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## Successful Aging and Changes in Sexual Interest and Enjoyment among Older European Men and Women

Journal:	<i>Journal of Sexual Medicine</i>
Manuscript ID	JSM-07-2018-374.R1
Article type:	Original Research
Keywords:	Successful aging, sexual interest, sexual enjoyment, cross-cultural assessment, gender
Subject Area:	Mental health and sexuality: female, Mental health and sexuality: male
Abstract:	<p><b>Background:</b> In spite of the popularity and analytical relevance of the concept of successful aging, little efforts have been made to address its relationship to sexuality in older individuals.</p> <p><b>Aim:</b> To explore the relationship between successful aging and the (retrospectively assessed) change in sexual interest and enjoyment in the past 10 years, using a new multidimensional model of successful aging.</p> <p><b>Methods:</b> The data for this study was collected in 2016 using national probability-based surveys in four European countries (Norway, Denmark, Belgium and Portugal). In total, information from 2,461 sexually active and inactive participants aged 60-75 years was used for analyses. Multi-group structural equation analysis was employed to address the associations between key constructs.</p> <p><b>Outcomes:</b> The dependent variable was a composite (two-item) indicator of change in sexual interest and enjoyment in the past 10 years was; a multi-faceted model of successful aging predicted the change by country and gender.</p> <p><b>Results:</b> Tested cross-culturally, the proposed model of successful aging demonstrated a good fit to the data. Furthermore, its metric characteristics enabled direct comparisons across gender and national cultures. Controlling for sociodemographic characteristics, higher successful aging scores were consistently related to lower reduction in sexual interest/enjoyment among female and male participants across the four countries.</p> <p><b>Clinical Translation:</b> Given an increased life-expectancy and focus on healthy aging in many countries, the findings about the associations between sexual expression, quality of life and aging well are valuable to professionals working in the area of healthy sexual aging.</p> <p><b>Strengths &amp; Limitations:</b> This is the first study to systematically address the relationship between successful aging and sexuality. Furthermore, it provides a multidimensional measure of successful aging for a wide range of sexological studies. Among limitations, possible self-selection bias (toward more sexually permissive and sexually active participants) and the fact that the findings are restricted to older heterosexual individuals, should be considered.</p> <p><b>Conclusion:</b> Without stigmatizing the absence of sexual expression in aging</p>

	individuals, the findings from this cross-cultural study point out that sustained sexual interest and sexual enjoyment are linked to successful aging in both genders.

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## ABSTRACT

**Background:** In spite of the popularity and analytical relevance of the concept of successful aging, little efforts have been made to address its relationship to sexuality in older individuals.

**Aim:** To explore the relationship between successful aging and the (retrospectively assessed) change in sexual interest and enjoyment in the past 10 years, using a new multidimensional model of successful aging.

**Methods:** The data for this study was collected in 2016 using national probability-based surveys in four European countries (Norway, Denmark, Belgium and Portugal). In total, information from 2,461 sexually active and inactive participants aged 60-75 years was used for analyses. Multi-group structural equation analysis was employed to address the associations between key constructs.

**Outcomes:** The dependent variable was a composite (two-item) indicator of change in sexual interest and enjoyment in the past 10 years was; a multi-faceted model of successful aging predicted the change by country and gender.

**Results:** Tested cross-culturally, the proposed model of successful aging demonstrated a good fit to the data. Furthermore, its metric characteristics enabled direct comparisons across gender and national cultures. Controlling for sociodemographic characteristics, higher successful aging scores were consistently related to lower reduction in sexual interest/enjoyment among female and male participants across the four countries.

**Clinical Translation:** Given an increased life-expectancy and focus on healthy aging in many countries, the findings about the associations between sexual expression, quality of life and aging well are valuable to professionals working in the area of healthy sexual aging.

**Strengths & Limitations:** This is the first study to systematically address the relationship between successful aging and sexuality. Furthermore, it provides a multidimensional measure of successful aging for a wide range of sexological studies. Among limitations, possible self-

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selection bias (toward more sexually permissive and sexually active participants) and the fact that the findings are restricted to older heterosexual individuals, should be considered.

**Conclusion:** Without stigmatizing the absence of sexual expression in aging individuals, the findings from this cross-cultural study point out that sustained sexual interest and sexual enjoyment are linked to successful aging in both genders.

**KEY WORDS:** Successful aging; sexual interest; sexual enjoyment; cross-cultural assessment; gender

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## **Successful Aging and Changes in Sexual Interest and Enjoyment among Older European Men and Women**

### **INTRODUCTION**

Successful aging is a widely recognized concept in social gerontology. With roots in the US, it has gained popularity over the last 30 years and now has a significant influence on the way service providers, policy makers, and older people themselves view the process of aging [1]. While there is no single agreed definition of successful aging [2], the concept is often described in terms of an absence of disease, the presence of good physical and mental health, participation in social events, and satisfaction with life [3]. Although the successful aging perspective aims to conceptualize the totality of the (positive) aging experience, sexual aspects of aging have not been systematically linked to the concept. Despite the fact that sexual activity and satisfaction are recognized for having benefits to psychological well-being and physical health in older age [4–6], the relationship between sexuality and successful aging has only recently been addressed, in a preliminary fashion [7,8].

