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Sexual Orientation, Preferences, and Gender Identity: Health, Cognition, and Life History Strategies

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ABSTRACT

Background: The interplay between sexual orientation, preferences, and gender identity is essential for understanding sexual and psychological health. This study examines how these factors are linked to cognitive performance, personality traits, and life history strategies.

Objective: To explore the relationships between sexual orientation, sexual preferences, gender identity, and their associations with health, cognition, and life history strategies in a large, diverse sample.

Methods: Data were collected from 5,307 internet users through a 50-minute survey assessing personality, health (physical and mental), cognitive performance, and life history strategies. Prevalence rates of various sexual orientations, gender identities, and preferences were calculated, and their relationships with cognitive performance and health were analyzed.

Results: Bisexuality emerged as the most prevalent non-heterosexual orientation (40.02% of women, 25.35% of men), followed by homosexuality (2.17% of women, 3.47% of men) and asexuality (0.34% of women, 0.11% of men), with heterosexuality being the most common (57.82% of women, 71.18% of men). A small proportion of participants identified as transsexual (0.23% of women, 0.22% of men), with a notable percentage reporting gender identity incongruence. Bisexual participants exhibited superior cognitive performance but reported worse health and lower reproductive success compared to heterosexuals. Additionally, 50% of men and 40% of women reported sexual arousal related to dominance/submission dynamics, with gender differences in preference for dominance or submission. Age-related declines were observed in same-sex arousal, alongside shifts in gender identity and sexual partner counts across the lifespan.

Conclusions: This study presents a novel theoretical framework for understanding sexual orientation and gender identity through life history theory, shedding light on the cognitive, behavioral, and health-related patterns associated with these factors.

Keywords: Asexuality; homosexuality; bisexuality; heterosexuality; transgender individuals; BDSM; Masochism; sadism; life history strategy.

Introduction

Understanding sexual orientation, sexual preferences, and gender identity is critical for advancing individual psychological and social health. Sexual orientation plays a substantial role in shaping psychological well-being and social interactions. For instance, bisexual individuals are often exposed to higher levels of stigma, resulting in elevated mental health challenges compared to their heterosexual and homosexual peers. A study by Bostwick et al. (2010) (Bostwick, Boyd, Hughes, & McCabe, 2010) found that bisexual individuals had higher rates of mood and anxiety disorders, substance use, and suicidal behavior compared to heterosexuals, a phenomenon linked to unique stressors, such as "double discrimination" from both heterosexual and homosexual communities. Similarly, Meyer (2003) (Meyer, 2003) proposed the *minority stress model*, which suggests that sexual minorities experience chronic stress due to societal stigma, prejudice, and discrimination, with bisexuals often reporting higher levels of social isolation than gay or lesbian individuals.

In addition to mental health concerns, sexual orientation also affects physical health. For example, a large-sample study by Gonzales & Henning-Smith (2017) (Gonzales & Henning-Smith, 2017) showed that sexual minorities, particularly bisexual individuals, reported poorer self-rated health and more chronic health conditions compared to heterosexual individuals. Furthermore, findings from a population-based study by Fredriksen-Goldsen et al. (2013) (Fredriksen-Goldsen, Kim, Barkan, Muraco, & Hoy-Ellis, 2013) revealed that compared to heterosexuals LGB individuals face health disparities, specifically higher risk of disability, poor mental health, smoking, and excessive drinking.

Sexual orientation is also linked to social dynamics. Bisexual individuals often face difficulties due to societal misconceptions and negative stereotypes (Dodge et al., 2016), which

can impact their sexual relationships and likelihood of disease acquisition. These examples highlight the profound influence of sexual orientation on both psychological and social well-being.

Additionally, understanding the prevalence and characteristics of other sexual orientations, such as asexuality, can help in developing supportive environments and tailored mental health interventions for those who experience little to no sexual attraction (Bogaert, 2015). Asexuality, estimated to represent about 1% of the population (Bogaert, 2004), is often misunderstood and stigmatized. Research has shown that asexual individuals face unique challenges, such as feelings of alienation and invisibility in a society that highly values sexual relationships (MacInnis & Hodson, 2012). These individuals may also experience pressure to conform to traditional expectations surrounding sexual attraction, which can contribute to anxiety and low self-esteem and poor health (Bogaert, 2004; Yule, Brotto, & Gorzalka, 2015). At the same time, asexual individuals present specific life history related characteristics, such as shorter stature, lower education and socioeconomic status, and later menarche in women (Bogaert, 2004).

Preferences for sexual submissiveness and dominance also play a role in psychological health and sexual well-being. Studies show that women are generally more likely to prefer submissive roles, while men tend to favor dominant roles in sexual contexts (Sanchez, Phelan, Moss-Racusin, & Good, 2012). Although these differences may be an artifact of other sociodemographic variables (Conley & Satz-Kojis, 2024), female sexual preferences may be more malleable and flexible, possibly as a part of more submissive strategy (Baumeister, 2000). Although being a minority, BDSM practitioners are either undistinguishable from general population in mental and physical health condition and report good psychological and social

adjustment (Dunkley & Brotto, 2018). Still, relatively little is known about interaction among sexual orientation, gender identity, and preferences for sexual submissiveness and dominance.

Gender identity, and the potential mismatch between experienced gender and biological sex, has significant implications for psychological and social health. Transgender individuals often face unique mental health challenges, including around 50% rates of depression, anxiety, and suicidal ideation (Budge, Adelson, & Howard, 2013). For example, a large scale qualitative study reported that in the UK up to 48% of transgender adults have attempted suicide at least once (Bailey, Ellis, & McNeil, 2014). These mental health disparities are frequently exacerbated by experiences of discrimination, stigma, and lack of social support, which can also contribute to lower self-esteem and social isolation (Hughto, Reisner, & Pachankis, 2015).

Theoretical Perspectives on Health and Sexual Minorities

Understanding the development of diverse sexual preferences and identities requires an exploration of the interplay among biological, psychological, and social factors. Large-scale studies can illuminate patterns and correlations that shed light on how various experiences and environments shape sexual preferences across populations. For instance, formative sexual experiences influence development of some specific sexual preferences (Sullivan & Sheehan, 2016). Several plausible theories may be applied to the developmental pathways of sexual preferences.

Life History Theory

Life history theory offers a valuable framework for examining how different environments and early life experiences contribute to the diversity of sexual preferences. According to this theory, organisms, including humans, allocate resources between growth, reproduction, and maintenance. In challenging environments, characterized by compromised

health or high mortality, individuals may adopt a faster life history strategy. This strategy typically includes earlier reproduction, increased sexual activity, and reduced investment in long-term commitments, such as marriage. On the individual level, individuals facing significant health issues often report higher levels of sociosexuality, indicating a tendency to engage in more sexual partners with less selectiveness (Patch & Figueredo, 2017). Another cross-sectional study involving 33 thousand subjects found that individuals with poorer health reported a lower age at menarche and earlier initiation of sexual activity in women, as well as stronger sexual desire and earlier reproduction in both sexes. However, these individuals also reported lower overall sexual activity, fewer sexual partners, and a lower total number of children (Sýkorová & Flegr, 2021). This perspective suggests that poorer physical and mental health outcomes could catalyze a faster life history strategy, leading individuals to increase the number of sexual partners while decreasing their selectiveness.

In contrast, general environments with greater instability and higher mortality rates may encourage slower life history strategies, emphasizing monogamy and biparental investment to ensure the survival of offspring (Schmitt, 2005). Thus, life history strategies may respond more to individual circumstances than to broader population health trends.

Minority Stress Theory

Minority stress theory posits that health disparities among sexual minorities arise from the stressors associated with navigating an identity in a potentially hostile society. This chronic stress can have profound psychological and physiological implications, contributing to various health issues. The stress associated with minority status may dysregulate the hypothalamic-pituitary-adrenal (HPA) axis, resulting in elevated cortisol levels and systemic inflammation.

Such chronic stress responses can lead to health problems, including cardiovascular disease and mental health disorders (Meyer, 2003; Pachankis, 2007).

