica anglosajona, envejecimiento con éxito es un término que ha ido consolidándose en los últimos años, al mismo tiempo que ha ido adoptando distintas denominaciones: «envejecimiento activo», «productivo», «saludable», «óptimo» o «positivo». A pesar de que estos conceptos han sido descritos mediante factores bio-psicosociales, la investigación empírica los ha reducido a variables funcionales y salud física y, aunque los autores consideran que los determinantes de este tipo de envejecimiento son también multi-dominio, su búsqueda e investigación ha sido también reducida a los estilos de vida. Lógicamente, la prevalencia de este tipo de envejecimiento hallada empíricamente es poco consistente y la investigación de sus determinantes o predictores se refiere a condiciones biomédicas. En este trabajo hemos analizado los resultados de 458 personas (170 varones y 288 mujeres, media de edad: 66,47, rango: 55-75) participantes en el estudio ELEA (Estudio Longitudinal de Envejecimiento Activo). Los resultados ponen de manifiesto (en dependencia de las definiciones operacionales simples o multidimensionales utilizadas) una amplia disparidad en la proporción de personas que envejecen con éxito, así como un amplio número de predictores multidominio de envejecimiento con éxito, entre los cuales se encuentran variables psicológicas intelectuales, de la personalidad y motivacionales.

Successful ageing is a relatively new concept, synonymous with others such as “healthy”, “productive”, “optimum” or “positive” ageing (for a review, see Fernández-Ballesteros, 2008). These concepts reflect the extraordinary variability in forms of ageing, which Rowe and Khan (1987, 1997) summarized in three categories: “usual”, “pathological” and “successful” ageing. On the basis of this conceptualization of forms of ageing, successful ageing can be considered as a categorical variable, so that for a given population it is possible to determine what percentage are “successful agers”, in the

same way as we can establish the prevalence of “dependent” elders or those with “pathological” ageing.

Successful ageing is considered as a multidimensional concept that encompasses and transcends good health, and is made up of a wide range of bio-psychosocial factors; for example, Rowe and Khan define it with the following components: low probability of illness and its associated disability, high physical and mental functioning and high social participation (Rowe & Khan, 1987, 1997). Other authors highlight subjective appraisal and life satisfaction as key elements of successful ageing (Lehr, 1982), while still others consider activity and productivity as key aspects (Siegrist, Knesebeck, & Pollack, 2004). In sum, health conditions, optimum physical functioning, high cognitive functioning, positive affect and social participation are the criteria generally accepted (some or all of them) for identifying this form of ageing

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(Fernández-Ballesteros, 2008). Moreover, all of these multidimensional conditions appear in the “popular” concept of *ageing well* as understood by the elderly themselves, and which extends across different countries and cultures (Bowling, 2006; Fernández-Ballesteros et al., 2008).

However, Peel, McClure and Bartlett (2005), on examining the results of the majority of the articles from longitudinal studies (1985 to 2003), concluded that two criteria are used in the identification of successful ageing: survival and level of functioning. Furthermore, the review of these studies revealed that the majority of the determinants or predictors addressed in the literature are essentially lifestyle aspects (not smoking, not drinking, appropriate diet and physical exercise). Finally, Peel and colleagues reported that when the goal of the research is to measure the prevalence of successful agers, the variability is quite broad, with a range of 12.7 to 49%.

Depp and Jeste (2006) also made an extensive review of studies on successful ageing, both cross-sectional and longitudinal. After identifying the criteria for the definition of successful ageing, they reported the proportion found in each sample used in these studies, as well as the determining factors of successful ageing. These authors identified 28 studies that met a set of pre-established criteria. Among the reviewed studies, they identified 10 principal aspects used as criteria for successful ageing, present in a limited number of studies. Their findings can be summarized as follows: functional ability and physical functioning were present in 26 studies, cognitive functioning in 15; life satisfaction and well-being in 9; social participation/productivity in 8, presence/absence of illness in 6; longevity in 4; self-assessment of health in 3; personality aspects in 2; environment and income in 2; and self-assessment of successful ageing in 2.