In the context of an increasing aging population in the developed world and recognition of the sexual rights of older adults [9], a systematic exploration of the potential links between sexual expression and successful aging is timely. In this study, we analyzed survey data from four European countries (Norway, Belgium, Denmark, and Portugal) collected from aging men and women to explore the structure of associations between a successful aging model and change in sexual interest and enjoyment.

### **Successful Aging**

Early conceptions of successful aging focused upon personal happiness, life satisfaction and the avoidance of disrupting or harming other people within society [10,11]. The concept of successful aging has shifted since its first appearance in the latter half of the twentieth century, influenced in large by the theorizing of Rowe and Kahn who developed a

successful aging model to counteract the predominant view within gerontology of older age as a time of disease and disability [12]. In recognition that some older people were ‘non-pathological’, their aim was to challenge negative ageism and the taken-for-granted connection between older people and physical and mental decline. The Row and Kahn model [12] includes three main components: (1) health; (2) high cognitive and physical function; and (3) engagement with life. As Stephens [13] pointed out, this model has been very successful and has had a significant influence on policy, intervention, and research. The successful aging model has helped to create positive narratives of aging, which promote health and happiness in older age. However, considering that “individual and collective phobias about the very process of growing older” remain highly visible in contemporary societies, the model has been criticized for failing to completely “erase the stereotypical representations of old age” [14]. Although there have been numerous empirical applications of the successful aging perspective [15], there is no consensus about its definition and, consequently,

operationalization [1,16,17]. The concept of successful aging remains in a state of flux, with new research studies proposing different domains and/or operational definitions. Most research on successful aging is based on the Rowe and Kahn model, which is usually modified to take the focus away from the biomedical constructs [11]. For example, one contemporary understanding of successful aging refers to social, psychological, and physical well being in older age, whereby the social dimension is conceptualized as engagement with others or connectedness [16].

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### Sexuality and Successful Aging

In early theorizing about successful aging, Palmore [18] noted that the three strongest predictors of life satisfaction identified in the Second Duke Longitudinal Study were social activity, health, and sexual enjoyment. Interestingly, sexuality-related issues have not featured strongly in attempts to theorize successful aging since then. Indeed, only a few academic and

clinical researchers have called for theories and models of successful aging to incorporate sexual activity and function [19,20]. Despite the recognition that sexual expression should be an integral part of healthy aging, research linking sexuality and successful aging is limited.

In a sample of 127 Israeli women aged 45+ years (the majority were in the 55-65 age group), Woloski-Wruble et al. [8] explored the associations between life satisfaction and sexual activity, as well as satisfaction with one's sex life. Although their study was conceptualized using the Rowe and Kahn model, the authors did not operationalize successful aging, but used the Life Satisfaction Index as a proxy. After reporting that life satisfaction was significantly correlated with sexual satisfaction, the authors concluded that women's satisfaction with their sex life "is an important contribution to achieving successful aging" [8].

In a similar study, Thompson et al. [7] explored the associations among self-rated successful aging, indicators of physical and psychological health, sexual function, sexual activity, and sexual satisfaction. In their community-based sample of 1,235 women aged 60-89, of whom just over a half (53%) were married or in an intimate relationship, the authors found that their single-item measure of self-rated successful aging (the construct was not defined in the questionnaire) correlated significantly with sexual desire and sexual activity. Clearly, preliminary evidence suggests a relationship between sexuality and successful aging in older adults [5].

### The Current Study

Considering the dearth of research on successful aging and sexuality, the aim of this study was two-fold. First, we focused on the construction and validation of a

multidimensional model of successful aging. Considering that Although most operationalizations of successful aging—including the inclusion of a health component (often defined as the absence of disease) in the Rowe and Kahn and other models—have included a health component (often defined as the absence of disease), this biomedical aspect

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has been criticized [16] for failing to take into account that a substantial proportion of older individuals seem to age successfully despite not being completely healthy [21,22]. the model proposed in this study focused on life satisfaction instead of health. Building on the standard 3-dimensional conceptualization [12], we tested a model composed of three dimensions: (1) social connectedness, (2) absence of depression, and (3) life satisfaction. The first and third constructs indicate (positive) engagement with life, while the second is a rough proxy for psychological health. To a degree, the three dimensions cover the social and psychological health facets suggested by Carver and Buchanan [16].

Our second aim was to systematically address the association between successful aging and sexuality. The role that sexual expression can play with regard to health and well-being in older age is becoming more visible in public health discourses. For example, the Canadian government started to advocate sexual activity, through public health promotion material, as an element of an aging well agenda [23]. It is imperative, thus, to examine how successful aging connects with change in sexual interest (desire) and sexual enjoyment—and in what way. To answer these questions, we assessed the relationship between successful aging and the change in sexual interest and enjoyment in the past 10 years, while controlling for sociodemographic characteristics. Considering that the social regulation of sexuality is often culture-specific, even in the Western world [24], in this exploratory study we used a cross-national sample of aging European men and women.

## MATERIAL AND METHODS

### Participants and Procedure

In late 2016, a survey on aging and sexuality was carried out by a professional polling agency (*Ipsos*) using national probability-based samples of men and women aged 60-75 years from four European countries (for details about sampling, data collection procedures and sample characteristics see **\*\*\*blinded\*\*\***)[6,25].

