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Successful sexual aging: conceptualization and Bi-Country (Croatia and Germany) measure validation



Aleksandar Štulhofer¹, Laura Pietras^{2,3}, Ivan Landripet¹ and Goran Koletić^{1*}

Abstract

Background The increasing importance of sexual expression among older Europeans calls for a more comprehensive understanding of the process of sexual aging. Combining social gerontological and sexological theories, the current study aimed to conceptualize and operationalize a process-focused model of successful sexual aging (the SSAM).

Methods Using a Croatian sample of older partnered individuals (n = 200; $M_{age} = 71.2$) and a large-scale German sample of both partnered (n = 442; $M_{age} = 69.2$) and non-partnered individuals (n = 971; $M_{age} = 69.2$), we developed and validated a 9-item measure of successful sexual aging.

Results The 3-dimensional Successful Sexual Aging Scale (SSAS) reflects two internal processes (acceptance of and adaptation to aging-related changes) and an external one (opportunities for sexual expression). The measure was age, gender, and (to a large extent) culture invariant in older partnered individuals. With a minor adjustment (re-wording of a single item), the SSAS assessed positive sexual aging comparably well in non-partnered individuals. As hypothesized, the measure was significantly related to positive attitudes about older people's sexuality, life and relationship satisfaction, subjective age, and self-reported health. SSAS scores, which were lower among Croatian than German participants, were also linked to lower levels of social isolation, as well as depression and anxiety symptoms.

Conclusions The new measure can be useful in a range of quantitative assessments of older people's sexuality and well-being. Furthermore, the concept of successful sexual aging may assist in challenging ageism and in interventions focusing on positive sexual aging.

Clinical trial number Not applicable.

Keywords Aging, Sexuality, Successful aging, Successful sexual aging scale

*Correspondence: Goran Koletić

akoletic@m.ffza.hr

¹Department of Sociology, Faculty of Humanities and Social Sciences,

University of Zagreb, I. Lučića 3, Zagreb 10000, Croatia

²Institute for Sex Research, Sexual Medicine and Forensic Psychiatry,

University Medical Center Hamburg-Eppendorf, Hamburg, Germany

³Junior Research Center for Sexual and Reproductive Health in

Overweight and Obesity, University Medical Center Hamburg-Eppendorf,

Hamburg, Germany



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Introduction

An increasing number of people across Europe and the Western world in general are living into old age and these new generations of older adults seem to place a higher value on sexual activity and sexual health [1, 2]. This calls for a more comprehensive understanding of the process of sexual aging, and, consequently, novel approaches to sexual education and sexual health interventions for older adults [3, 4]. Aging individuals and couples are likely to be exposed to greater expectations about prolonged quality of life, including sexual vitality, but also to persisting sexual ageism (i.e., beliefs and stereotypes about older people as asexual) [5, 6].

Aging-related changes may present significant challenges to older women's and men's sexual health and sexuality in general [7]. Previous research on later-life sexuality has mainly focused on losses, such as a decline in sexual functioning and sexual frequency [8–10]. Within this discourse, changes in sexual functioning are often discussed as indicators of "unsuccessful" sexual aging. This perspective starkly contrasts with older adults' subjective assessments of sexuality. Many older adults report satisfying and active sex lives despite a decline in the frequency of sexual activity and sexual function [11–13]. This paradox stresses the need for a model of positive, dynamic, and non-normative model of later-life sexuality that would better reflect the reality and complexities of sexual aging.

To assist with bridging gaps in research on sexual aging, the current study proposes a new conceptualization of positive sexual aging—defined as the process of acceptance of and adaptation to age-related changes in sexuality that contributes to life satisfaction and overall well-being through specific emotional, cognitive, and behavioral experiences—the Successful Sexual Aging Model (SSAM) and its operationalization. The SSAM builds on a highly influential social gerontological paradigm, the Successful Aging theory [14, 15] and its process-based elaborations [16]. It should be emphasized that SSAM is not a normative concept. It does not assume that sexual activity is a prerequisite for successful sexual aging.

Positive sexual aging

Earlier discussions about sexual aging have often focused on reduced sexual function and declining frequency of sexual activity. This narrow perspective has been criticized as ignoring non-pathological aging-related changes in sexual practices on the one hand and life-cycle specific changes in priorities and preferences on the other hand. To that purpose, two concepts were recently proposed, healthy sexual aging [17] and sexual well-being in older adults [18, 19], of which only the latter was operationalized and validated in four European countries (Norway, Denmark, Belgium, and Portugal). However, the measure of sexual well-being in aging individuals has two important limitations. The measure lacks conceptual anchoring—it was developed based solely on empirical accounts of what older (partnered) individuals find erotically and sexually important [20–22]—and is static (i.e., it fails to capture the process of aging-related changes in sexual expression).

Another recent contribution is Mitchell's et al. [23] conceptualization and operationalization of sexual wellbeing. The measure has seven distinct domains (resilience, sexual self-determination, self-forgiveness, sexual safety, comfort with one's sexuality, sexual respect, and sexual self-esteem) and was developed using a mixed methods procedure [24]. Given that the concept and the measure did not focus on older adults (80% of participants in the initial concept-defining qualitative study were under 40 years of age), it remains unclear how relevant the selected domains are for sexual aging. Moreover, Mitchell and colleagues' model assesses the current state of a person's sex life and sexuality, leaving out the developmental perspective which is highly important for sexual aging.

Toward a process-based concept of successful sexual aging

Since the 1990s, successful aging (SA) has been a prominent topic in gerontological research as researchers and practitioners seek to understand and promote positive experiences of aging. Rowe and Kahn's early conceptualization [14, 15] was highly influential and shaped the discourse of positivity [25, 26]. Their tripartite biopsychosocial model highlights the absence of disease and disability, maintaining high cognitive and physical functioning, and active engagement with life as hallmarks of SA. The model has been criticized for being overly biomedical and neglecting psychosocial factors and experiences that may have more weight than a compromised health status [25, 27]. The fact that Rowe and Kahn focused on ideal outcomes rather than dynamic adaptive processes [26, 28] prompted discussions about an interplay between challenges (i.e., negative changes and losses) and personal responses to aging (adaptation and compensation to maintain the sense of meaning and purpose). One of central revisions, the Selective Optimization with Compensation model (SOC) [16], proposed that SA should be understood as a dynamic outcome of three intrapersonal adaptive processes: (1) selection, which involves adjusting or prioritizing goals when abilities or resources decline (2), optimization, which refers to maximizing resources and abilities needed for the adjustment, and (3) compensation, which denotes finding alternative strategies to achieve goals when previous methods are no longer possible.