Allostatic load theory complements minority stress theory by emphasizing the cumulative wear and tear on the body caused by chronic stress. It highlights how prolonged stress can affect multiple bodily systems—cardiovascular, metabolic, and immune systems—accounting for the diverse health challenges reported by sexual minorities (McEwen, 1998). Notably, chronic stress has been associated with accelerated cellular aging, as evidenced by shorter telomeres, which are linked to various age-related diseases and poorer overall health outcomes (Oliveira et al., 2016). Research indicates that gay (although not bisexual) individuals may have shorter telomeres, which could help explain their reported poorer health (Rivera, Chao, & Hechter, 2024).

Personality, Cognitive Traits, and Sexual Preferences

Beyond early experiences and environmental factors, personality traits also play a significant role in influencing sexual preferences. A meta-analysis has revealed that personality traits, specifically neuroticism, are associated with non-heterosexual orientation in men and women (Allen & Robson, 2020). However, populations such as asexual individuals or those with specific preferences for sexual submissiveness and dominance often remain underrepresented in research on personality and sexual preferences.

While lower mental health outcomes in sexual minorities are well-documented in the literature (Budge et al., 2013; Meyer, 2003), there is a dearth of research linking physical health and cognitive traits to sexual preferences. A recent meta-analysis suggests that gay men perform similarly to heterosexual women in both male-advantaged cognitive tasks (e.g., spatial cognition) and female-advantaged tasks (e.g., verbal fluency). In contrast, lesbian women align with heterosexual men primarily in male-advantaged tasks. These cognitive differences may be linked

to structural and functional brain variations, potentially indicating distinct neurodevelopmental pathways among individuals with varying sexual preferences. Research on personality and cognitive abilities in asexual individuals or those with preferences for sexual dominance or submissiveness, however, remains limited. Further exploration of these connections could provide a more comprehensive understanding of the factors contributing to the health disparities observed among sexual minorities.

Aims of the current study

This study aims to explore the relationships between health outcomes, cognition, and sexual preferences among sexual minorities. It addresses existing gaps in the literature by using a large and diverse sample to investigate the biological, psychological, and social factors influencing sexual orientation and sexual preferences. The findings aim to contribute to a more detailed understanding of the experiences and health needs of these populations. Specifically, we test for possible differences in health outcomes and cognitive abilities among heterosexual, homosexual, bisexual and asexual individuals, as well as among transgender individuals and individuals with preferences for sexual submissiveness and dominance.

To address the sexual minorities of our focus, we need to recruit a large sample. Despite significant advancements in the study of sexual orientation, preferences, and gender identity, large-scale research remains limited, especially in online populations. Traditional studies often rely on smaller convenience samples, such as college students or clinical populations, which may not reflect the diversity of experiences found in the general population. This can lead to skewed results, particularly when studying sexual minorities like bisexual and asexual individuals. For example, research on these groups often suffers from small sample sizes, hindering the generalizability and robustness of the conclusions (Bogaert, 2015; Bostwick et al., 2010).

Consequently, there is a growing need for more comprehensive research that captures the wide spectrum of sexual orientations, identities, and preferences across diverse populations.

Here we employ online sampling which offers unprecedented access to a broad and geographically diverse audience, facilitating the collection of data from populations that might be underrepresented or harder to reach through traditional, in-person methodologies. In particular, online surveys can attract participants who may feel uncomfortable or unwilling to engage in face-to-face research due to concerns about stigma or privacy. Studies suggest that online samples may differ from convenience and clinical samples in important ways (Kuper et al., 2012). Online recruitment methods are adequate for exploring underrepresented sexual minorities, offering a more detailed understanding of how sexual orientation, identity, and preferences interact with psychological and social outcomes. As more researchers turn to online platforms for large-scale data collection, these studies will play a crucial role in filling the gaps left by smaller, less diverse samples, advancing knowledge in the field of sexual health and well-being.

Materials and methods

Participants

An online survey, was promoted in the media as investigating 'the relationships between moral attitudes, cognitive performance, and biological, psychological, and sociodemographic factors. Participants were told the study was anonymous and could exit anytime. Only those over 15 and giving informed consent could participate. A total of 9,204 subjects took part between March 2022 and August 2023. The study was approved by Charles University's Institutional Review Board (No. 2021/4) and followed all relevant guidelines and regulations.

Questionnaires and Tests

The survey, designed to collect data for multiple unrelated projects, consisted of 264 questions and tasks, taking participants an average of 38 minutes to complete. It included an array of standard performance tests, psychological questionnaires, and a detailed medical history questionnaire. The first two questions concerned the official sex listed on the birth certificate and current gender identity, asking, "How do you currently identify internally?". The participants should choose from the answers: Definitely Female (1), Mostly Female (2), Somewhat Female (3), In Between (4), Somewhat Male (5), Mostly Male (6), Definitely Male (7). Based on the 'sex' and 'gender' variables, three binary variables were derived: 'Transgender certain' (code 1 in men, code 7 in women), 'Transgender - serious doubt' (codes 1-4 in men, codes 4-7 in women), and 'Transgender some doubt' (codes 1-6 in men, codes 2-7 in women). Each participant was then assigned values of 0 or 1 for these three binary variables based on their responses to the gender variable. Other six questions concerning sexual orientation, preferences, and behavior were at the end of the survey. Before answering, participants were reminded that they could skip any uncomfortable questions. Participants were presented with the following four statements and asked to indicate their level of agreement on a 5-point scale, where 1 meant 'definitely not' and 5 meant 'definitely yes':

- I am attracted to individuals of the same sex as me. (Same-Sex Attraction)
- I am attracted to individuals of the opposite sex as me. (Opposite-Sex Attraction)
- I am aroused by my own powerlessness, humiliation, or pain. (Arousal by Own Submission)
- I am aroused by others' powerlessness, humiliation, or pain. (Arousal by Others' Submission)

A 'Homosexuality Index' was calculated as the difference between 'Same-Sex Attraction' and 'Opposite-Sex Attraction.' Based on participants' level of agreement with the aforementioned statements, we calculated binary variables to represent different sexual orientations. Specifically,

we defined 'Non-heterosexual' as individuals who are equally or more attracted to the same sex as to the opposite sex. 'Bisexual in strict sense' was defined as experiencing equal levels of attraction to both genders, while 'Bisexual in loose sense' was defined as experiencing some level of attraction to both sexes. 'Asexual' was defined as experiencing no attraction to either men or women. 'Heterosexual in strict sense' was defined as experiencing attraction to the opposite sex while feeling no attraction to the same sex. 'Heterosexual in loose sense' was defined as experiencing a higher level of attraction to the opposite sex than to the same sex. 'Homosexual in strict sense' was defined as experiencing attraction to the same sex while feeling no attraction to the opposite sex. 'Homosexual in loose sense' was defined as experiencing a higher level of attraction to the same sex than to the opposite sex.

To further explore sexual dominance and submission, we calculated an 'SM Score' variable as the sum of 'Arousal by Own Submission' and 'Arousal by Others' Submission.' A 'Sexual Dominance' variable was also calculated as the difference between 'Arousal by Others' Submission' and 'Arousal by Own Submission.' For descriptive statistics, we created five binary variables: 'Submissiveness or Dominance Positive' (some arousal by own or others' submission), 'Dominant in Sex in Strict Sense' (arousal by others' submission > arousal by own submission), 'Dominant in Sex in Loose Sense' (some arousal by others' submission), 'Submissive in Sex in Strict Sense' (arousal by others' submission < arousal by own submission), and 'Submissive in Sex in Loose Sense' (some arousal by own submission).

Additionally, we asked participants about their number of male and female sexual partners to date. The question for male partners was, "How many different male partners have you had sexual intercourse with so far (including your current partner)?" An analogous question was posed for female partners. Respondents could select from nine options: '0,' '1,' '2,' '3,' '4,' '5-

6,' '7-9,' '10-19,' and '20 or more.' Based on these responses, we defined two binary variables for descriptive statistics: 'Opposite-Sex Experienced' and 'Same-Sex Experienced.'