Taking into account the studies that use functioning as a criterion, the mean proportion of successful agers found was 27.2%, with a range of 0.4 to 63 (Mean: 20.8; SD: 27.1). In those studies that included both cognitive and physical competencies the range of prevalence of active ageing was even broader, from 3% to 95% (Mean: 20.4; Median: 19, SD: 14.8).

On the other hand, bearing in mind the variety of empirical definitions, explanatory or predictor variables are generally addressed separately. Thus, the most common independent variables of successful ageing are as follows: lower age, higher income, education, sex/female, sex/male, C-reactive protein, ankle-arm

index, presence of medical conditions, hearing problems and absence of depression. It should be pointed out that “illness” is one of the domains almost always present as a criterion variable, but, inappropriately, it is also included as an independent variable, while the same can be said of income, which is considered in the area of environmental conditions as a dependent variable but likewise included as an independent variable. This situation, as common as it is unfortunate (and which we have extensively criticized elsewhere: Fernández-Ballesteros et al., 2004; Fernández-Ballesteros, 2008), leads to a confusion between the defining criterion of successful ageing and its determinants which equates, as pointed out in another work, to confusing the *explanans* with the *explanandum* (Fernández-Ballesteros et al., 2004).

In sum, whilst successful ageing is considered a multidimensional construct, in many cases it is operationalized by means of simple criteria that can be of categorical or continuous format. Finally, there is frequently confusion between definitional elements or criteria and their predictors or determinants.

Our goal in this article is to examine the prevalence of successful ageing using both specific and composite (multi-domain) criteria, as well as to identify the predictors of these criteria.

METHOD

Participants

The present study used baseline data from the ELEA (*Estudio Longitudinal sobre Envejecimiento Activo*; Longitudinal Study on Active Ageing; Fernández-Ballesteros et al., 2007). Participants were 458 individuals (170 men and 288 women) with a mean age of 66.47 (range: 55-75); 21% reported no formal education (though they did know how to read and write), 41% had primary education, 14% secondary, 11.6% high school or similar, and 12.3% had been to university. As regards marital status, 70.5% reported being married, 5.3% single, 7.2% divorced and 17.1% widowed. Finally, with regard to employment situation, 53.3% were retired, 10% were working and 33.3% were housewives/homemakers. The sample can be considered incidental, since although we started out from a representative probabilistic sample of the population of Madrid, of that sample only 95 agreed to participate, so that, with a view to obtaining a heterogeneous sample of elderly people, we recruited from different contexts: thus, 289 participants were from senior citizens' clubs, 49 were from rural senior citizens' centres and 25 were

volunteers on university programmes for older persons (see Fernández-Ballesteros et al., 2007). In all cases the inclusion criteria were the same: being aged 55 to 75 and being independent enough to carry out activities of daily living.

Instrument

Depending on the context from which they came, participants were interviewed and assessed in their own homes (representative sample), in the senior citizens' clubs (rural or urban) or in the university. For the data collection we used an adaptation of the ESAP (*European Survey on Ageing Protocol*), the PELEA (*Protocolo del Estudio Longitudinal sobre Envejecimiento Activo*; Protocol of the Longitudinal Study on Active Ageing), which provided psychometric data from the EXCELSA pilot study (*Cross-European Longitudinal Study on Ageing-P*; Fernández-Ballesteros et al., 2004) on reliability (test-retest and internal consistency), including differences in the degree of objectivity/subjectivity of the variable examined by country. Thus, test-retest reliability ranged from 0.95 (digit symbol in Finland) to 0.14 (perceived strength in Poland) and internal consistency ranged from 0.94 (perceived physical capacity in Poland) to 0.59 (perceived fitness in Spain). As regards construct validity throughout the protocol, we found high-to-moderate factor congruence (ranging from 0.93 to 0.64) in the confirmatory analyses in 6 of the 7 countries involved in the study.