By directing attention to the multi-faceted adaptation to aging, the SOC model is highly relevant for the understanding of positive sexual aging. If positive sexual aging is considered a facet of SA, the same processes that determine SA are also likely to be important for positive sexual aging. However, given that sexuality is gendered (in most cultures, sexual socialization and sexual norms are not gender blind), based on social learning (family, peers, partners, and social norms), and developmental (related to the life cycle), the sexual component of aging is also specific. This specificity calls for an integration of social gerontological and sexological theory.

Two important sex research contributions are the gendered life cycle perspective [29] and the sexual scripts theory [30, 31]. The first concept views personal sexual expression, sexual agency, and identity as processes or trajectories shaped by life experiences. Within this perspective, expressions of sexuality (and gender) are conceptualized as developmental processes rather than stable states [29]. The sexual scripts theory distinguishes among three levels of social learning about sexuality and sexual behaviors: cultural scenarios (macro level), interpersonal scripts (mezzo level), and intrapsychic scripts (micro level). In brief, the model posits that sexual thought, beliefs, and behaviors are learned (i.e. socially constructed), often simultaneously and fraught with contradicting messages, by growing up in a specific culture (dominant societal scripts), interacting with others, and experiencing sexual feelings and sensations [30]. Taken together, the two contributions indicate that dynamic adaptive processes of sexual aging are strongly influenced by personal sexual history, as well as (culture-specific) social regulation of sexuality and reflected in age- and gender-specific expectations about sex and sexuality.

Toward a concept and an operationalization of successful sexual aging

The need for an operational concept of positive sexual aging was first raised in 2018 in a panel of European sex researchers who were discussing the findings from a 6-country study on healthy sexual aging [32]. The consultation meeting resulted in an empirically based 7-dimensional concept of positive sexual aging, which in 2021 was validated in a sample of partnered Croatian and Norwegian individuals aged 65 + years (*manuscript under review*). The analyses suggested that a 4-dimensional measure is superior to the initial model. The final measure, the brief Positive Sexual Aging Scale, consisted of four dynamic components: (1) adaptation to aging-related changes in sexual function (2), acceptance of aging-related bodily changes (3), sexual agency, and (4) opportunities for sexual expression.

The first of the four components, older adults' perception of having adapted well to changes in sexual function seems essential for positive sexual aging. Unsuccessful sexual adaptation creates a gap between personal goals and circumstances/abilities, which creates distress, the feeling of helplessness, and feelings of sexual inadequacy [7, 33]. Rigid adherence to "the way I'm used to have sex" can lead to disappointment and, possibly, withdrawing from sex. In contrast, being open to modifying circumstances and activities, employing accommodative strategies-those based on selection, maximization and optimization processes-to experience pleasurable moments [34] and to fit declining capacities, represents positive sexual aging. Commonly employed strategies, which seem to buffer the negative impact of functional and situational losses on later life sexuality, are adjusting or changing comparison standards, aspirations, and needs, as well as redefining sexual expression and the role of sexuality in one's life [20, 35, 36]. Thus, positive sexual aging seems less dependent on (preserved) sexual function than on satisfying adaptation to unavoidable changes.

Another essential element of positive sexual aging is the acceptance of bodily changes. Evidence suggests very heterogeneous experiences of the aging process in relation to bodily appearance [37, 38]. Some older adults experience a gap between their self-perceived age and their physical appearance, which could indicate maladjustment, particularly if accompanied by distress [39]. Others may use a variety of assimilative strategies, such as exercise and cosmetic procedures, to stop or slow down visible but also experiential aspects of aging [40]. However, efforts to remain "youthful" or "ageless" are unsustainable in a longer run, which is where acceptance becomes essential. Older people who manage to accept the aging process by rejecting youthful beauty standards and reevaluating age-specific appearance are characterized by more self-reported freedom, opportunities, feeling of agency, and self-confidence [39, 41]. Embracing a more diverse understanding of beauty appears to be a more efficient aging strategy than resorting to cosmetic procedures.

The third component, sexual agency, represents the ability to set priorities and accomplish personal goals in the realm of sexuality [42]. This construct fits well with the SOC model as it does not set universal behavioral standards [43], but focuses on individuals' adaptive abilities to attain personal goals [26]. Feeling agentic does not necessarily require having a sexual partner [44] or an active sexual life [45]. In qualitative studies of older Polish and Croatian women, increased sexual agency sometimes involved feeling entitled to withdraw from a sexual life [46]. In another qualitative study, older American women reported that sexual agency (e.g., information seeking and adaptation of sexual scripts) was crucial for

maintaining sexual activity in the face of various challenges [47].

Finally, positive aspects of sexual aging were tied to opportunities for sexual expression. In contrast to the previous three constructs that represent inner (i.e., psychological) process, the opportunities dimension represents an external (i.e., social) process. For different reasons, aging is usually characterized by a progressive reduction of opportunities for sexual activity [48, 49]. The shrinking opportunities are due to a lack of privacy, reduced mobility, normative pressures (ageism), social expectations ("older people are asexual") and potential stigmatization, lack of potential partners, etc. Structural aspects should not be overlooked either. Opportunities for sexual expression are often related to socioeconomic status, as is overall adaptation to and acceptance of agingrelated changes [38].

Further conceptual refinements

In June 2024, additional qualitative material on sexual aging was collected from focus groups from three large retirement homes in the Croatian capital city. These qualitative insights and discussions with international experts working with the aging population prompted several conceptual and methodological revisions of the original concept. Firstly, when considering sexual agency from a process-based perspective, age-related changes in sexual agency may be better conceptualized as a part of the overall adaptation than as one of its precursors. It would be more realistic to conceptualize sexual agency as a facet of the adaptation process, which facilitates successful (behavioral) selection and optimization with compensation. Secondly, a question about whether the acceptance and adaptation dimensions should be defined more broadly emerged from the qualitative material. There is little evidence that acceptance is solely related to physical appearance. Older couples and individuals often need to accept that their sexual function has deteriorated or has been hampered by illness. Similarly, adaptation seems also relevant in the context of changing appearance and body image (and not only sexual function), given that older adults may use different strategies to delay aging and/or employ new and more flexible standards of beauty. Consequently, the processes of acceptance and adaptation were re-conceptualized more broadly to enable a more realistic perspective on how older people deal with age-related changes.