In the main portion of the survey, respondents completed three standard personality questionnaires: the Ten-Item Personality Inventory (TIPI) by Gosling et al. (2003), which measures the Big Five personality traits (Extroversion, Agreeableness, Conscientiousness, Emotional Stability, and Openness to Experience); the Three Domain Disgust Scale (TDDS) by Tybur (2009), which assesses three facets of disgust (Pathogen Disgust, Sexual Disgust, and Moral Disgust); and the Short Dark Triad test (SD3) (Jones and Paulhus 2014; Mejzlíková et al., 2018), which evaluates Machiavellianism, Narcissism, and Psychopathy.

Additionally, participants underwent three cognitive performance tests, including an intelligence test, a recognition memory test, and the Stroop test. The participants' intelligence was assessed using the standard Cattell 16PF test (Variant A, Scale B) (Cattell, 1970). Recognition memory was evaluated using a modified version of the Meili test (Flegr et al., 2012; Meili, 1961). In this test, participants were initially presented with a list of twelve distinct words (knife, handcuffs, pump, chain, tree, collar, ice, glasses, arrow, tank, bars, and rifle) for a duration of 24 seconds. Approximately five minutes later, they were presented with a list of 24 words and asked to identify the original twelve words in a recognition memory test.

Our adaptation of the Stroop Test was structured into three distinct phases, each initiated only after participants had ample time to understand the guidelines and take a brief pause. They were instructed to commence 'when ready.' In the initial phase, participants were tasked with selecting a specific word (e.g., "red") from a set of four options (“red,” “green,” “blue,” “brown”), displayed in a randomized sequence at the center of the screen. The color of the text was intentionally incongruent with the word's semantic meaning. A directive at the top of the

screen indicated the word to be chosen, and participants were told to overlook the text's color. The second phase mirrored the first, but here the focus was on selecting a word based on its font color, while ignoring its actual meaning. The third phase was a variation of the first, where the directive was consistently displayed in a color that did not match either the meaning or the color of the words shown. Before each phase, participants were given explicit instructions, informed about the number of trials (always five), and told to respond as swiftly as possible. They could start each phase by clicking a "Begin Test" button. We counted the number of correct answers across all 15 trials (Stroop test accuracy) and calculated the average response time for these (Stroop test speed).

Standard questionnaires and performance tests were interspersed with clusters of questions focusing on areas such as health, attitudes, and self-assessment. In the health-focused section of the survey, participants were asked to answer 11 questions related to their physical well-being. These questions covered topics such as the frequency of experiencing infectious diseases, headaches, other types of physical discomfort, recurring physical issues, the number of physician visits, feelings of fatigue, neurological conditions, current usage of physician-prescribed medications (excluding those for mental health), antibiotic usage in the past year and past three years, instances of hospital stays exceeding one week in the last five years, and their own life expectancy estimates. Additionally, four questions were posed about their mental health, specifically addressing the frequency of experiencing depression, anxiety, other mental health issues, and the number of different medications prescribed for mental health they were currently taking. Participants responded using a 6-point Likert scale, except for the questions about number of medications prescribed. For more details, refer to (Flegr et al., 2021). We calculated

indices for physical and mental health based on the mean Z-score of the relevant set of 11 and four questions, respectively.

In the section dedicated to value attitudes, participants were asked to express their level of agreement with the following statements using a 6-point scale:

1. I would risk my life to save two unknown peers (with a 50% risk of dying in the rescue attempt).
2. I would risk my life (50% risk) to save 1000 peers.
3. I would return a found wallet containing an ID and 10,000 CZK (about 400 Euro).
4. I would return a found plastic bag containing 1,000,000 CZK (about 40,000 Euro).
5. I would return a found medieval gold treasure.
6. I have lied in a serious matter to help myself.
7. I have lied in a trivial matter to help myself.
8. I give more to charitable causes than my peers do.
9. I frequently and selflessly help others.

Responses to the first two and last two questions were used to calculate an Altruism Index, while the middle five questions were used to calculate an Honesty Index. Both indices were computed as the average Z-score of the responses to the respective questions.

In the self-assessment section of the questionnaire, participants were instructed with the following: "Now you will be evaluating some of your personality traits. Try to answer as truthfully as possible and definitely forget about false modesty." Participants were then asked to rate themselves on a 6-point scale anchored with 1 as "Rather Low" and 6 as "Rather High" on the following traits: "empathy (the ability to empathize with others' feelings)," "intelligence

(IQ)," "current knowledge of elementary school subjects," and "attractiveness to individuals of the opposite sex."

Additionally, at the end of the TIPI questionnaire, two more items were added where participants rated their level of agreement on a 7-point scale with the statements: "I consider myself a person who is fearless and courageous" and "I consider myself a person who is dominant, and likes to lead others." Except for the question on dominance, these questions were used to calculate a Self-Esteem Index, again as the average Z-score.

The questionnaire also gathered information on participants' age, the size of their current residence (measured on an ordinal scale from 1-7: 1 for less than 1,000 inhabitants, 2 for 1,000-5,000, 3 for 5,000-50,000, 4 for 50,000-100,000, 5 for 100,000-500,000, 6 for more than 500,000, and 7 for residing in capitals of Czech or Slovak countries - Prague or Bratislava), marital status (categorical: unmarried, married, divorced, widowed), number of biological children, height, weight, and educational attainment. Educational attainment was measured on a scale from 1-10: 1 for basic education only, 2 for basic education plus enrollment in secondary school, 3 for secondary education including vocational training (without A-levels), 4 for complete secondary education or higher vocational training (with A-levels or diploma), 5 for complete secondary education or higher vocational training plus enrollment in a bachelor's degree program, 6 for holding a Bachelor's degree (BA, BSc), 7 for enrollment in a master's degree program, 8 for holding a Master's degree (MA, MSc, MBA, MD, LL.M, MEng, etc.), 9 for holding a Master's degree plus enrollment in a doctoral program, and 10 for holding a Doctoral degree (PhD, DPhil, EdD, etc.).

Data analyses

Associations between all variables, both binary and ordinal, were examined using a nonparametric partial Kendall test, controlled for age and the size of the current residence. The Kendall correlation test is robust against the presence of outliers, irregularities in the distribution of variables, and is also insensitive to an unbalanced number of individuals across different categories. These tests were conducted using the R script Explorer v. 1.0 (Flegr & Flegr, 2021), which utilizes the ppcor R package (Kim, 2015). . The dataset is available at Figshare (Flegr, 2022b).

Technical Notes: Throughout the article, the term "effect" is used in a statistical context to refer to an observed association, specifically the difference between the true population parameter and its null hypothesis value. The distinction between cause and effect is made only in the Discussion section.

The study is primarily exploratory in nature. As such, we report results that have not been corrected for multiple testing (Althouse, 2016). It's worth noting, however, that due to the very low P-values associated with the majority of significant effects, and the large number of such effects, virtually all remained significant even after adjustments for multiple testing by the Benjamini-Hochberg method (Benjamini & Hochberg, 1995) were made. In line with the exploratory focus of the study, the Discussion section not only addresses formally significant effects but sometimes also considers pronounced trends that did not reach formal significance.