The ESAP (and its PELEA version) includes 55 variables for assessing 23 functions grouped in 9 domains: anthropometrics (weight, height, etc.); health (subjective health, number of illnesses diagnosed, sensory functions, need for help, etc.); physical and physiological functioning (blood pressure, balance, speed, strength, fitness assessment, etc.); lifestyles (physical activity, nutrition, smoking, drinking alcohol, etc.); cognitive functioning (mental state, psychomotor coordination, working memory, verbal learning); emotional-motivational functioning (life satisfaction, well-being, emotional regulation, self-efficacy for ageing, etc.); personality (extraversion, neuroticism, openness); social functioning and participation (social and family network, helping others, receiving care, leisure activities and social productivity); and sociodemographic data (age, sex, marital status, education, income, etc.). The PELEA survey was administered via individual interview by specially-trained interviewers, who informed participants of the

study's goals and obtained their consent prior to its application.

Measures

In order to achieve our goals, and based on the literature examined, we drew up 4 *simple* definitions of successful ageing calculated according to *illnesses, subjective health, mental state* or reported *satisfaction*. Likewise, we drew up 4 *composite* definitions of successful ageing, as follows: 1) *Illness* with a value of 1 or less, MMSE 29 or over, quite or very satisfied (Satisfaction), and being able to manage on one's own; 2) *Good or very good Subjective health*, MMSE 29 or over, quite or very satisfied, and being able to manage on one's own; 3) *Leisure activities* above the mean, MMSE 29 or over, quite or very satisfied, and being able to manage on one's own; 4) *Productivity* above the mean, MMSE 29 or over, quite or very satisfied, and being able to manage on one's own.

Data analysis

Descriptive analyses were carried out on all the criteria employed, both simple and composite. After classifying participants according to the 8 definitions of successful ageing, we calculated the percentages corresponding to each one of them. Finally, we carried out simple and logistic regression analyses using as criteria the 8 above-mentioned variables and as predictors the remaining PELEA variables. The SPSS-17 statistics package was used for all the analyses.

RESULTS

First of all, according to the simple criteria, the percentages of successful agers were as follows: 80% for those reporting high or very high life satisfaction; 57.2% for those reporting good or very good subjective health; 46% for those who obtained an MMSE score of 29 or over, and finally, 27.4% for those who reported total absence of illness.

However, according to the composite measures we found lower proportions of successful agers. First, the highest prevalence corresponds to 41.4%, on using combination 2, involving subjective health, no need for help, high mental state and high life satisfaction. Second, a result of 27.9% was yielded for combination 1, involving reported illness as well as the rest of the domains. Third, on including leisure activities in our first definition (combination 3), we found 19.5% of successful agers. Finally, just 15.5% of the sample could be considered successful agers on incorporating the productive activities (combination 4).

Table 1 shows the results of the stepwise regression analyses of the four simple criteria (illness, subjective health, mental state and satisfaction). As it can be seen, among the sociodemographic characteristics, sex (being male) was the most important predictor, followed by income, education and age. As far as lifestyle is concerned, habitual use of alcohol emerged as the predictor of all our simple indicators of successful ageing, while regular physical exercise was a predictor of two of them. As for physical characteristics, strength was the predictor of all our simple indicators, followed by speed, body mass and lung capacity. A measure of intelligence, digit symbol, predicted all of our successful ageing indicators, while digits backward and cognitive

learning or plasticity allowed the prediction of the individual's mental state. With regard to personality, affect and motivational characteristics, neuroticism, positive affect balance and self-efficacy for ageing predicted three of our simple subjective indicators and extraversion made up of mental state. Finally, among psychosocial conditions, helping others and family network emerged as predictors of two of our simple measures, and receiving help of just one, mental state.