The revisions resulted in the final conceptualization of the Successful Sexual Aging Model (SSAM), shown in Fig. 1, which title pays tribute to the continuing importance of the Successful Aging paradigm. More directly, the Adaptation dimension of the SSAM is based on the dynamic elaboration of the SA paradigm provided by the SOC model [16]. The Acceptance dimension was added based on the sexological developmental and scripting literature [29, 30], which highlights the life-cycle-specific



importance of appearance and body satisfaction for sexual expression and satisfaction. The final dimension, Opportunities, reflects the fact that sexual aging is inevitably embedded in social, cultural, and economic reality over which individuals most often have only imperfect control.

Although all three core dimensions of the SSAM are interrelated-changes in Acceptance or Adaptation, or both, can lead to changes in Opportunities (e.g., a failure to adapt to a declining sexual function can lead to a reduction in opportunities for sexual expression), and vice versa-the relation between the two intrapersonal processes is assumed to be the central one and strongest in size. Several micro (e.g., personal sexual history), mezzo (shrinking social networks) [50], and macro factors (social norms and beliefs about aging and sexuality) are theorized to influence the three dimensions and their interrelationships. To avoid the central limitation of the brief Positive Sexual Aging Scale, the fact that each of its four items represented a complex psychosocial process, the operationalization of the SSAM focused on a multiitem assessment of the multi-dimensional SSA construct.

The current study

Based on the conceptual model described, the current study focused on developing and validating a multi-faceted measure of positive sexual aging to be used in a wide range of studies focusing on older adults' sexuality and well-being. More precisely, we operationalized the SSAM by developing a multi-dimensional process-focused measure and validating it in two European countries, Croatia and Germany, using community samples of older individuals. In addition, we aimed to demonstrate that the measure can be used to compare successful sexual aging levels across age, gender, and country.

Method

Participants and procedures *Croatian study*

In June 2024, 200 partnered women and men aged 65 + years were surveyed using a national commercial online panel of adults. Of the contacted 3,142 older adults, 541 agreed to take the survey about sexual health in the aging population, and 200 completed it (55% of participants were women), producing a response rate of 17% and a completion rate of 37%. Planned sample size (n = 200) was determined by limited study funding. Hence, the analyses presented here should be considered preliminary. The employed sampling strategy was typical for commercial online panels. A quota sampling procedure, in which individuals initially recruited through probability-based public opinion surveys were randomly selected into corresponding quotas, was applied to broadly reflect the national population aged 65 + years

in six traditionally distinct regions and different settlement sizes (four categories were used: village, small town, large town, metropolitan dwelling). All participants provided active informed consent prior to accessing a brief online questionnaire. The average time to complete the questionnaire was seven minutes. All study procedures were approved by the Research Ethics Committee of the Department of Sociology, Faculty of Humanities and Social Sciences at University of Zagreb.

German study

Data was collected in October and November 2024 using an online questionnaire programmed with Qualtrics XM and administered through an anonymous link. The study was a multi-themed online survey on sexual and reproductive health in Germany, preregistered under https:/ /doi.org/10.17605/OSF.IO/ZB3RQ. The study received ethical approval (LPEK-0814) from the Local Psychological Ethics Committee at the Center for Psychosocial Medicine, University Medical Center Hamburg-Eppendorf. Participants were recruited through an incentivized online panel of the European marketing and social research institute Bilendi GmbH. Randomized quota sampling procedure was applied to reflect the composition of the German online population between 18 and 75 years in terms of age groups distribution, gender, education, and regional distribution. Of 103,677 panelists who were invited to participate in the study, 13,777 accessed the questionnaire (13.3% participation rate). During data cleaning procedures, 5,056 individuals were excluded due to: not signing the informed consent (n = 411), completing survey faster than 50% of the median time (n = 2,596), being underaged or not residing in the country (n = 4), or failing attention checks (n = 2,045). Median time to complete the online questionnaire was 36 min. Only partnered (n = 895; 34.2% of women) and non-partnered participants (n = 442, 48.2% of women) aged 65 + years were selected for the current study.

Measures

Successful sexual aging items

Focusing on the four recently identified domains of positive sexual aging (manuscript under review), the authors of this study developed 18 items to capture the processes of selection, optimization, and compensation within each domain (see questionnaire in the supplementary material). The items were pre-tested for content validity and comprehensiveness by employing cognitive interviewing. In May 2024, 11 short interviews were carried out with partnered and non-partnered older women (n = 6) and men (n = 5), whose age varied from 69 to 90 years. All proposed items were perceived to be intuitively clear and meaningful. The following 18 items were included in the questionnaire: five denoting adjustments to aging-related changes in sexual expression, three describing sexual agency, five indicating acceptance of aging-related changes in appearance, and five denoting opportunities for sexual expression. Responses were recorded using a 4-point scale that ranged from 1 = it does not relate to me, to 4 = it completely relates to me. Responses to the opportunity items were reversed, so that higher scores denoted more opportunities for (i.e., less obstacles to) personal sexual expression. It should be noted that responses in the German sample were anchored using a 5-point scale ranging from 1 = it does not relate to me at all, to 5 = it completely relates to me.

Sociodemographic characteristics and health status

Apart from participant's gender and age, subjective age was also assessed, but only in the Croatian sample ("Regardless of your actual age, how old do you feel?"). Self-reported health status was indicated using the standard single-item indicator ("In general, would you say your health is..."). Responses were anchored on a 5-point scale ranging from 1 = excellent to 5 = poor. In the German sample, the standard 4-point scale (1 = poor, 4 = very good) was used to record answers. The scale scores were reversed, so that higher scores denote better health in both samples.

Social isolation

was assessed only in the Croatian sample using the 3-item (e.g., "How often do you feel left out?") revised UCLA Loneliness Scale [51]. Response options ranged from 1 = never to 4 = often, with higher scores indicating greater isolation. Internal consistency for the scale was good (McDonald's $\omega = 0.87$).