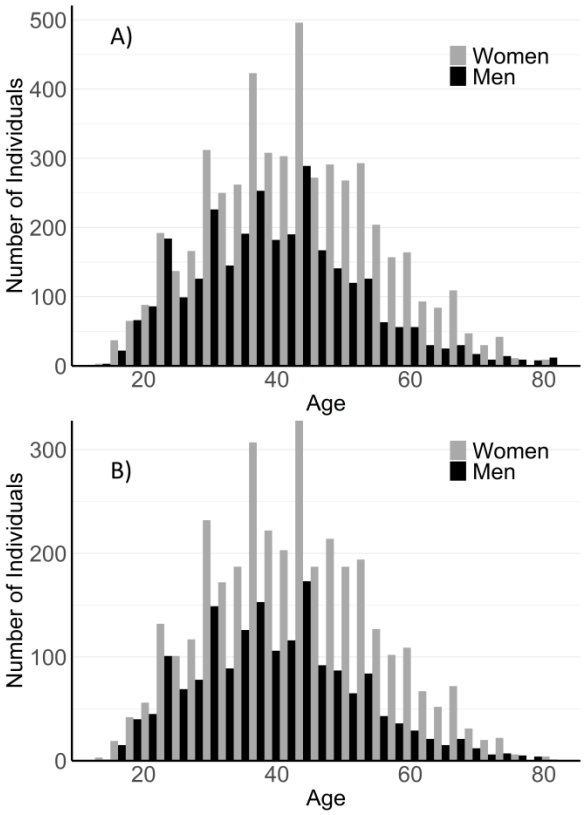
Results

The dataset initially comprised 8,119 participants, of which 5,117 (63.5%) were women with an average age of 42.9 years (SD = 12.6) and 2,945 (36.5%) were men with an average age of 39.7 years (SD = 12.5). Fifty-seven participants did not disclose their gender, and 2,640 dropped out before completing the last section of the questionnaire, which included six questions on sexual orientation and preferences.

Out of the remaining 5,422 participants, 5,307 (97.9%)—comprising 3,518 women (66.3%, average age: 42.6 years, SD: 12.4) and 1,789 men (33.7%, average age: 39.6 years, SD: 12.2)—provided complete responses to questions necessary for determining sexual orientation. These participants were the focus of the present study. A visual comparison of the age distribution histograms between the initial dataset and the subset used for this study (as shown in Fig. 1) suggests that the willingness to answer questions related to gender identity and sexual orientation

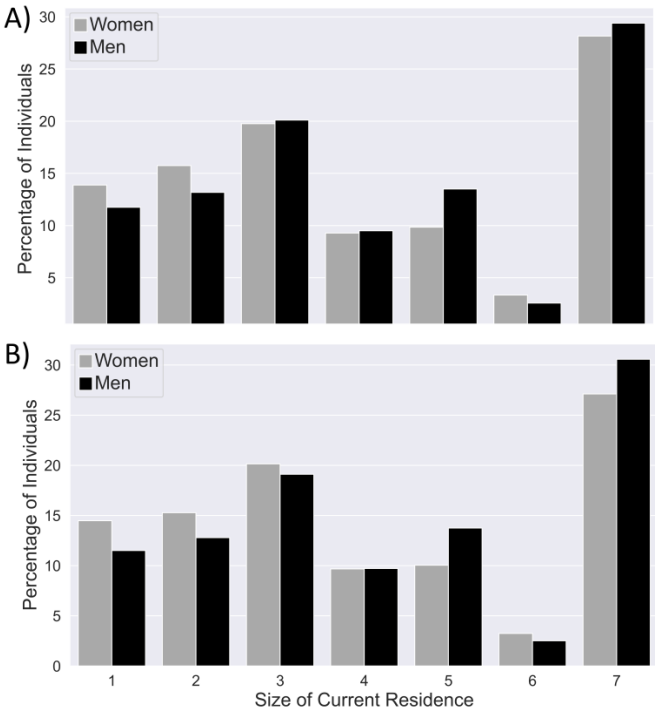
did not vary across different age groups. This pattern was also observed for variables such as the size of current residence (Fig. 2) and educational attainment (Fig. 3). However, the dropout rate was significantly lower among women compared to men, with an odds ratio (OR) of 0.88 and a 95% confidence interval (CI_{95}) ranging from 0.82 to 0.95 (p = 0.001).

Fig. 1. Age distribution of female and male participants



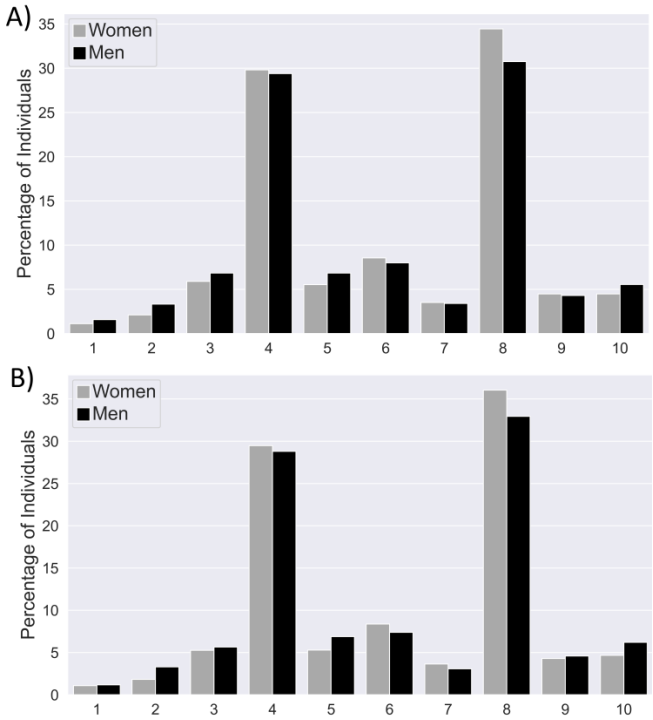
The histogram A represents the entire study population, encompassing 5,117 women and 2,945 men. In contrast, the histogram B focuses solely on participants who provided responses to questions regarding gender and sexual orientation. This subset includes 3,518 women and 1,789 men.

Fig. 2. Distribution of Participants by Current Residence Size



Categories 1 and 7 represent the smallest settlements (fewer than 1,000 inhabitants) and capital cities (Prague or Bratislava), respectively. The histogram A represents the entire study population, encompassing 5,117 women and 2,945 men. In contrast, the histogram B focuses solely on participants who provided responses to questions regarding gender and sexual orientation. This subset includes 3,518 women and 1,789 men.

Fig. 3. Distribution of Participants by Educational Attainment



The most populous categories, 4 and 8, represent individuals with complete secondary education or higher vocational training (with A-levels or diploma) and those holding a Master's degree (MA, MSc, MBA, MD, LL.M, MEng, etc.), respectively. For the meanings of other codes, see the chapter Methods. The histogram A represents the entire study population, encompassing 5,117 women and 2,945 men. In contrast, the histogram B focuses solely on participants who provided responses to questions regarding gender and sexual orientation. This subset includes 3,518 women and 1,789 men.

Table 1 indicates that 9.04% of women and 8.79% of men identified as non-heterosexuals, meaning they felt attraction to individuals of the same sex at least as strongly as to those of the opposite sex. The table also reveals that 0.23% of female respondents firmly identified with the male gender (code 7 on a 7-item scale). Additionally, 0.57% felt they were more likely male than female (codes 5, 6, 7), ...and 1.62% believed they had the same or higher likelihood of being male than female (codes 4, 5, 6, 7). Only, 90.25% of women were certain of their female gender

identity (code 1). Among men, 0.22% were confident in their female gender identity (code 1), 0.45% felt they were more likely female than male (codes 1, 2, 3), and 1.23% believed they had the same or higher likelihood of being female than male (codes 1, 2, 3, 4). Only 88.65% of men were certain of their male gender identity (code 7).

However, the alignment between sex and gender dramatically differed between heterosexual and non-heterosexual participants. For heterosexual vs. non-heterosexual women, the figures were as follows: 0.09% vs. 1.52% were certain of being male; 0.24% vs. 3.65% felt more likely male than female; 0.65% vs. 10.94% believed they had the same or higher likelihood of being male than female; 92.54% vs. 68.09% were certain of being female. For heterosexual vs. non-heterosexual men, the figures were: 0.12% vs. 1.26% were certain of being female; 0.24% vs. 2.52% felt more likely female than male; 0.85% vs. 5.04% believed they had the same or higher likelihood of being female than male; 89.75% vs. 77.36% were certain of being male. Considering the inverse, the proportion of non-heterosexual women among those certain of being male was 62.5%. Among those more likely male, it was 60.0%, and among those with the same or higher likelihood of being male, it was 63.16%. Among women certain of being female, it was 7.06%. Similarly, the proportion of non-heterosexual men among those certain of being female was 50.00%. Among those more likely female, it was also 50%, and among those with the same or higher likelihood of being female, it was 36.36%. Among men certain of being male, it was 7.76%.