Table 2 shows the results of the logistic regression of our potentially predictive variables in relation to the four composite (multi-domain) measures employed. As it can be seen, of the sociodemographic conditions, sex and income were the best predictors, followed by age and

Table 1
Simple criteria of successful ageing and their predictors

Table 1 Simple criteria of successful ageing and their predictors						
Predictors						
Simple criteria	Sociodemog. *	Lifestyles *	Physical adjustment *	Cognitive functioning *	Personality, affect, subjective rating *	Social networks, participation
Illnesses (range 0-8)	Sex β= .155 (p≤.001)	Drinking β= -.198 (p≤.000)	Strength β= -.226 (p≤.000)	Digit symbol β= -.249 (p≤.000)	Neuroticism β= .142 (p≤.015)	Family network β= .126 (p≤.008)
	Income β= .028 (p≤.015)		Tapping speed β= -.126 (p≤.008)		Emotional balance β= -.126 (p≤.032)	
Subjective health (range 3-14)	Education β= .151 (p≤.002)	Drinking β= .206 (p≤.000)	Strength β= .126 (p≤.021)	Digit symbol β= .223 (p≤.000)	Emotional balance β= .315 (p≤.000)	Helping others β= .108 (p≤.023)
	Sex β= -.133 (p≤.012)	Physical activity β= .165 (p≤.000)	Body mass β= -.168 (p≤.000)		Self-efficacy for ageing β= .168 (p≤.000)	
Mental state (range 0-30)	Education β= .239 (p≤.000)	Drinking β= .157 (p≤.001)	Strength β= -.238 (p≤.000)	Digit symbol β= .396 (p≤.000)	Fitness evaluation β= .172 (p≤.000)	Helping others β= -.138 (p≤.005)
	Sex β= -.150 (p≤.001)			Digits backward β= .219 (p≤.000)	Neuroticism β= -.154 (p≤.002)	Receiving help β= -.116 (p≤.018)
Satisfaction (range 1-4)	Income β= .128 (p≤.033)			Learning gain β= .114 (p≤.005)	Extraversion β= -.132 (p≤.007)	
	Age β= -.103 (p≤.005)	Physical activity β= .152 (p<.001)	Tapping speed β= -.120 (p≤.019)	Digit symbol β= -.179 (p≤.000)	Neuroticism β= -.236 (p<.000)	Family network β= .222 (p<.000)
	Sex β= -.151 (p<.006)	Drinking β= .144 (p≤.002)	Strength β= -.111 (p≤.030)		Emotional balance β= .208 (p<.000)	
					Self-efficacy for ageing β= .111 (p<.019)	

education. It is worth pointing out that the combined measure which includes leisure activities was not predicted by any of our sociodemographic conditions. As regards lifestyle, habitual alcohol use predicted all our combined measures of successful ageing, while regular physical exercise predicted just one of them (including leisure). Among physical characteristics, strength and lung capacity were the most important predictors of combined indicators of successful ageing, and as was the case for the simple measures, digit symbol was the only cognitive predictor of three of our combined measures. Among personality, affect and control variables, fitness assessment emerged as the best predictor of all the combined measures, followed by neuroticism, extraversion and openness to experience.

Finally, with regard to psychosocial characteristics, only the helping others variable was a significant predictor of one of our combined measures, that which includes productive activities.

DISCUSSION

As we assumed, our results on the prevalence of successful ageing depend on the type of operational definition, with simple criteria yielding the highest prevalence figures – ranging from 80% to 27% – compared to the case of combined criteria, for which prevalence ranges from 41.4% to 15.5%. Our results also show that subjective indicators (satisfaction and subjective health) yield much higher prevalence than objective indicators (illness, productivity). Thus, on the

Table 2
Combined (multi-domain) criteria of successful ageing and their predictors