Depression and anxiety symptoms

were measured using by the Hopkins Symptom Checklist SCL-5 (e.g., Feeling fearful; Feeling hopeless about the future) [52]. The Checklist employs a four-point scale (1 = not at all to 4 = extremely), with higher scores denoting higher depression/anxiety. The 5-item measure had good reliability (McDonald's ω = 0.89). In the German sample, four items (Patient Health Questionnaire [PHQ-2] and Generalized Anxiety Disorder Scale [GAD-2]) [53, 54] were used to indicated symptoms of depression and anxiety within the past two weeks. A 4-point scale, ranging from 1 = not at all, to 4 = nearly every day, was used to record the frequency of symptoms. The 4-item measure had satisfactory reliability (ω = 0.87).

Positive attitudes toward older adults' sexuality

were tapped into with the 5-item measure developed in the Štulhofer et al. (*manuscript under review*) study (e.g., "Sex has no role in the life of older people" and "Sex in aging couples is for pleasure"). Five-point Likert-like scale was used to record responses (1=strongly disagree, 5=strongly agree). In the current study, all items loaded strongly (>0.77) on a single factor that explained 71% of the variance in item variability. The measure, not included in the German questionnaire, had good internal consistency (McDonald's ω =0.89). The higher the factor scores, the more positive perspective on older adults' sexuality.

Life satisfaction

was assessed by asking participants how satisfied, in general, they are with their life: Answers ranged from 1 = completely dissatisfied, to 5 = completely satisfied in the Croatian sample. In the German sample, a 7-point anchoring scale was used.

Relationship satisfaction

was assessed only in the German sample. It was assessed by the four item Couple's Satisfaction Index (e.g., "How rewarding is your relationship with your partner?" and "In general, how satisfied are your with your relationship?"; [55]). A six-point scale ranging from 1 = not at allto 6 = completely was used to record answers. The measure had good reliability (McDonald's $\omega = 0.80$).

Satisfaction with the role of sex in life

was indicated with a single item indicator ("Regardless of whether you are sexually active or not, how satisfied are you with the role that sexuality plays in your life"). Answers were recorded on a 7-point scale ranging from 1 = very dissatisfied, to 7 = very satisfied. In the German sample, a single-item indicator of sexual satisfaction was used ("Overall, I am satisfied with my sex life"), with answers ranging from 1 = does not relate to me at all, to 5 = it completely relates to me.

In the Croatian sample, *sexual activity* was asked about with the following question: "Were you sexually active in the past 12 months? By sexual activity we refer to masturbation or any kind of partnered sex." The answers were 0 = sexually inactive, and 1 = sexually active. In the German sample, sexual activity was specified as sexual intercourse.

Analytical strategy

The logic and temporal sequence of the scale construction and validation procedures presented here largely follow the guidelines recently suggested by Boateng et al. [56]. Exploratory factor analysis (EFA) with promax oblique rotation was used in the Croatian sample for item reduction based on item-to-conceptualized dimension mismatch. To confirm the robustness of 3-dimensional structure of the measure, confirmatory factor analysis (CFA) with robust maximum likelihood estimator was employed in a substantially larger sample of partnered German individuals. Satorra-Bentler scaled chi-square test was used to account for data non-normality. An additional CFA was carried out in the German sample of non-partnered individuals to further validate the measure in single older women and men. The SSAS items were originally developed in Croatian and then translated in English by the first author of the study. The translation was checked by a colleague who is a native English speaker. German wording was obtained by applying a back translation procedure, which is frequently used in cross-cultural research [57], whereby the second author translated items from English to German, while another German colleague translated them back to English to be reviewed by the first study author.

Five absolute and relative/incremental indices of model fit (χ^2 , TLI, CFI, RMSEA, and SRMR) were used to evaluate model fit, with TLI and CFI values ≥ 0.95 , RMSEA values ≤ 0.05 and SRMR values ≤ 0.05 indicating good fit [58–61].

To explore measurement invariance across age and gender, we employed a multi-group CFA with parameters progressively constrained to equality between two age groups (Croatia: 65–74 and 75+years; Germany: 65-69 and 70-75 years) and genders. The CFI and RMSEA difference tests were employed to assess configural, measurement, and scalar invariance. For higher levels of invariance to be achieved, < 0.01 change in CFI and <0.015 change in RMSEA values were required [62]. Attaining at least a partial scalar invariance was considered the necessary condition for direct comparisons of SSAS scores between age and gender groups [63, 64]. Using multi-group testing, we also explored possible cultural specificity of the measure used for CFA and structural equation modeling to account for data non-normality.

Average variance extracted (AVE) method and bivariate structural equation modeling (latent dependent variable was regressed on a set of manifest independent variables) explored construct validity of the SSAS. Following standard guidelines, AVE values over 0.50 (> 50% of variance in items is explained by a latent construct) indicated convergent validity [65]. Based on the literature on aging sexuality [9, 49, 66], we additionally expected moderate to strong positive associations between the SSAS scores and positive attitudes toward older people's sexuality, life satisfaction, and self-reported health. Small to moderate links with subjective age (negative) and sexual activity (positive) were also expected, as well as a weak link to sexual activity in the past 12 months. Moderately strong negative associations are expected between the SSAS scores on the one hand, and social isolation and depression and anxiety symptoms on the other hand.

In the Croatian sample, no missing information was observed on the indicators of interest. Missing

information in the German sample amounted to less than 1% and was treated using full information maximum likelihood. All statistical analyses were carried out using IBM SPSS 22 and JASP v0.19.3 [67] statistical software packages.

Results

Sample sociodemographic characteristics

Participants' age in the Croatian sample was in the 65-85 years range ($M_{\text{age}} = 71.2$, SD = 5.1). All participants were partnered, with the majority (83.6%) married and living together with a spouse. On average, the reported relationship started more than four decades ago. Half of the sample reported a secondary education (50.7%). Expectedly for a survey focusing on aging and sexuality, the proportion of participants with college or university degrees were substantially higher (40.8%) than in the respective national age cohort. Asked about changes in their cognitive capacities in the past two years, most participants reported no perceptible change (77.1%). Interestingly, no participants reported mental decline, but the percentage of those who refused to provide an answer was the highest in the survey (18.4%). Most participants (64.7%) reported acceptable or good health. Very good to excellent general health characterized one fourth of the sample (24.9%), while 10.5% of participants described their health as bad. We observed no significant gender difference in self-reported health status.

In the German sample ($M_{age} = 69.2$, SD = 3.0), most individuals were partnered at the time of the survey (68.7%). On average, the duration of their relationship or marriage was 37.4 years. Regarding education, 45.9% of participants reported secondary and 29.5% tertiary education. The latter proportion of the national population in the respective age cohort is around 19%. Comparably to the somewhat older Croatian participants, most participants in the German sample reported moderated or good health (88.6%), with good or very good health characterizing slightly over a half of the sample (52.2%). As in the Croatian sample, no substantial gender difference in health status was observed.