Table 1 Gender Self-Identification by Sexual Preference

	Women	Men

Gender	All	Heterosexual	No-heterosexual	All	Heterosexual	No-heterosexual
	100%	90.96%	9.04%	100%	91.21%	8.79%
Definitely female (code 1)	3175 (90.25%)	2951 (92.54%)	224 (68.09%)	4 (0.22%)	2 (0.12%)	2 (1.26%)
Almost certainly female (code 2)	195 (5.54%)	159 (4.99%)	36 (10.94%)	1 (0.06%)	1 (0.06%)	0 (0%)
Rather female (code 3)	91 (2.59%)	58 (1.82%)	33 (10.03%)	3 (0.17%)	1 (0.06%)	2 (1.26%)
Somewhat in between (code 4)	37 (1.05%)	13 (0.41%)	24 (7.29%)	14 (0.78%)	10 (0.61%)	4 (3.77%)
Rather male (code 5)	7 (0.2%)	3 (0.09%)	4 (1.22%)	33 (1.84%)	27 (1.66%)	6 (4.35%)
Almost certainly male (code 6)	5 (0.14%)	2 (0.06%)	3 (0.91%)	148 (8.27%)	126 (7.73%)	22 (13.84%)
Definitely male (code 7)	8 (0.23%)	3 (0.09%)	5 (1.52%)	1586 (88.65%)	1463 (89.75%)	123 (77.36%)

Values in parentheses in columns 2-7 represent percentages. Heterosexuals are participants more aroused by the opposite sex than the same sex. We did not include asexuals (individuals who are not attracted to either men or women) in the non-heterosexual category. If asexuals were included, the proportion of heterosexuals would be 90.65% among women and 91.11% among men.

In addition to questions on sexual orientation, specifically on arousal by male and female sexual partners, the participants were also surveyed about their arousal from both personal and others' experiences of submission, including feelings of powerlessness, humiliation, or pain, as detailed in Table 2.

Table 2 Sexual Preferences and Arousal Patterns of Participants

Agreement Level	**Attraction to Opposite Sex**	**Attraction to Same Sex**	**Arousal by Own Submission**	**Arousal by Others' Submission**
	Women | Men	**Women | Men**	**Women | Men**	**Women | Men**
1: Definitely No	88 (2.5%) | 64 (3.58%)	2039 (57.96%) | 1274 (71.21%)	2230 (63.81%) | 1249 (70.13%)	2754 (79%) | 975 (54.84%)
2	63 (1.79%) | 41 (2.29%)	705 (20.04%) | 260 (14.53%)	415 (11.87%) | 219 (12.3%)	334 (9.58%) | 274 (15.41%)
3	25 (0.71%) | 17 (0.95%)	209 (5.94%) | 47 (2.63%)	187 (5.35%) | 83 (4.66%)	119 (3.41%) | 124 (6.97%)
4	65 (1.85%) | 27 (1.51%)	219 (6.23%) | 51 (2.85%)	347 (9.93%) | 107 (6.01%)	155 (4.45%) | 204 (11.47%)
5	331 (9.41%) | 71 (3.97%)	126 (3.58%) | 35 (1.96%)	194 (5.55%) | 76 (4.27%)	72 (2.07%) | 116 (6.52%)
6: Definitely Yes	2946 (83.74%) | 1569 (87.7%)	220 (6.25%) | 122 (6.82%)	122 (3.49%) | 47 (2.64%)	52 (1.49%) | 85 (4.78%)

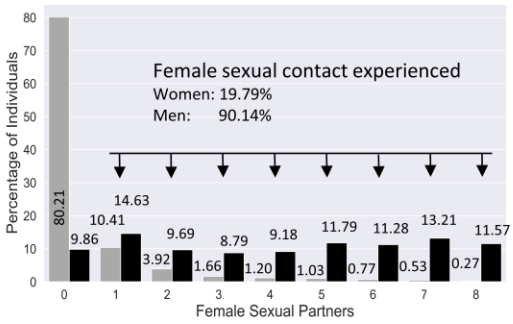
The scale was anchored at 1 (Definitely No) and 6 (Definitely Yes), with respondents interpreting the intermediate numbers based on their feelings. Percentages in parentheses represent the proportion of respondents within each biological sex category.

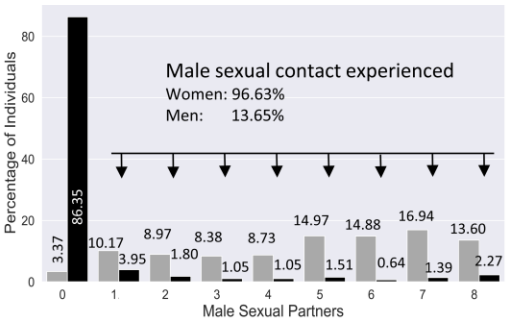
Figure 4 displays the distributions for various responses and introduces derived variables such as the SM Index, which is calculated as the sum of arousal from others' submission and one's own. It also introduces the variable 'Sexual Dominance,' defined as the difference between arousal from others' submission and one's own. Additionally, the figure presents the range for lifetime counts of female and male sexual partners. These source ordinal variables were used to calculate binary variables, which in turn were used to categorize individuals based on sexual orientation, gender and sex alignment (congruence or incongruence between sex and gender), and sexual dominance and submissiveness. Table 3 shows the representation of female and male individuals in these categories.

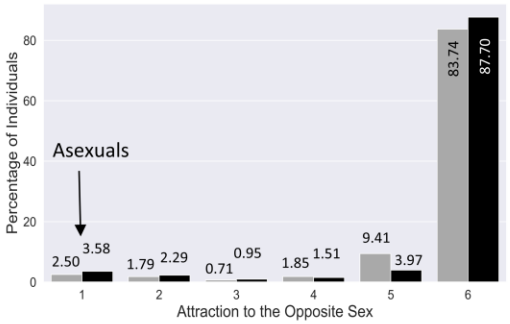
It's important to note that before the block of 6 sex-related variables, participants were reminded that they could skip any questions that made them uncomfortable: "The last 6 questions are about sexuality – we remind you that the data will be anonymized and you can also skip any question you like - please answer truthfully, or skip the question." Relatively few study participants took advantage of the option to skip some of the questions. Specifically, 8 (0.45%) out of 1789 men did not answer the question about how their own powerlessness arouses them, and 11 (0.61%) did not answer the question about how others' powerlessness arouses them. Among women, 23 (0.65%) and 32 (0.91%) out of 3518 did not answer the same questions, respectively. For comparison, 67 men (3.75%) didn't disclose their male partners, and 25 (1.40%) didn't disclose their female partners. Among women, these numbers were 105 (2.98%)

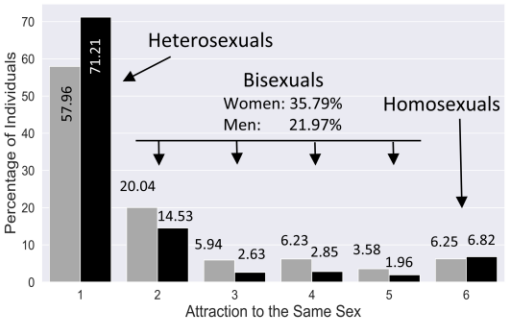
and 511 (14.53%), respectively. This suggests that the willingness to answer questions about sexual submissiveness and dominance is significantly higher in the current population than the willingness to answer questions about the number of past sexual partners. Therefore, it is likely that the relevant results in Table 3 will not be significantly impacted by missing data from individuals who are reluctant to disclose the nature of their sexual preferences.