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Using national phone registries, a random sample of individuals was drawn in Norway, Denmark and Belgium.<sup>1</sup> Due to non-existence of a similar registry in Portugal, the Portuguese sample was selected using the standard procedure for public opinion surveys in the country. The total sample size was 1,270 in Norway, 1,045 in Denmark, 990 in Belgium, and 509 in Portugal. Non-participation rates differed substantially and ranged from 74.5% in Portugal to 31.8% in Norway, possibly reflecting cultural differences between the Protestant north and Catholic south of Europe in discussing sexuality. After excluding a dyadic subsample (a certain number of couples were surveyed in each country), the final sample size was reduced to 2,461 individuals.

### Questionnaire and Measures

Following the initial contact by telephone, prospective participants were sent a postal questionnaire in their national language. The questionnaire, which included slightly over 200 items, was developed in English and translated into local languages by members of the project's international research team.

The following two questions were used to tap into possible *changes in sexual interest and enjoyment*: “Compared to 10 years ago, how would you rate your interest in sex?” and “Compared to 10 years ago, how would you rate your overall enjoyment in sex?” Both questions had a 5-point scale (ranging from 1 = much lower to 5 = much higher) for anchoring answers. Taking into account a broad range of (possible) sexual expression in older individuals, “sex” or “having sex” was defined in the study as “including sexual intercourse, masturbation, petting or fondling”. Following the two constructs' conceptual interrelatedness (more enjoyable sex may lead to greater sexual interest) and their strong correlation in this study ( $r = .62$ )—both of which suggested that the indicators may represent different facets of a common underlying latent construct (e.g., a change in aging individual's sexual life)—the

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<sup>1</sup> Sample size per country was not based on any statistical power calculations. The usual sample size in European public opinion surveys ( $n \approx 1,000$ ) was targeted in all four countries.

items were summed, so that low scores denoted a decrease, and high scores an increase in sexual interest and sexual enjoyment compared to 10 years ago. It should be noted that the indicator has no absolute meaning (i.e., two participants with substantially different levels of sexual interest 10 years ago may be characterized by an identical score). Instead, it reflects the *direction* of self-evaluated change (i.e., increase, decrease or stability) in person-specific sexual interest and enjoyment—regardless of their initial levels.

*Depression in the past month* was assessed with a brief and psychometrically validated depression scale, the SCL-DEP [26]. The 6-item scale had acceptable reliability in this study (Cronbach's  $\alpha$  by country was in the .79–.83 range). Scores were reverse-recoded, so higher scores indicate low or no depression.

*Perceived social connectedness* was indicated by reverse-coded scores of the loneliness scale [27]. The 3-item (e.g. “How often do you feel left out?”) scale had satisfactory reliability (Cronbach's  $\alpha$  ranged from .77 to .81). Again, the scale scores were reverse-recoded, with higher scores denoting low or no sense of loneliness.

Finally, *life satisfaction* was measured by a 4-item version (e.g., “In most ways my life is close to my ideal” and “The conditions of my life are excellent”) of the 5-item Satisfaction with Life Scale [28]. A 7-point Likert-type scale was used to anchor items; higher scores indicate higher life satisfaction. The scale had excellent reliability (Cronbach's  $\alpha$  was .90 in all four countries).

*Control variables* were: age, education (categorized into primary, secondary and tertiary education), religiosity (frequency of attending religious services was measured by a 7-point scale ranging from never to at least once a week) and relationship status (single vs. in a relationship or married). To assess convergent validity of our model of successful aging, we used the standard single-item indicator of self-rated general health [29]: “In general, would

you say your health is: excellent/very good/good/fair/poor? The scale was reversed, so that higher scores denote better health.

### Statistical Analysis

Instead of listwise omission of cases with missing observations, we employed model-based full information maximum likelihood (FIML) estimation to minimize bias associated with missing information [30,31]. Confirmatory factor analysis was employed to assess the fit of a 3-dimensional construct of successful aging. The latent construct of depression was indicated by three parcels of randomly paired manifest variables. Considering the size of our sample, the following cut-off values were considered to indicate adequate model fit [32]: comparative fit index (CFI)  $\geq .90$  (acceptable fit) and  $\geq .95$  (excellent fit) and the root mean square error of approximation (RMSEA) index of parsimony  $\leq .08$  (acceptable fit) and  $\leq .05$  (excellent fit). In testing for model invariance across gender and country, the standard chi square difference test was replaced with CFI difference test, which is insensitive to sample size; values  $\leq .01$  of  $\Delta$ CFI test indicated invariance [33]. Model invariance was assessed on three progressively restrictive stages [34]. Taking into account gender-specific and, possibly, country-specific norms that regulate sexuality, at least partial scalar invariance was required to confirm the assumption of gender and country invariance [35].

Finally, controlling for age, education, religiosity and relationship status (compared to coupled older men and women, individuals who are single may have experienced a systematically different change in sexual expression), we estimated the association between successful aging and the change in sexual interest/enjoyment by gender, separately for each country. Again, model fit was assessed with CFI and RMSEA indices. All analyses were carried out using IBM AMOS 22 statistical software package [30].