Item reduction, dimensionality exploration, and reliability in the croatian sample

An EFA with an oblique (*promax*) rotation was carried out with 17 items (the 18th item is intended only for non-partnered older individuals). Parallel analysis initially suggested a 4-factor solution. After omitting two items with high uniqueness (>0.75), Acceptance items loaded on the first latent dimension, Opportunities items loaded on the second factor, while the third and fourth factors each contained two Adaptation and an agency item (see Table 1). Unlike the third factor, which was moderately-to-strongly correlated with the first

 Table 1
 Exploratory factor analysis of items intended to indicate successful sexual aging (factor loadings)

Dimension	Factor 1	Factor 2	Factor 3	Factor 4
Acceptance 1*	0.95			
Acceptance 2*	0.91			
Acceptance 3*	0.75			
Acceptance 4	0.46			
Opportunities 1*		0.79		
Opportunities 2*		0.77		
Opportunities 3*		0.76		
Opportunities 4		0.39		
Adaptation 5*			0.91	
Adaptation 1*			0.80	
Agency 1*			0.56	
Adaptation 3				0.83
Adaptation 2				0.63
Agency 2				0.51

Notes. Nine items selected for further validation are marked with asterisk

two factors—reflecting the conceptualization based on inter-related psychosocial processes—the fourth factor was only marginally associated with the first two latent dimensions, which resulted in dropping the factor. The remaining 11 items were further reduced by removing an Opportunity item and an Acceptance item with poor loading. When tested with CFA, the fit of this final 9-item SSAS was good: $\chi^2 = 40.6$, df = 24, TLI = 0.957, CFI = 0.972, RMSEA = 0.059 (90% CI = 0.027–0.087), SRMR = 0.046.

Reflecting the conceptualization of SSAM, all three latent dimensions were significantly and moderately related (r=.22– 0.49, p <.001). Correlation between the two internal processes (Acceptance and Adaptation) was expectedly the strongest (r=.49), followed by the link between Adaptation and Opportunities (r=.42). Reliability indices for the three dimensions (Acceptance: ω = 0.88; Opportunities: ω = 0.78; Adaptation: ω = 0.80), as well as the whole measure (ω = 0.88), were all satisfactory.

Testing for robustness in the German sample

In the next step, the 9-item model was explored for robustness in the large-scale sample of partnered German individuals. Good fit ($\chi^2 = 87.0$, df = 23, TLI = 0.959, CFI = 0.974, RMSEA = 0.056 [90% CI = 0.045-0.067], SRMR = 0.050) was obtained after an error covariance was allowed between two logically overlapping items: "At my age, I still try to look good" and "I still find things about my appearance that another person may find attractive", as suggested by modification indices. Reliability of the dimensions (Acceptance: $\omega = 0.62$ [without the error covariance = 0.79]; Opportunities: $\omega = 0.76$; Adaptation: $\omega = 0.80$) and the total scale ($\omega = 0.78$) was acceptable.

After replacing one of the three Opportunities items ("My partner's negative reactions") with a more

meaningful wording ("Difficulties in finding a suitable partner") for older individuals who are not in a relationship or married, we also tested measure in non-partnered German participants. Again, good fit was obtained (χ^2 = 30.8, *df* = 23, TLI = 0.988, CFI = 0.992, RMSEA = 0.028 [90% CI = 0.000-0.050], SRMR = 0.028) once the error covariance between two Acceptance items was allowed. Reliability of dimensions (Acceptance: ω = 0.58 [without the error covariance = 0.81]; Opportunities: ω = 0.53; Adaptation: ω = 0.79) and the whole measure (ω = 0.77) was also acceptable, except for the Opportunities construct. Its reliability was reduced by weak associations between the "Difficulties in finding a suitable partner" item and the other two Opportunities items.

Overall, the testing in the large-scale German sample replicated the structure of the SSAS in partnered older women and men, and partially in their non-partnered peers.

Measurement invariance testing across the two countries

We first tested age and gender invariance of the measure in the Croatian sample using multi-group CFA. Full scalar invariance was observed between the two age groups (65–74 and 75–85 years) and a partial scalar invariance between female and male participants (Table 2), which was achieved by allowing the Agency item ("I always clearly communicate to my partner what I like and dislike in sex") to freely estimate in two groups. The younger participants were characterized by significantly higher latent mean Opportunities and Adaptation scores (M=0.86, p=.002 and M=0.76, p<.001, respectively) compared to older participants. When comparing Croatian women and men, a significant difference was observed only in Acceptance dimension, with women scoring somewhat higher than men (M=0.25, p=.003).

In the partnered German sample, full scalar invariance was obtained across age and gender groups. Compared to older participants (70–75 yrs.), those in the younger group (65–69 yrs.) had substantially higher latent Acceptance and Adaptation mean scores (M=0.09, p<.004 and M=0.29, p<.001, respectively). We observed no gender specificity in the three latent constructs.

Similar findings were obtained in the non-partnered German sample. Full scalar invariance was achieved across age groups and a partial scalar invariance across gender, achieved after unconstraining the two Acceptance items with shared error variance. The older age group reported a significantly lower mean Adaptation score than the younger age group (M = -0.29, p = .014). In contrast to partnered German participants, non-partnered female participants were characterized by somewhat higher Acceptance (M = -0.12, p = .026), but lower Adaptation (M = -0.35, p = .003) than their male peers.