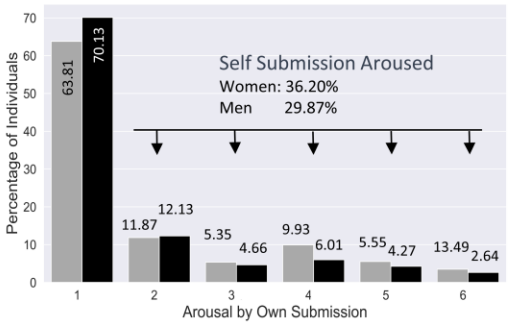
Fig. 4: Distributions of sexual life-related variables and self-reported dominance in normal life

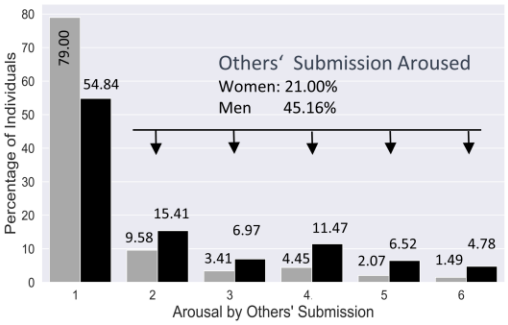

Female sexual contact experienced
Women: 19.79%
Men: 90.14%
Percentage of Individuals
Female Sexual Partners

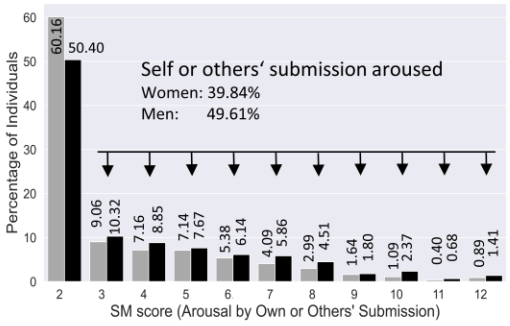

Male sexual contact experienced
Women: 96.63%
Men: 13.65%
Percentage of Individuals
Male Sexual Partners

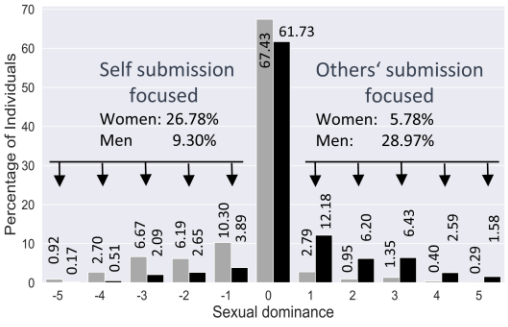

Asexuals
Percentage of Individuals
Attraction to the Opposite Sex

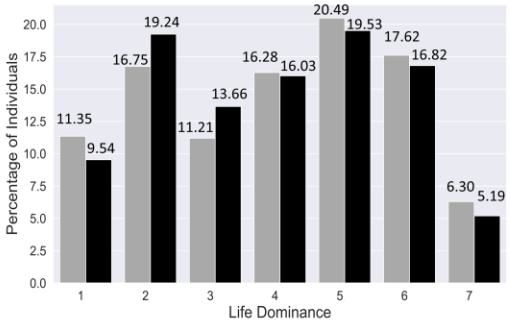

Heterosexuals
Bisexuals
Women: 35.79%
Men: 21.97%
Homosexuals
Percentage of Individuals
Attraction to the Same Sex

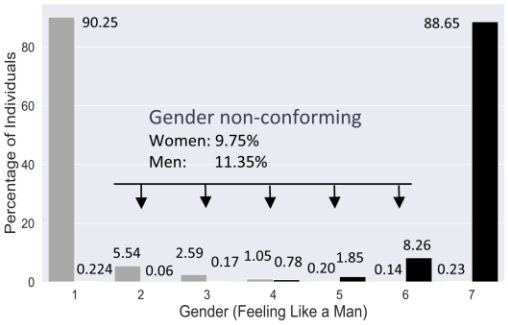

Self Submission Aroused
Women: 36.20%
Men 29.87%
Percentage of Individuals
Arousal by Own Submission


Others' Submission Aroused
Women: 21.00%
Men 45.16%
Percentage of Individuals
Arousal by Others' Submission


Self or others' submission aroused
Women: 39.84%
Men: 49.61%
Percentage of Individuals
SM score (Arousal by Own or Others' Submission)


Self submission focused
Women: 26.78%
Men 9.30%
Others' submission focused
Women: 5.78%
Men: 28.97%
Percentage of Individuals
Sexual dominance


Percentage of Individuals
Life Dominance


Gender non-conforming
Women: 9.75%
Men: 11.35%
Percentage of Individuals
Gender (Feeling Like a Man)

All numbers adjacent to the columns (gray columns for women, black columns for men) represent the percentage of individuals within that sex group who selected the given response on an ordinal scale. For more detailed information regarding individual questions and the calculation of derived variables SM score and Sexual dominance, please refer to the 'Methods' chapter.

Table 3 Distribution of Individuals by Biological Sex, Categorized by Sexual Orientation, Gender Identity, and Sadomasochistic Preferences

Variable	**Definition**	**Women**		**Men**	
		Yes (n, %)	No (n, %)	Yes (n, %)	No (n, %)
Opposite sex experienced	already had an opposite-sex sexual partner No. of opposite-sex partners > 0	3298 (96.63)	115 (13.37)	1590 (90.14)	174 (9.86)
Same-sex experienced	already had a same-sex sexual partner No. of same-sex partners > 0	595 (19.79)	2412 (80.21)	235 (13.65)	1487 (86.35)
Asexuals	attracted to opposite sex = 1 AND attracted to same sex = 1	12 (0.34)	3506 (99.66)	2 (0.11)	1787 (99.89)
Heterosexuals s.s.	attracted to opposite sex > 1 AND attracted to same sex = 1 [(1)]	2027 (57.82)	1479 (42.18)	1272 (71.18)	515 (28.82)
Heterosexuals s.l.	attracted to opposite sex > attracted to same sex [(1)]	3189 (90.96)	170 (5.06)	1630 (91.21)	130 (7.39)
Homosexuals s.s.	attracted to same sex > 1 AND attracted to opposite sex = 1 [(1)]	76 (2.17)	3430 (97.83)	62 (3.47)	1725 (96.53)
Homosexuals s.l.	attracted to same sex > attracted to opposite sex [(1)]	170 (4.85)	3189 (94.94)	130 (7.27)	1630 (92.61)
Bisexuals s.s.	attracted to same sex = attracted to opposite sex [(1)]	147 (4.19)	3359	27 (1.51)	1760

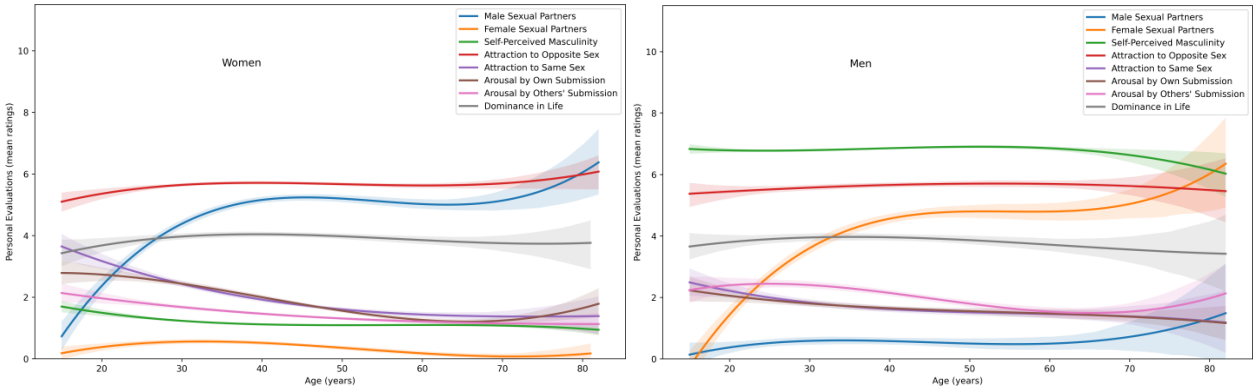
			(95.81)		(98.49)
Bisexuals s.l.	attracted to same sex > 1 attracted to opposite sex > 1 [(1)]	1403 (40.02)	2103 (59.98)	453 (25.35)	1334 (74.65)
Transgenders, certain	(sex = 0 AND gender = 7) OR (sex = 1 AND gender = 1)	8 (0.23)	3510 (99.77)	4 (0.22)	1785 (99.78)
Transgenders, serious doubt	(sex = 0 AND gender > 3) OR (sex = 1 AND gender < 5)	57 (1.62)	3461 (98.38)	22 (1.23)	1767 (98.77)
Transgenders, mild doubt	(sex = 0 AND gender > 1) OR (sex = 1 AND gender < 7)	343 (9.75)	3175 (90.25)	203 (11.35)	1586 (88.65)
Submissiveness or dominance positive	aroused by own submission + Aroused by others' submission > 2	1393 (39.98) [(3)]	2091 (60.02)	883 (49.69) [(3)]	894 (50.31)
Dominant in sex s.s.	aroused by others' submission > aroused by own submission [(2)]	201 (17.76)	931 (82.24)	514 (75.70)	165 (24.30)
Dominant in sex s.l.	aroused by others' submission > 1	732 (21.10)	2752 (78.99)	803 (45.19)	974 (54.81)
Submissive in sex s.s.	aroused by own submission > aroused by others' submission [(2)]	931 (82.24)	201 (17.76)	165 (24.3)	514 (75.70)
Submissive in sex s.l.	aroused by own submission > 1	1265 (36.31)	2219 (63.69)	532 (29.94)	1245 (70.06)