## RESULTS

### Sample Characteristics

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Basic sociodemographic characteristics of the four-country sample are presented in Table 1. Significant differences (all at  $p < .001$ ) among the four European countries emerged in all five indicators. In regard to age, the Portuguese sample was the youngest and the Danish one the oldest (on average, Danish participants were about 2 years older than Portuguese). Tertiary education was most prevalent in the Norwegian, followed by the Belgian, sample and least prevalent among Portuguese men and women. The proportion of participants with only primary education was the highest in the Portuguese and the lowest in the Norwegian sample. The majority of participants, men more than women, reported being in a relationship or married. The exception were Belgian women, most of whom were non-partnered. With regard to the place of residence, the highest proportion of participants living in rural areas (about a third) was found in the Danish sample (Norwegians were second). The opposite was true for Portuguese men and women, about a third of whom reported living in the capital city. Finally, Norwegians were the least and Portuguese the most religious participants. The Portuguese sample was significantly more religious than the other three.

Overall, the levels of sexual interest and sexual enjoyment in the past 10 years decreased among both genders in all four countries ( $M_{\text{interest}} = 2.16$ ,  $SD = .89$  and  $M_{\text{enjoyment}} = 2.22$ ,  $SD = .96$ ), with the decrease being somewhat lower among male than female participants ( $t_{(3389)} = 9.50$ ,  $p < .001$  and  $t_{(3351)} = 6.14$ ,  $p > .001$ , respectively). Danish men and women reported the lowest and Belgian participants the highest decline in sexual interest and enjoyment.

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### Confirmatory Factor Analysis of a Successful Aging Model

The 3-dimensional model of successful aging explored in this study is shown in Figure 1. Its initial testing resulted in an inadequate fit to the data ( $\chi^2_{(32)} = 708.96$ ,  $CFI = .951$ ,  $RMSEA = .093$ ,  $90\% \text{ CI} = .087-.099$ ). After error terms of the three social connectedness items were allowed to correlate with error of the second absence-of-depression parcel, the

model fit greatly improved ( $\chi^2_{(29)} = 345.00$ , CFI = .977, RMSEA = .067 (90% CI = .060-.073); all but one first-order factor loadings were  $\geq .74$ , while all three second-order factor loadings were  $\geq .72$ . This re-specification was conceptually justified by the fact that the parcel in question contained an item (*Feeling lonely*) that reflected the absence of connectedness.

#### FIGURE 1 ABOUT HERE

Next, the model was tested for gender invariance. Compared to the model in which all parameters were freely estimated across gender (CFI = .975, RMSEA = .050, 90% CI = .045-.054), the model with parameters constrained to reflect scalar invariance (measurement weights and intercepts, and structural weights were fixed to be equal among men and women) performed substantially worse ( $\Delta$ CFI = .24). However, after allowing two measurement weights (i.e. factor loadings) and their respective intercepts to vary across gender, partial scalar invariance was obtained ( $\Delta$ CFI = .008; CFI = .967, RMSEA = .050, 90% CI = .046-.054). Furthermore, full scalar invariance was confirmed across country ( $\Delta$ CFI = .002; CFI = .945, RMSEA = .039, 90% CI = .036-.041; cf. Table 2), pointing that the proposed model was conceptually and metrically invariant in male and female participants, as well as among participants from different countries. This enabled direct comparisons of the relationships between successful aging and the change in sexual interest/enjoyment across gender and country.

#### TABLE 2 ABOUT HERE

### Successful Aging and Self-Rated Health

Following established conceptual and empirical links between successful aging and general health status [36], convergent validity of the successful aging model was assessed by correlating it with self-rated health indicator by country and gender. According to the findings, the model was consistently and significantly associated with male and female health in all four countries, with the exception of Portuguese women (Norway:  $r_{\text{men}} = .15$  and  $r_{\text{women}}$

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= .23,  $p < .001$ ; Denmark:  $r_{\text{men}} = .21$  and  $r_{\text{women}} = .16$ ,  $p < .01$ ; Belgium:  $r_{\text{men}} = .19$  and  $r_{\text{women}} = .18$ ,  $p < .001$ ; and Portugal:  $r_{\text{men}} = .17$ ,  $p < .05$  and  $r_{\text{women}} = .09$ ). Consistent with warnings against overly biomedical approach to successful aging [3] effect sizes were mostly small.

### Country-Specific Levels of Change in Sexual Interest/Enjoyment and Successful Aging

The average composite sexual interest/enjoyment score of 4.50 ( $SD = 1.61$ ) reflected a decline in participants' sexual interest and sexual enjoyment over the past 10 years (the indicator ranged from 2-10). When male and female participants' mean levels were compared by country, differences in the change of sexual interest and enjoyment did not reach significance only in the Portuguese sample ( $t_{(420)} = 1.63$ ,  $p > .10$ ).

Following the procedure outlined by Byrne [32], we compared latent means of successful aging in the four countries and between genders. As latent means are estimated as relative values, we set Norwegian participants and men, respectively, as reference category. Only Portuguese participants differed significantly from Norwegians, reporting a lower mean value of successful aging ( $M = -.20$ ,  $S.E. = .09$ ,  $p < .05$ ). Regarding gender comparisons, Portugal was the only country where no significant mean difference in successful aging was observed ( $M = .04$ ,  $S.E. = .18$ ). In contrast, in Norway ( $M = .19$ ,  $S.E. = .08$ ,  $p < .05$ ), Denmark ( $M = .38$ ,  $S.E. = .10$ ,  $p < .001$ ) and Belgium ( $M = .23$ ,  $S.E. = .12$ ,  $p < .05$ ) women reported higher mean levels of successful aging than men.