Table 2 Combined (multi-domain) criteria of successful ageing and their predictors						
Predictors						
Simple criteria	Sociodemog. *	Lifestyles *	Physical adjustment *	Cognitive functioning *	Personality, affect, subjective rating *	Social networks, participation
SUCCESSFUL AGEING 1 ILLNESS \leq 1 & MMSE \geq 29 & satis1 \geq 3 & func1 = 3 (yes)	Sex $\beta = -.845$ ($p \leq .000$) Income $\beta = .293$ ($p \leq .003$)	Drinking $\beta = .239$ ($p \leq .000$)	Strength $\beta = .026$ ($p \leq .000$) Body mass $\beta = .002$ ($p \leq .027$) Lung capacity $\beta = -.094$ ($p \leq .003$)	Digit symbol $\beta = .029$ ($p \leq .004$)	Neuroticism $\beta = -.129$ ($p \leq .000$) Fitness evaluation $\beta = .06$ ($p \leq .000$)	-
SUCCESSFUL AGEING 2 SUBJ. HEALTH \geq 3 & func1 = 3 & MMSE \geq 29 & satis1 & func1=3 (yes)	Sex $\beta = -.678$ ($p \leq .000$) Education $\beta = .255$ ($p \leq .012$) Income $\beta = .152$ ($p \leq .032$)	Drinking $\beta = .446$ ($p \leq .000$)	Strength $\beta = .024$ ($p \leq .000$) Lung capacity $\beta = -.094$ ($p \leq .003$)	Digit symbol $\beta = .030$ ($p \leq .010$)	Fitness evaluation $\beta = .145$ ($p \leq .000$) Neuroticism $\beta = -.055$ ($p \leq .000$) Extraversion $\beta = -.038$ ($p \leq .009$) Openness $\beta = .37$ ($p \leq .015$)	-
ACTIVE AGEING 3 LEISURE \geq mean & func1 = 3 & MMSE \geq 29 & satis1 & func1 = 3 (yes)	-	Drinking $\beta = .554$ ($p \leq .000$) Physical activity $\beta = .254$ ($p \leq .027$)	Strength $\beta = .14$ ($p \leq .016$)	Digit symbol $\beta = .022$ ($p \leq .019$)	Fitness evaluation $\beta = .175$ ($p \leq .000$) Neuroticism $\beta = -.033$ ($p \leq .000$)	-
ACTIVE AGEING 4 PRODUCTIVITY \geq mean & func1 = 3 & MMSE \geq 29 & satis1 & func1 = 3 (yes)	Age $\beta = -.057$ ($p \leq .044$) Income $\beta = .161$ ($p \leq .051$)	Drinking $\beta = .337$ ($p \leq .005$)	Lung capacity $\beta = .003$ ($p \leq .002$)	-	Fitness evaluation $\beta = .191$ ($p \leq .000$)	Helping others $\beta = .338$ ($p \leq .000$)

basis of our findings, if we consider a subjective indicator, satisfaction, as a single simple indicator of successful ageing, eight out of ten people aged 55 to 75 would be successful agers, which is in contradiction not only to many other ageing indicators but also to those theories which postulate that life satisfaction is the most relevant indicator of successful ageing (Havinghurst, 1960; Lehr, 1993).

In any case, and in general terms, our results on the prevalence of active ageing are quite consistent with those of Depp and Jeste (2006), who obtained a range of 0.4% to 63% (mean proportion 27.2%), and very similar to those of Peel and cols. (12.7 to 49%).

As regards the prediction of successful ageing, in general, there are clearly predictors of this type of ageing in all the domains explored, and using both simple and composite criteria. Thus, as occurs in other studies, it is the sociodemographic variables that are the most consistent predictors: men (as opposed to women), higher income, better education and younger (as opposed to older) are those that appear to age better (Britton, Shipley, Singh-Martoux, & Marmot, 2008), and this also reflects the importance of socio-economic inequalities in forms of ageing and in survival and longevity (WHO, 2002).

As far as lifestyle-related predictors are concerned, it is worth bearing in mind the sociocultural and geographical context of our sample, characterized by having a Mediterranean diet. This, of course, has implications for both nutrition and alcohol use, but although 50% reported drinking wine and/or beer regularly, over 90% also reported not drinking any stronger alcohol at all (Fernández-Ballesteros et al., 2007; Montero et al., 2011). This would explain the fact that, in our context (and perhaps also in those of other Mediterranean countries), *regular* use of wine or beer is a lifestyle in people who age well, and this result is obtained whether this type of ageing is operationalized by means of simple or composite criteria. Also, regular physical activity has been highlighted in numerous research articles as an excellent predictor of successful ageing, and this was likewise the case in our results, regardless of whether the operationalization was with simple criteria of subjective health or with multidimensional criteria linked to leisure. On this point, Fries (1989, 2002) stresses the fact that regular physical exercise is one of the determinants of successful ageing in both cross-sectional and longitudinal designs.