The numbers in parentheses represent percentages. The abbreviations 's.s.' and 's.l.' stand for 'strict sense' and 'loose sense,' respectively. [(1)] Proportions related to sexual orientation were calculated while excluding approximately 0.2% of the subjects who reported experiencing no sexual arousal towards either men or women. This exclusion was logical for the purpose of our analysis, as we compared heterosexual individuals (coded as 1) with non-heterosexual individuals (coded as 0). [(2)] For similar reasons,494 individuals who reported being equally aroused by their own and others' submission were excluded from the calculation of the binary

variable 'Dominant in sex'. [(3)] *In fact, 4 men did not respond to either the question concerning arousal by their own submission or the question about arousal by the submission of others. An additional 8 men answered '1'—indicating 'definitely not'—to one of these questions and did not respond to the other. The corresponding numbers for women were 13 and 21, respectively. It is likely that these individuals were reluctant to disclose that they are aroused by either their own or others' submission. When these individuals are included in the calculations, the frequency of people with a positive attitude towards either submissiveness or dominance is 40.19% for women and 50.03% for men.*

Figure 5 provides a view of how various personal attributes evolve across the lifespan for both women and men. For women, the data reveals a marked decline in same-sex attraction and arousal from their own submission as they age, along with a more moderate decrease in arousal from others' submission. In contrast, men generally maintain these attributes, except for a noticeable decline in arousal from others' submission between the ages of 30 and 65. The number of lifetime same-sex and opposite-sex sexual partners for both genders increases until the ages of 30 and 40, respectively, and then stabilizes until around age 65. Interestingly, seniors reported an increase in the number of sexual partners. It must be reminded, however, that the sample size for this age group was smaller, resulting in broader confidence intervals. While the intensity of same-sex attraction consistently diminishes with age, the intensity of opposite-sex attraction remains stable or even slightly increases, particularly among very young and very old women. The results of statistical tests that examine age-related trends are detailed in Table 4 and Supplementary Tables S1-S5.

Fig. 3 Correlation of various sexual life-related attributes and self-reported dominance in normal life with age of female and male participants of the study



The graph plots various psychological and behavioral traits against age for female respondents aged 15 and older. The X-axis represents age in years, while the Y-axis shows personal evaluations in the form of mean ratings. Each curve on the graph is a 3rd-order polynomial regression of the corresponding variable, with 95% confidence intervals included.

In the final part of our study, we explored the interrelationships among sexual orientation, gender identity, and variables related to sexual dominance. We also examined how these factors correlate with various traits, including indicators fecundity, physical health, mental well-being, and personality traits, across both male and female participants. Our primary focus was on analyzing the associations of binary variables like asexuality, homosexuality, bisexuality, etc. – see Table 3, with these traits. However, Supplementary Tables 1-4 also provide more extensive data, featuring ordinal source variables and three indices derived from them.

Due to the skewed distribution inherent in most of our variables, we employed the non-parametric Kendall Tau correlation method. To account for the significant influence of age and the size of the current residence on most variables, we controlled for these factors using partial correlation methods. Except for education, openness to experience, and courage, all other 38

variables exhibited strong correlations with sex. As a result, we conducted separate analyses for men and women. Table 4 presents the magnitude and direction of these correlations, specifically the partial Kendall Tau correlations controlled for age and the size of the current residence, for women (left numbers) and men (right numbers). Table 5 provides the corresponding p-values for each correlation.

A comprehensive discussion on the implications and interpretations of the findings from Table 4 will follow in the Discussion section.

Table 4. Correlation between Binary Variables Representing Individual Categories and Various Characteristics of Women and Men

	Asexual	Homosexual s.s.	Bisexual s.l.	Transgender Certain	Transgender mild doubt	SM Plus	Dominant s.s.
Age	0.011 | -0.011	**0.040** | 0.002	**-0.299** | **-0.150**	**-0.023** | 0.012	**-0.129** | **-0.087**	**-0.275** | **-0.176**	**0.044** | 0.001
Current Residence Size	-0.019 | -0.010	0.011 | **0.038**	**0.029** | **0.053**	0.003 | 0.009	**0.031** | -0.005	**0.056** | **0.050**	-0.032 | -0.016
Attraction to Opposite Sex	**-0.152** | **-0.095**	**-0.390** | **-0.546**	**-0.274** | **-0.283**	**-0.047** | -0.018	**-0.221** | **-0.129**	**-0.052** | **-0.081**	**-0.112** | **0.137**
Attraction to Same Sex	**-0.042** | -0.021	**0.271** | **0.367**	**0.809** | **0.819**	**0.054** | **0.083**	**0.221** | **0.242**	**0.223** | **0.200**	**0.095** | **-0.206**
Aroused by Own Submission	-0.011 | -0.022	**-0.027** | **0.033**	**0.202** | **0.261**	**0.022** | **0.074**	**0.105** | **0.207**	**0.826** | **0.602**	**-0.450** | **-0.630**
Aroused by Others' Submission	-0.004 | -0.028	-0.001 | 0.009	**0.240** | **0.177**	**0.033** | -0.007	**0.197** | **0.083**	**0.588** | **0.793**	**0.588** | **0.458**
SM index	-0.011 | -0.029	-0.015 | 0.018	**0.227** | **0.226**	**0.031** | 0.02	**0.148** | **0.147**	**0.87** | **0.832**	**0.048** | **-0.107**
Sexual Dominance	0.011 | -0.013	**0.033** | -0.031	**-0.076** | -0.018	0.000 | **-0.053**	**0.026** | **-0.075**	**-0.481** | **0.358**	**0.602** | **0.670**
Homosexuality Index	**0.095** | **0.056**	**0.275** | **0.373**	**0.767** | **0.785**	**0.05** | **0.078**	**0.244** | **0.236**	**0.206** | **0.196**	**0.099** | **-0.190**
Lifetime Male	**-0.046** | -0.013	**-0.023** | **0.320**	**0.086** | **0.299**	**-0.035** | **0.089**	-0.005 | **0.126**	**0.112** | **0.080**	-0.016 | **-0.127**