### Associations between Successful Aging and Sexual Interest/Enjoyment

The path analytic model of the association between successful aging and change in sexual interest and enjoyment was carried out by country and gender, controlling for basic sociodemographic characteristics (age, education, relationship status and religiosity), is presented in Figure 2. The initial multi-group model, with men and women as groups, had good fit ( $\chi^2_{(166)} = 810.38$ ,  $CFI = .956$ ,  $RMSEA = .040$ ,  $90\% \text{ CI} = .037-.042$ ). Across the countries, successful aging was significantly and positively associated with change in sexual

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interest and enjoyment among both men and women (i.e., higher successful aging scores were linked to lower reduction in sexual interest and enjoyment)—with the exception of Portuguese men. The associations were small to moderate in size (zero-order correlations ranged from .06 to .39).

Among sociodemographic characteristics, being in a relationship or married was consistently and moderately strongly associated with successful aging, except in the case of Belgian men. An effect of education was observed only in Belgium, with women who completed secondary education and men with tertiary education—compared to their compatriots who reported only primary schooling—being characterized by significantly higher successful aging scores. The effect size, however, was small ( $\beta = .10-.20$ ). The proportion of variance in successful aging explained by sociodemographic indicators was modest, with the coefficient of determination ranging between .05 in Belgian men and .22 in Portuguese women.

No consistent associations with sociodemographic indicators were observed in the case of change in sexual interest and enjoyment. Being in a relationship or married was positively associated with the outcome only among Danish and Belgian men. Similarly, higher educational levels were significantly related to the outcome among Belgian women (high-school vs. primary school educated participants) and Portuguese women (college vs. primary school educated participants), but not other participants. Age was negatively and weakly related to change in sexual interest and enjoyment only among Belgian women.

FIGURE 2 ABOUT HERE

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TABLE 3 ABOUT HERE

## DISCUSSION

The objectives of the present study were to construct and validate a multidimensional indicator of successful aging, as well as to explore the association between successful aging



and change in sexual interest and enjoyment among aging men and women from four European countries (Norway, Belgium, Denmark and Portugal). Following the widely used model of successful aging by Rowe and Kahn [12] and items suggested by Carver and Buchanan [16], we constructed a 3-dimensional construct consisting of satisfaction with life, the absence of depression, and social connectedness. In a broad sense, the dimensions indicate quality of life, cognitive and emotional coping with aging, and social engagement. Our model moves away from objective, biomedical definitions of aging, which have been criticized for suggesting that successful aging is an unattainable goal for the majority of older individuals [37,38]. While the first and last dimensions are widely accepted as integral parts of successful aging [16,39], the absence of depression has thus far been tested only as a predictor and not as an integral dimension. In the model presented here, the absence of depression is a proxy for mental well-being in aging men and women. Taking into account different clinical presentations of depression in older individuals [40] — often entailing memory and concentration problems, cognitive slowing down and loss of interest in life—our inclusion of the absence of depression as a facet of successful aging appears to be supported by the observed negative associations between depression and all facets of successful aging [39].

Tested cross-culturally, the proposed model of successful aging demonstrated a good fit to the data ~~and. Furthermore, its metric characteristics~~ enabled direct comparisons across gender and national cultures. The average levels of successful aging were lowest in the Portuguese sample (Norwegian, Danish and Belgian participants did not significantly differ). Considering the well-documented relationship between socioeconomic status and health [41], this finding may reflect different socioeconomic realities in the four countries. With regard to the standard of living, the disposable median net income in 2015 was 8,435 EUR in Portugal, 21,654 EUR in Belgium, 28,364 EUR in Denmark, and 41,483 EUR in Norway [42].

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The analysis of sociodemographic predictors of successful aging **has important ramifications. The finding that age was not significantly associated with successful aging, which is in accordance with other studies [16], seems to** **pointed to** the importance of personal characteristics and lifestyle, rather than biological age, for subjective well-being of aging men and women between 60 and 75 years of age. This is also reflected in the substantial association between successful aging and being partnered. Being in a close relationship most likely contributes to successful aging through more than one underlying mechanism. It increases the sense of connectedness (diminishing loneliness) and likelihood of care and emotional support **and augments an individual's social connectedness through the partner's social ties [43]. It is also possible that successful aging assists in the recognition of the relevance of one's close relationship.**

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Interestingly, education was not a consistent predictor of successful aging in this study. Although some studies have found that more years of formal education can serve as protective factor against the diminishing of cognitive function [11,44], we observed a significant relationship between successful aging and tertiary education only among Norwegian women and Belgian men. The effect size was small, suggesting that higher education does not play a crucial role in aging well—at least in developed countries characterized by easily accessible health information and high quality medical services.

In a recent literature review, Carver and Buchanan [16] concluded that religiosity, although not necessarily predictive of successful aging, should be included in studies that explore the construct. Although some studies found a significant association between spirituality and successful aging [45,46], we observed no significant relationship between religiosity and the proposed model of successful aging in either of the four European samples. Whether personal faith, rather than religiosity (i.e., frequency of attending religious ceremonies), may play a role in successful aging remains a task for future studies.