Croatian sample: Invariance levels across age groups				
	CFI	ΔCFI	RMSEA	ΔRMSEA
Configural invariance	0.969		0.056	
Metric invariance	0.977	0.008	0.050	0.006
Scalar invariance	0.978	0.001	0.045	0.005
Croatian sample: Invariance	levels acro	ss gender		
	CFI	ΔCFI	RMSEA	∆RMSEA
Configural invariance	0.944		0.078	
Metric invariance	0.944	0.000	0.078	0.000
Scalar invariance	0.937	0.007	0.079	0.001
German partnered sample:	Invariance	levels acros	ss age group:	5
	CFI	ΔCFI	RMSEA	∆RMSEA
Configural invariance	0.968		0.071	
Metric invariance	0.965	0.003	0.070	0.001
Scalar invariance	0.966	0.001	0.063	0.007
German partnered sample:	Invariance	levels acros	ss gender	
	CFI	ΔCFI	RMSEA	∆RMSEA
Configural invariance	0.965		0.074	
Metric invariance	0.964	0.001	0.070	0.004
Scalar invariance	0.967	0.003	0.062	0.008
German non-partnered sam	nple: Invaria	ance levels	across age gi	roups
	CFI	ΔCFI	RMSEA	∆RMSEA
Configural invariance	0.992		0.030	
Metric invariance	0.994	0.002	0.023	0.007
Scalar invariance	0.986	0.008	0.034	0.011
German non-partnered sam	ple: Invaria	ance levels	across gende	er
	CFI	∆CFI	RMSEA	∆RMSEA
Configural invariance	0.993		0.028	
Metric invariance	0.991	0.002	0.029	0.001
Partial scalar invariance	0.988	0.003	0.031	0.002
Invariance levels across the A	two count	ries		
	CEL	ACEL	RMSEA	ARMSEA
Configural invariance	0.941		0.085	
Metric invariance	0.939	0.002	0.082	0.003
Partial scalar invariance	0.936	0.003	0.080	0.002
В				
Configural invariance	0.939		0.087	
Metric invariance	0.935	0.004	0.085	0.002
Partial scalar invariance	0.931	0.004	0.085	0.000
С				
Configural invariance	0.933		0.079	
Metric invariance	0.938	0.005	0.078	0.001
Partial scalar invariance	0.933	0.005	0.078	0.000
D				
Configural invariance	0.955		0.071	
Metric invariance	0.952	0.003	0.069	0.002
Scalar invariance	0.950	0.002	0.068	0.001

 Table 2
 Measurement invariance testing of the 9-Item SSAS across age and gender Groups, and countries

Cross-cultural differences

To explore measurement invariance across the two countries, the German sample of partnered older adults was randomly split into four smaller samples (n = 199,

200, 220, and 250, respectively) to avoid the problem of underestimating differences due to larger sample bias in multi-group analysis with unequally-sized samples [68]. Consequently, four separate measurement invariance tests were carried out, with partial scalar invariance attained in the first three cases and full scalar invariance obtained in the remaining case (see Table 2). In two cases, partial scalar invariance required unconstraining only the Agency item, while in the third case the Agency and two Acceptance items (those that shared error variance in the German sample) had to be released to estimate freely across the two samples.

In all three cases, older Croatian participants were characterized by significantly lower Adaptation latent mean scores (M = -0.25 - -0.39, p < .001) than their German peers. Cohen's *d* values, which ranged from 0.22 to 0.35, point to a small difference. No significant differences in Acceptance and Opportunities scores were observed between the two countries.

Validity testing

In the Croatian sample, AVE values for the three latent dimensions were 0.70, 0.55., and 0.57, respectively. In the partnered German sample, the values were 0.49 (0.56 without the error covariance), 0.51, and 0.57, respectively, and in the non-partnered samples 0.44 (0.58 without the error covariance), 0.31, and 0.57. The unsatisfactory value for the Opportunities latent dimension in the non-partnered German sample was caused by a small loading ($\lambda = 0.32$) for the "Difficulties in finding a suitable partner" item. This and the finding that the Opportunities dimension was only marginally related to the other two latent dimensions indicates the need for further testing of the SSAS in non-partnered individuals.

Next, the SSAS was bivariately regressed on several relevant constructs using structural equation modeling to account for the latent dependent variable (for the analysis, the SSAS was specified as a second-order factor). As shown in Table 3, the measure was, expectedly, moderately related to positive attitudes toward older people's sexuality ($\beta = 0.30$, p < .001) and moderately-tostrongly associated subjective age ($\beta = -0.52$, *p* <.001), life satisfaction ($\beta = 0.59$, p < .001), satisfaction with the role of sex in one's life ($\beta = 0.53$, p < .001), and self-reported health ($\beta = 0.50$, p < .001). Small to moderate (negative) links with depression and anxiety symptoms ($\beta = -0.27$, p = .007), and social isolation ($\beta = -0.37$, p < .001) were also observed. Contrary to expectations, the link between SSAS scores and sexual activity in the past 12 months was particularly strong ($\beta = 0.69$, *p* <.001).

Overall, the associations in the German sample were of somewhat smaller size. Among partnered older women and men, SSAS scores were weakly correlated to relationship satisfaction (β =0.21, *p*<.001) and moderately

 Table 3
 Bivariate associations between the 9-item SSAS and

 Validation-relevant constructs in the Croatian and German
 samples

Croatian sample	β	SE	р
Depression and anxiety symptoms	-0.27	0.05	0.007
Social isolation		0.05	< 0.001
Positive attitudes toward sexual aging		0.05	< 0.001
Subjective age		0.00	< 0.001
Self-reported health status		0.04	< 0.001
Life satisfaction	0.59	0.04	< 0.001
Satisfaction with the role of sex in one's life	0.53	0.04	< 0.001
Sexual activity in the past 12 months (1 = yes)	0.69	0.09	< 0.001
German partnered sample		SE	р
Depression and anxiety symptoms	-0.29	0.04	< 0.001
Self-reported health status	0.30	0.04	< 0.001
Life satisfaction	0.33	0.04	< 0.001
Relationship satisfaction	0.21	0.04	< 0.001
Sexual satisfaction	0.46	0.01	< 0.001
Sexual activity in the past 12 months (1 = yes)	0.46	0.03	< 0.001
German non-partnered sample	β	SE	р
Depression and anxiety symptoms	-0.24	0.03	< 0.001
Self-reported health status	0.20	0.04	< 0.001
Life satisfaction	0.23	0.02	< 0.001
Sexual satisfaction	0.44	0.01	< 0.001
Sexual activity in the past 12 months (1 = yes)	0.20	0.07	0.03

Notes. β = standardized path coefficient; SE = standard error

associated with depression and anxiety symptoms ($\beta = -0.29$, p < .001), self-reported health ($\beta = 0.30$, p < .001), and life satisfaction ($\beta = 0.33$, p < .001). Moderate to strong links were found with sexual satisfaction and sexual activity ($\beta = 0.46$, p < .001 in both cases). Comparable findings were observed in non-partnered participants, with a notably weaker association between SSAS scores and sexual activity in the past 12 months ($\beta = 0.20$, p = .03), compared to their partnered peers. Combined with CFA results, the findings indicate that the German version of the SSAS is a metrically valid measure of positive sexual aging. The nine SSAS items are listed in Table 4.