Of the variables related to physical functioning, strength and lung capacity are the most important

predictor variables, followed by speed and body mass. This is in the same line as findings from other studies (see Peel et al., 2005), though it should be pointed out that in our data sex is a mediating factor, since there is a larger effect in men than in women, associated with greater strength and lung capacity.

With regard to psychological conditions, it should be stressed that, of all the predictor variables, that which emerges most consistently, whatever the successful ageing criterion employed, is the intelligence variable Digit symbol. The association of intellectual functioning with survival and longevity is well-established in the psychology of ageing, and appears in the majority of longitudinal studies (e.g., Lehr, 1982; Schaie, 2005; Thomae, 1975). It is also important to note that it is precisely Digit symbol (a task for assessing learning ability, psychomotor coordination and fluid functioning), compared to other tests assessing audio-verbal memory, that emerges as the best cognitive predictor, using different criteria of successful ageing. Moreover, this is in accordance with a promising line of research from cognitive epidemiology which strongly associates intellectual functioning with mortality and also with survival and longevity (Batty et al., 2009; Deary, 2009).

We also found predictors of successful ageing in affect and personality; among the most consistent, through different criteria, are neuroticism (with negative weight) and the positive appraisal of physical fitness. The latter variable has emerged in other studies as an important factor in both cognitive and physical competence (Fernández-Ballesteros et al., 2004). Likewise, our analyses yielded, as relevant factors of successful ageing, positive emotional balance, extraversion and self-efficacy for ageing. All of these conditions appear to have substantial weight in a large part of the criteria employed, be they simple or composite (for a review, see Fernández-Ballesteros, 2008).

Finally, despite broad support in the ageing literature on the importance of social relations (Baltes & Baltes, 1990; Lehr, 1993; WHO, 2002; Rowe & Khan, 1987, 1997), the predictors that appear to have least relevance in successful ageing are those referring to family and social relations and social participation. Among the scarce few social predictors, the most important factor appears to be "helping others", which emerges as a predictor of both objective (mental state) and subjective criteria (subjective health), and of both simple and composite criteria. Other predictive factors of relative importance are family network and receiving help. We should stress here that the instrument contained in the

PELEA protocol allows a detailed assessment of social and family support networks, and that giving and receiving help have been extensively examined by Lubben (1988), its author, and in many longitudinal and cross-sectional studies. Therefore, this result would not seem to be attributable to a poor measure of this domain. The relative scarcity of social determining factors of successful ageing found may be due, at least partly, to the high degree of homogeneity of the social relations in our sample; we present this as a *post hoc* hypothesis that should be explored in future studies.

In sum, this article shows how the successful ageing criteria identified by the authors, both simple and composite, yield highly diverse rates of successful agers; it also reveals the extent to which simple criteria (score on life satisfaction, mental state, etc.) and composite measures of successful ageing are predicted by a set of conditions which have previously been indicated by the authors as determinants of successful ageing. The greatest strength of the present study lies in the multiplicity of bio-psycho-social factors assessed in the Protocol which, as mentioned earlier, have been extensively tested in seven European countries (including Spain); furthermore, it took into account objective and subjective factors, both in the operationalization of successful ageing and in the identification of its potential determining factors. However, a weakness of the study concerns the sample employed, since, although it was planned to be probabilistic and representative (which would permit the generalization of the results to the corresponding population), this goal was unfortunately not achieved due to the low participation of those in the intended sample, even though a sufficiently heterogeneous group was eventually obtained, which can be appreciated, essentially, in the sociodemographic conditions.

In conclusion, it is extremely important and urgent to arrive at a commonly accepted empirical definition of successful ageing so as to be able to make comparisons of the proportion of persons ageing well in particular populations and to identify the relevant predictors. All of this is essential if we are to advance in this research programme (as is our case) and to transfer the knowledge obtained to the applied context, that is, to the promotion of successful ageing.

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