This study's central finding—that individuals who seem to age more successfully reported less reduction in their sexual interest and enjoyment—is consistent with two studies which found that successful aging was significantly associated with sexual satisfaction [8] and sexual desire and activity [7]. However, as both of these studies included only aging female participants, our findings are the first evidence of a similar relationship in aging men. Given that “contextual” or sociocultural data were not collected in this study, we can only speculate about the reasons behind the observed gender differences in successful aging and, to a lesser extent, change in sexual interest and enjoyment. Considered cross culturally, in the European context, the observed discrepancies between male and female successful aging may reflect socioeconomic and socio-cultural differences in the European North and West vs. the South—particularly a higher standard of living, women's economic self-sufficiency and higher gender equality. That Norwegian women reported less negative change in sexual interest/enjoyment compared to men, while in Portuguese women it was the opposite, might reflect the existence of different social norms that regulate gender roles and sexuality in the European South and North [47,48]. Traditional (heterosexual) gender relations and higher levels of religiosity—both of which are known to affect sexual activity, interest, and pleasure—have been observed in Portugal as compared to Norway [49,50].

Being in a relationship or married was systematically associated with successful aging but not with changes less negative change in sexual interest and enjoyment, in the past 10 years only among men in Denmark and Belgium. Having a partner was related to a lower decline in sexual interest and enjoyment only among Danish and Belgian men, which is somewhat surprising considering that being single has been repeatedly reported as a major reason for sexual inactivity in older women [4,6,51]. The effect of singlehood on older men's sexuality has received much less attention in the literature, most

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likely due to the fact that older women usually outlive their male partners, which future research should aim to remedy.

Taking into account the cross-sectional character of the present study, it should be noted that the direction of the relationship between successful aging and changes in sexual interest and enjoyment cannot be specified. Different aspects of successful aging can positively influence changes in one's sexual interest and enjoyment in sex, but the same is true of a positive change—which can improve an individual's perception of his/her aging. The small size of the association between the two constructs suggests, however, that their (likely) mutual influence is limited. According to our findings, it is possible to age successfully in spite of decreasing sexual interest and enjoyment.

#### Study Limitations

While this study has provided important insights into successful aging and sexuality, several limitations need to be considered. As with all research that includes volunteers, it is likely our samples were biased toward sexually active aging men and women, as well as individuals with more liberal views about sexuality (more traditional persons were, most probably, substantially more likely to refuse to participate in the survey about healthy sexual aging). Although it was emphasized during the recruitment process that one did not need to be sexually active (or in a sexual relationship) to participate in the study, it is plausible that the motivation for getting involved was higher in sexually active men and women. Another

source of the restricted generalizability of our findings is a high non-participation rate observed in the Portuguese sample. Compared to the other three national samples, the findings pertaining to older Portuguese men and women are likely less representative of the national 60+ years old population.

Another limitation pertains to the fact that sexual orientation was not controlled for in this study, in spite of the evidence that the domains of successful aging outlined in the

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Rowe and Kahn model may be better suited for heterosexual than lesbian, gay, bisexual and transgender (LGBT) adults who can face additional challenges related to identity and shared experiences of stigma and discrimination [52,53]. The reason behind this omission was practical, as almost 95% of participants in our sample described their sexual orientation as heterosexual. Only 1.9% of the recruited individuals identified as gay, lesbian or bisexual, while additional 3.2% checked the category “other”. Finally, our “umbrella” indicator of sexual activity included a range of different sexual and/or erotic acts which relative importance likely changes with advancing age. For the oldest individuals in our sample fondling might have played a more important role than sexual intercourse. These differences could not be explored in this study.

## CONCLUSIONS

To the best of our knowledge, this is the first study to develop and cross-culturally validate a successful aging model with sexuality-related correlates. It fills a gap in the literature on aging, offers further validation with different groups, as well as a model that is, and will remain, important in the context of increasing interest in successful ageing for healthy aging. According to the findings (higher successful aging scores were related to lower reduction in sexual interest and enjoyment), successful aging is systematically associated with changes in aging male and female sexuality. Recognizing potential dangers of health agendas—highlighted by critical scholars [23]—which emphasize that sexual activity is essential for aging successfully, we would argue that any attempt to incorporate sexual expression into measures and theories of successful aging should take diversity and differences into account. Without stigmatizing the absence of sexual expression in aging men and women, our findings point out that sustained sexual interest and sexual enjoyment are linked to successful aging.