Discussion

There is evidence suggesting that the importance of sexuality is increasing among older adults [1, 2]. Although positive aspects of sexual aging have been recognized and addressed in sexological literature, conceptually grounded measures of positive sexual aging are currently lacking. Thus, the current study aimed to: (a) build a dynamic conceptual model of successful sexual aging (the SSAM), (b) operationalize the concept as a multi-dimensional process-focused measure (the SSAS), (c) validate the new measure in two countries, and (d) demonstrate that the measure can be used to compare levels of successful sexual aging across age groups, gender, and cultures. Informed by the social gerontological theory of successful aging, as well as by sexological life cycle and the sexual scripts models, the SSAM incorporates

 Table 4
 English and German versions of the successful sexual aging scale (SSAS)*

Dimension	Item
Acceptance	At my age, I still try to look good. In meinem Alter versuche ich immer noch gut auszusehen.
Acceptance	l still find things about my appearance that another person may find attractive. Ich finde immer noch Dinge an meinem Aussehen, die eine andere Person attraktiv finden könnte.
Acceptance	Older people like me can be sexually attractive despite aging-related changes. Ältere Menschen wie ich können trotz altersbedingter Veränderungen sexuell attraktiv sein.
Opportunities ^a	Current circumstances in which I live (e.g., lack of privacy) Die aktuellen Umstände, unter denen ich lebe (z. B. Mangel an Privatsphäre.
Opportunities ^a	Concerns about negative reactions of people around me. Besorgnis über negative Reaktionen der Menschen in meiner Umgebung.
Opportunities ^a	My partner's negative reactions. (Difficulties in finding a suitable partner.) ^b Die negativen Reaktionen meines Partners/meiner Partnerin. (Schwierigkeiten bei der Such nach einem geeigneten Partner oder Partnerin.) ^b
Adaptation	Despite my age, I can still enjoy sex. Trotz meines Alters kann ich Sex noch genießen.
Adaptation	l am content with how, at my age, my body reacts to sexual touch. Ich bin damit zufrieden wie mein Körper in meinem Alter auf sexuelle Berührungen reagiert.
Adaptation (agency)	l always clearly communicate to my partner what I like and dislike in sex. Ich teile meinem Partner/Partnerin immer klar mit, was ich beim Sex mag und was nicht.

Notes

* The following 5-point scale is used to anchor answers: 1 = it does not relate to me at all, 2 = it relates to me a little, 3 = it somewhat relates to me, 4 = it relates to me a great deal, 5 = it completely relates to me

^aOpportunities items are preceded by the following question: "To what extent are the following things obstacles to your being sexually active as you would like? If you currently feel no need for sexual expression, please provide your answers imagining a situation in which you would like to experience something sexual." Responses to four items are reversed, so that higher scores indicate lower perceived obstacles

^b When surveying non-partnered individuals, the item should be used instead of the preceding one

three interrelated processes (Acceptance, Adaptation, and Opportunities) that are theorized to underlie positive and functional reactions to aging-related changes in sexuality and sexual expression.

Using a sample of older partnered Croatian individuals, the 9-item SSAS was developed and validated. The structure of the measure was then confirmed in a large-scale German sample of partnered and non-partnered older women and men. The measure demonstrated acceptable reliability and validity in both groups of participants, although convergent validity was only partially supported in the non-partnered group. The SSAS was significantly related to a host of relevant constructs, such as positive attitudes toward older people's sexuality, life satisfaction, relationship satisfaction, sexual satisfaction, subjective health status, subjective age, social isolation, as well as depression and anxiety symptoms, in both countries. All correlation signs were in the expected direction and effect sizes in the expected range, except for the link between successful sexual aging and sexual activity in the past 12 months-which was considerably stronger, particularly in the Croatian sample, than expected.

The SSAS exhibited measurement invariance across age and gender groups, and was acceptably invariant across the two countries. After measurement invariance was established, we compared group-specific levels of the three successful sexual aging dimensions. Two consistent differences emerged. Firstly, participants in the younger age groups scored consistently higher in Adaptation than those in the older age groups. The finding is not surprising given that the process of aging has been consistently (and negatively) associated with sexual function, primarily through reduction in sexual desire, declining erectile function, more frequent difficulties in reaching orgasm, and increased risk of sexual pain disorders [49, 69, 70]. Secondly, participants in the Croatian sample reported significantly lower Adaptation scores than their German peers.

Although Croatian participants were a couple of years older than their German peers, this age difference cannot fully account for their Adaptation discrepancy. The country-specific Adaptation levels-together with the difference in average levels of sexual agency (defined as the ability to communicate sexual likes and dislikes to one's partner)may reflect substantial differences in cultural norms, as well in the standard of life and socioeconomic status of older people in the two countries. According to the Eurostat, purchasing power adjusted GDP per capita in 2022 was 25,900 US\$ in Croatia and 42,400 US\$ in Germany. The same year, the average GDP per capita PPA in the European Union amounted to 36,600 US\$. Although further and more detailed testing in diverse cultural settings is necessary for better understanding of sociocultural influences on sexual aging, the role of specific social norms that regulate sexuality (e.g., sexual ageism), and corresponding values (e.g., gender equality), has been strongly implicated in the literature [6, 71]. According to the European Union Gender Equality Index, in 2022 Germany ranked 10th, with the score of 72, and Croatia 24th, with the score of 59.7, among 27 EU countries. Mean index score for the EU was 71.

Several other findings deserve a brief discussion. Firstly, there are statistical indications that the processes of Acceptance of and Adaptation to aging-related changes partially overlap. Because our study design precludes any conclusion about whether the two processes develop simultaneously or sequentially (e.g., adaptation following acceptance), or if both processes deal with changes in physical appearance *and* sexual function (perhaps in different ratios), future explorations should address these current dilemmas.

Secondly, of the associations between the SSAS and the constructs chosen for validity testing, the links with sexual activity, sexual satisfaction, and life satisfaction were, overall, the strongest. Given that the associations with other sexuality-related constructs are hardly surprising, the observed relation between SSAS levels and life satisfaction underscores—with a caveat that it cannot be generalized to all aging adults in the two countries—an important role of positive sexual aging in older people's eudemonic wellbeing. This is further supported by findings about positive associations with subjective health and negative relations with social isolation and adverse psychological health.