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For Peer Review

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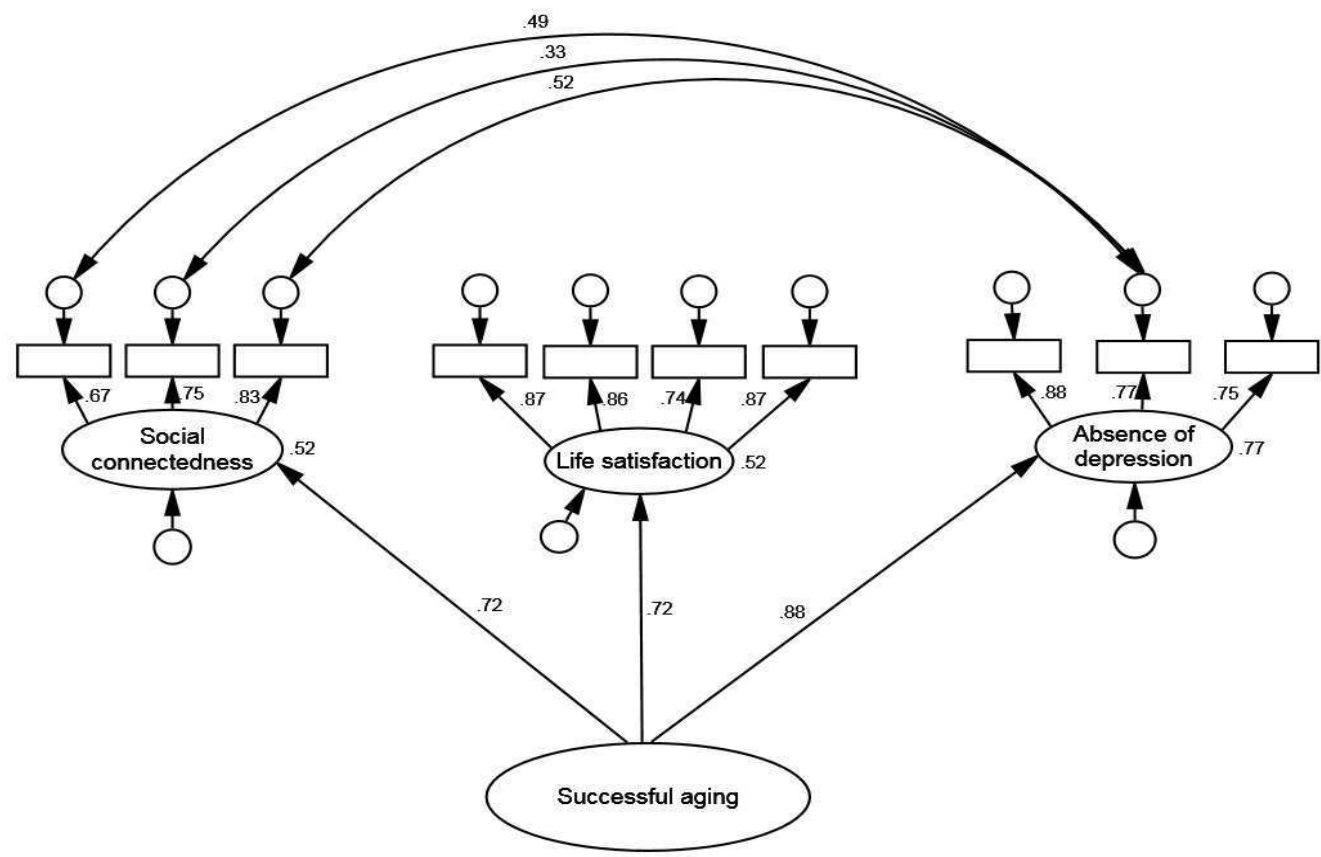
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Figure 1 – Confirmatory Factor Analytic Model of Successful Aging (n = 2,461)



Notes. Standardized path coefficients represent associations between the higher-order factor and the three lower-order factors (i.e. facets of successful aging construct).

Table 1 – Basic Sociodemographic Characteristics of the Sample by Country and Gender

	Norway		Denmark		Belgium		Portugal		
	Men	Women	Men	Women	Men	Women	Men	Women	
	( <i>N</i> = 458)	( <i>N</i> = 377)	( <i>N</i> = 323)	( <i>N</i> = 308)	( <i>N</i> = 183)	( <i>N</i> = 537)	( <i>N</i> = 119)	( <i>N</i> = 156)	
	<i>n</i> (%)		<i>n</i> (%)		<i>n</i> (%)		<i>n</i> (%)		
<b>Age</b>									
60-65	173 (37.8)	140 (37.1)	128 (39.6)	91 (29.5)	75 (41.0)	220 (41.0)	61 (51.3)	83 (53.2)	
66-70	162 (35.4)	123 (32.6)	82 (25.4)	93 (30.2)	61 (33.3)	199 (37.1)	42 (35.3)	37 (23.7)	
71-75	123 (26.9)	114 (30.2)	113 (35.0)	124 (40.3)	47 (25.7)	118 (22.0)	16 (13.4)	36 (23.1)	
<b>Education</b>									
Primary	46 (10.1)	34 (9.8)	93 (29.0)	85 (27.7)	23 (12.6)	70 (13.2)	32 (26.9)	46 (30.3)	
Secondary	156 (34.1)	149 (39.6)	118 (36.8)	121 (39.4)	87 (47.5)	276 (52.0)	59 (49.5)	80 (52.6)	
Tertiary	256 (56.9)	190 (50.6)	110 (34.2)	101 (32.9)	73 (39.9)	185 (34.8)	28 (23.5)	26 (17.1)	
<b>In a relationship/married</b>									
Yes	340 (74.2)	190 (50.4)	235 (73.3)	228 (74.0)	125 (68.3)	178 (33.1)	103 (86.6)	90 (57.7)	
No	111 (24.2)	180 (47.7)	86 (26.7)	79 (25.6)	55 (30.1)	357 (66.5)	15 (12.6)	64 (41.0)	

## Religiosity

Never	191 (41.7)	101 (26.8)	123 (38.1)	76 (24.7)	90 (49.2)	235 (43.8)	30 (25.2)	35 (22.4)
Less than once a year	107 (23.4)	91 (24.1)	71 (22.0)	74 (24.0)	26 (14.2)	55 (10.2)	18 (15.1)	27 (17.3)
Once a year	54 (11.8)	43 (11.4)	43 (13.3)	46 (14.9)	8 (4.4)	32 (6.0)	11 (9.2)	7 (4.5)
Twice a year	54 (11.8)	68 (18.0)	42 (13.0)	66 (21.4)	29 (15.8)	98 (18.2)	21 (17.6)	17 (10.9)
Once a month	26 (5.7)	32 (8.5)	20 (6.2)	29 (9.4)	5 (2.7)	40 (7.4)	15 (12.6)	14 (9.0)
Once every two weeks	10 (2.2)	22 (5.8)	8 (2.5)	7 (2.3)	6 (3.3)	20 (3.7)	3 (2.5)	12 (7.7)
Once a week or more	9 (2.0)	18 (4.8)	14 (4.3)	8 (2.6)	18 (9.8)	50 (9.3)	18 (15.1)	38 (24.4)

## Place of residence

Rural	151 (33.0)	114 (30.2)	113 (35.0)	99 (32.1)	49 (26.8)	143 (26.6)	20 (16.8)	26 (16.7)
Small town	165 (36.0)	138 (36.6)	114 (35.3)	111 (36.0)	89 (48.6)	203 (37.8)	30 (25.2)	30 (19.2)
Medium sized city	55 (12.0)	43 (11.4)	47 (14.6)	39 (12.7)	19 (10.4)	71 (13.2)	23 (19.3)	30 (19.2)
Suburb of a large city	33 (7.2)	20 (5.3)	17 (5.3)	15 (4.9)	15 (8.2)	58 (10.8)	9 (7.6)	14 (9.0)
Central large city	50 (10.9)	51 (13.5)	28 (8.7)	32 (10.4)	9 (4.9)	31 (5.8)	36 (30.3)	52 (33.3)

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Table 2 – Structural Models' Fit and Invariance Testing Information

	$\chi^2$ (df)	CFI	$\Delta$ CFI	RMSEA	RMSEA 90% CI
Total sample	345.00 (29)	.977		.067	.060-.073
Baseline multi-group model by gender (unconstrained)	409.55 (58)	.975	Ref.	.050	.045-.054
Multi-group model by gender, scalar invariance	609.05 (77)	.967	.008	.050	.046-.054
Multi-group model by country	926.14 (182)	.947	Ref.	.041	.038-.043
Multi-group model by country, scalar invariance	988.76 (211)	.945	.002	.039	.036-.041



Table 3 – Results of Path Analytic Assessment of the Association between Successful Aging (SA) and Sexual Interest/Enjoyment (SIE) in Four European Countries by Gender

	Norway		Denmark		Belgium		Portugal	
	Men ( <i>N</i> = 458)	Women ( <i>N</i> = 377)	Men ( <i>N</i> = 323)	Women ( <i>N</i> = 308)	Men ( <i>N</i> = 183)	Women ( <i>N</i> = 537)	Men ( <i>N</i> = 119)	Women ( <i>N</i> = 156)
<i>Correlations</i>	<i>r</i> (S.E.)	<i>r</i> (S.E.)	<i>r</i> (S.E.)	<i>r</i> (S.E.)	<i>r</i> (S.E.)	<i>r</i> (S.E.)	<i>r</i> (S.E.)	<i>r</i> (S.E.)
Successful aging (SA) and change in sexual interest and enjoyment (SIE)	.16** (.06)	.12* (.05)	.14* (.07)	.39*** (.06)	.24** (.12)	.14** (.06)	.06 (.11)	.24* (.12)
<i>Paths</i>	$\beta$ (S.E.)	$\beta$ (S.E.)	$\beta$ (S.E.)	$\beta$ (S.E.)	$\beta$ (S.E.)	$\beta$ (S.E.)	$\beta$ (S.E.)	$\beta$ (S.E.)
Age to SA	.00 (.01)	.00 (.01)	-.02 (.01)	-.03 (.01)	.02 (.01)	.02 (.01)	.01 (.01)	.02 (.01)
Secondary education to SA	-.00 (.08)	.05 (.08)	-.02 (.10)	.04 (.10)	-.09 (.15)	.10* (.08)	.25 (.17)	.13 (.18)
Tertiary education to SA	-.05 (.10)	.17** (.12)	-.04 (.14)	.08 (.16)	.20* (.18)	.05 (.13)	.15 (.21)	-.09 (.26)
In a relationship/married to SA	.35*** (.09)	.39*** (.10)	.26*** (.14)	.35*** (.15)	.13 (.16)	.20*** (.10)	.41*** (.18)	.40*** (.15)
Religiosity to SA	-.08 (.02)	.01 (.02)	-.05 (.03)	.02 (.03)	.01 (.08)	.02 (.02)	-.09 (.04)	-.15 (.03)
Age to SIE	-.05 (.02)	.01 (.02)	-.02 (.02)	.05 (.02)	-.08 (.03)	-.11* (.02)	-.11 (.04)	-.00 (.03)
Secondary education to SIE	.03 (.16)	-.03 (.17)	.05 (.20)	.03 (.21)	.12 (.30)	.12** (.16)	-.01 (.31)	.07 (.36)

Tertiary education to SIE	.06 (.22)	-.01 (.26)	.05 (.26)	.01 (.33)	.02 (.34)	-.01 (.25)	.14 (.39)	.17 (.51)*
In a relationship/married to SIE	.08 (.17)	.09 (.22)	.14* (.26)	-.02 (.31)	.15* (.31)	.03 (.19)	.11 (.32)	.14 (.30)
Religiosity to SIE	-.06 (.05)	.07 (.04)	-.01 (.05)	-.09 (.06)	-.03 (.07)	-.02 (.04)	-.03 (.07)	-.13 (.06)

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Notes. \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$

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