Thirdly, SSAS scores were strongly linked to the indicators of sexual activity-contrary to our expectations. The finding that the effect size was higher in the Croatian than the German sample is likely the consequence of the operationalization of sexual activity, which was broader in the former case, and more in line with findings about the diminishing importance of penetrative sex for older women and men [43]. As was recently demonstrated in a qualitative assessment of older Polish and Croatian women sexual histories [46], continuing sexual activity is not a prerequisite for being content with one's sex life. The cessation of sexual activity may not always be the consequence of negative experiences, health difficulties, partner's withdrawal, or a lack of partner. Sexual inactivity can also be a (distress-free) decision based on memories of a highly satisfying sex life with a deceased partner combined with a belief that such experiences would be impossible to recreate with someone else. Notably, sexual inactivity is here defined in behavioral terms, which does not imply the absence of sexual fantasies or erotic recollections. What the current study findings add to this perspective is that successful sexual aging, while it does not overlap with sexual activity, is more often than not tied to some form of partnered or solitary sexual expression. In cases where successful sexual aging is not accompanied by sexual activity, a lack of distress about sex life is postulated.

Although relationship satisfaction was only assessed in the German study, its substantial association with SSAS scores, albeit of small size, is in line with the literature on aging and sexuality. It has been consistently reported that the quality of relationship, emotional closeness, and relationship satisfaction are highly important for sexual activity, distress about sexual function, and sexual satisfaction in older age [4, 43, 72–74]. Future assessments of the SSAS should include various indicators of relationship quality and emotional intimacy to explore this important correlate of sexual aging in more detail.

Clinical relevance

The SSAM and its proposed operationalization also have clinical ramifications. The idea of positive sexual aging is an important contrast to the frequently encountered view that aging is a process of general decline, which is often accompanied by the notion that aging progressively "asexualizes" people [71, 75]. More specifically, focusing on answers to different groups items (i.e., those depicting acceptance, adaptation, and opportunities), a clinician can get an initial idea about where an intervention should be primarily directed to one (or both) of the internal processes or is counseling on current living conditions more appropriate. In dyadic assessments (with both partners filling the questionnaire), applying a similar logic may provide useful insights about the couple's dynamics of sexual aging.

The concept of SSA (SSAM) may also serve as a useful perspective to counter sexual ageism, as an evidence-based framework for educating older people, as well as health and residential care providers, on positive sexual aging [76, 77]. In the first case, we believe that a popular dissemination of the concept that emphasizes three distinct and intuitively meaningful processes may improve the understanding of sexual aging in general audience and, consequentially, increase the acceptance of sexuality in older people-or at least assist in decreasing sexual ageism. In addition, the SSAM could serve both as a promotion of positive sexual aging (similarly to the role of Successful Aging paradigm in the advancement of active and adaptive aging) and as a blueprint for an educational intervention. Either as an online tool, a brochure, or a brief and interactive educational program, the idea of the interrelated three key processes that underlie positive sexual aging has a potential for assisting older individuals in embracing a more positive and practical perspective on sexual aging. Similarly, for professionals working with older people, either in institutional or noninstitutional settings, the SSAM offers general guidelines about what needs to be addressed, facilitated, and/or challenged in working with clients who experience sexual aging.

Study strengths and limitations

The current study offers the first conceptualization and systematic operationalization of positive sexual aging. The proposed multi-dimensional measure of successful sexual aging, the SSAS, was found metrically sound and performing comparably well in partnered and nonpartnered individuals in two culturally distinct European countries. The applied online survey mode provided more privacy, which likely increased openness and improved data validity. The study also has several limitations. The fact that highly educated older individuals were overrepresented in both countries warrants against uncritical generalization of the current findings to lower educated older women and men. In addition, we should note that the relatively small size of the Croatian sample likely provided sufficient power for EFA and CFA analyses, given the number of factors and communality levels [78], but not for multigroup (age and gender) comparisons. This was somewhat compensated by the size of the German sample in which age and gender measurement invariance test confirmed the pattern observed in Croatian data.

Given the lower internal consistence of some subscales in the German compared to the Croatian sample, and considering that a partial scalar invariance was observed across the two countries, cross-population universality of the SSAS should be assumed only with due caution. Although the different SSAS item scoring scales in the two countries (four in Croatia vs. five points in Germany) may seem to be problematic for direct comparisons, the high-level of cross-cultural invariance achieved (only one of the nine item intercepts had to be unconstrained to estimate freely in each sample) indicates that the potential difference in data variability across countries may not be a substantial concern. This is corroborated by an empirically-based suggestion that 4- and 5-point response scales demonstrate similar psychometric outcomes [79].

The culture-specificity of our findings remains an open question, particularly within a broader cultural context. Future assessments with culturally more heterogeneous samples will be needed to address the question in a more robust and systematic manner. Apart from the standard research limitation in the social sciences (self-reported nature of the data), an important additional limitation for the current study is the sampling bias. The fact that more educated (and, thus, likely more sexually open and permissive) participants were overrepresented in both samples, warrants against generalizing our findings to all older individuals in Croatia and Germany.

Conclusion

The study presented a new concept of positive sexual aging (the SSAM) and its operationalization (the SSAS). Building on the social gerontological theory and conceptual insights from the field of sex research, the SSAM is based on three interrelated process that underlie positive sexual aging: Acceptance of and Adaptation to aging-related changes, and Opportunities for sexual expression. Although additional validation in culturally more heterogeneous samples is needed, the SSAS may be useful in a range of quantitative assessments of the role of sexuality in older people's life, health, and well-being, as well for promoting positive sexual aging in educational and clinical work with older population.

Supplementary Information

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Supplementary Material 1

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Author contributions

AŠ, IL, and GK developed the scale and collected the Croatian data. LP collected the German data. AŠ conducted the analyses and drafted the manuscript. IL, GK, and LP provided critical feedback on the analyses and contributed to shaping the manuscript. All authors read and approved the final manuscript.

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Data availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

All study procedures were approved by the Research Ethics Committee of the Department of Sociology, Faculty of Humanities and Social Sciences at University of Zagreb (reference number: 14-2023/2024), and the Local Psychological Ethics Committee at the Center for Psychosocial Medicine, University Medical Center Hamburg-Eppendorf (reference number: LPEK-0814). The research carried out in compliance with the Declaration of Helsinki.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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