Partners							
Lifetime Female Partners	-0.011 | -0.031	**0.036 | -0.167**	**0.311 |** -0.005	**0.058 |** -0.002	**0.129 |** -0.022	**0.181 |** 0.016	**0.056 | 0.143**
Marital Status	-0.016 | **-0.033**	0.020 | **-0.111**	**-0.113 | -0.051**	-0.018 | 0.022	**-0.089 | -0.059**	**-0.090 | -0.052**	-0.006 | -0.012
Number of Biological Children	-0.013 | -0.030	0.002 | **-0.117**	**-0.093 | -0.070**	-0.018 | 0.002	**-0.102 | -0.088**	**-0.065 | -0.066**	**-0.091 |** 0.031
Mental Sickness	-0.012 | -0.024	0.013 | **0.070**	**0.106 | 0.102**	-0.007 | 0.009	**0.129 | 0.138**	**0.097 | 0.095**	0.023 | -0.050
Physical Sickness	-0.008 | -0.006	-0.001 | **0.061**	**0.047 | 0.081**	0.005 | 0.0200	**0.077 | 0.095**	**0.071 | 0.033**	0.017 | 0.020
Reported Body Height	-0.017 | 0.008	0.002 | -0.015	0.004 | 0.000	-0.014 | **-0.038**	-0.018 | **-0.037**	0.015 | 0.027	-0.023 | 0.007
Reported Body Weight	**-0.027 |** 0.016	0.002 | -0.013	0.011 | -0.015	0.006 | 0.025	-0.011 | -0.015	**0.025 | 0.05**	0.020 | 0.033
Body Mass Index	**-0.024 |** 0.015	0.002 | -0.004	0.009 | -0.015	0.012 | **0.036**	-0.009 | -0.008	0.021 | **0.044**	0.030 | 0.026
Education	-0.010 | 0.011	**-0.049 |** 0.020	0.016 | **-0.038**	**-0.038 |** 0.014	**-0.032 | -0.051**	0.005 | 0.006	0.015 | 0.041
Intelligence	**-0.025 |** -0.009	**-0.025 |** 0.008	**0.094 | 0.042**	-0.012 | **-0.034**	**0.033 |** 0.015	**0.125 | 0.106**	0.010 | 0.018
Stroop Test Accuracy	-0.012 | -0.016	-0.015 | -0.004	**0.044 | 0.055**	0.001 | 0.020	**0.027 |** 0.005	**0.050 | 0.048**	0.008 | 0.020
Stroop Test Speed	0.003 | 0.020	0.016 | 0.005	**-0.063 | -0.045**	**0.023 |** -0.002	**-0.033 | -0.040**	**-0.079 | -0.039**	0.014 | 0.005
Memory	-0.003 | -0.021	0.014 | -0.002	**0.052 |** -0.004	**-0.032 | -0.032**	0.011 | 0.026	**0.065 | 0.045**	-0.001 | 0.007
Extroversion	**-0.027 |** 0.002	-0.007 | -0.004	-0.013 | -0.017	**-0.041 |** -0.012	**-0.063 | -0.061**	**-0.039 |** -0.009	-0.037 | **0.062**
Agreeableness	-0.009 | 0.015	-0.001 | 0.016	**-0.044 | -0.066**	0.017 | **0.054**	**-0.041 |** -0.007	**-0.078 | -0.080**	**-0.062 |** -0.025
Conscientiousness	**-0.034 | 0.037**	0.002 | 0.006	**-0.133 | -0.087**	0.013 | 0.003	**-0.102 | -0.104**	**-0.140 | -0.132**	-0.013 | 0.038
Emotional Stability	-0.004 | **0.034**	-0.008 | -0.005	**-0.064 | -0.106**	0.012 | 0.014	**-0.082 | -0.106**	**-0.085 | -0.063**	-0.015 | **0.098**
Openness to Experience	0.003 | -0.001	**-0.036 |** -0.002	**0.064 | 0.051**	0.005 | 0.012	**0.096 |** 0.020	-0.010 | -0.014	-0.002 | -0.029
Pathogen Disgust	-0.014 | 0.015	0.015 | 0.015	-0.018 | **-0.04**	-0.01 | -0.032	**-0.043 |** -0.013	-0.012 | -0.006	0.000 | 0.03
Sexual Disgust	0.012 | -0.023	**0.027 |** 0.026	**-0.171 | -0.104**	**-0.031 |** -0.01	**-0.043 |** 0.006	**-0.215 | -0.136**	0.020 | -0.024
Moral Disgust	-0.024 | -0.033	0.014 | 0.008	**-0.100 | -0.113**	-0.004 | 0.003	**-0.061 | -0.042**	**-0.142 | -0.114**	-0.033 | 0.011
Machiavellianism	-0.011 | -0.023	-0.003 | 0.015	**0.064 | 0.089**	0.009 | 0.019	**0.039 |** 0.010	**0.127 | 0.130**	0.030 | 0.000
Narcissism	**-0.038 |** -0.018	-0.012 | -0.005	**0.068 |** 0.024	**-0.030 | -0.036**	0.022 | -0.033	**0.036 | 0.050**	0.001 | **0.063**
Psychopathy	0.018 | -0.018	-0.007 | -0.005	**0.156 | 0.102**	0.021 | -0.016	**0.124 |** 0.014	**0.192 | 0.138**	**0.048 |** 0.030
Altruism	0.019 | 0.020	-0.015 | -0.028	0.018 | -0.028	-0.020 | -0.024	-0.003 | 0.006	0.000 | **-0.052**	0.009 | 0.028
Honesty	**0.024 | -0.034**	-0.009 | 0.030	0.007 | 0.011	0.010 | 0.028	-0.020 | -0.014	**0.044 |** -0.013	-0.014 | 0.025
Self-Esteem	-0.024 | -0.027	-0.013 | -0.019	-0.006 | -0.012	**-0.025 |** -0.002	**-0.072 | -0.044**	-0.023 | -0.001	-0.007 | 0.006

High Empathy	0.013 | -0.026	-0.001 | 0.022	**-0.055** | -0.019	0.004 | 0.011	**-0.060** | -0.007	**-0.086** | **-0.038**	-0.031 | -0.035
High IQ	**-0.025** | 0.027	-0.013 | -0.012	**0.054** | **0.058**	0.012 | 0.022	0.006 | -0.006	**0.067** | **0.071**	0.015 | 0.029
High Elementary School Knowledge	-0.017 | **-0.046**	0.012 | -0.016	-0.013 | **-0.034**	-0.017 | -0.015	**-0.061** | **-0.058**	-0.015 | -0.019	**0.042** | 0.021
Attractiveness to Opposite Sex	**-0.023** | **-0.039**	-0.015 | **-0.072**	-0.006 | -0.002	**-0.035** | -0.016	**-0.057** | **-0.035**	0.011 | 0.008	**-0.054** | 0.009
Dominance	-0.017 | -0.031	-0.019 | 0.013	**0.029** | 0.013	-0.018 | **-0.032**	0.013 | **-0.049**	0.020 | 0.027	**0.088** | **0.184**
Courage	0.000 | -0.022	**-0.046** | **-0.034**	0.012 | **-0.048**	0.003 | 0.008	**0.034** | **-0.060**	**-0.042** | **-0.041**	0.017 | **0.102**

Each cell displays the partial Kendall Tau values for women and men, separated by a vertical bar. Positive Tau values signify a positive correlation between the binary variables in the columns and the ordinal variables in the row headers. For marital status, 'unmarried' is coded as 0, while 'married,' 'divorced,' and 'widowed' are coded as 1. Associations deemed significant are highlighted in bold (for corresponding p-values, refer to Supplementary Table S5). Some categories defined in Table 3 either precisely or nearly mirror other variables (e.g., the values for 'Dominant s.s.' and 'Submissive s.s.' differ only in sign). Others serve merely a descriptive purpose (e.g., 'Dominant s.l.,' 'Submissive s.l.,' 'Non-heterosexual'). Such categories have been excluded from this table.

Discussion

In a large sample of the internet population, we found only 0.34% women and 0.11% men who reported to be aroused neither by men, nor women. Among the rest of the participants, we classified 57.82% of women and 71.18% of men as heterosexual based on their reported arousal exclusively toward individuals of the opposite sex. Similarly, 2.17% of women and 3.47% of men were classified as homosexual, as they reported arousal solely toward individuals of the same sex. A substantial proportion—40.02% of women and 25.35% of men—were classified as bisexual, indicating arousal toward both men and women. Additionally, we found that 19.79% of

women and 13.65% of men had same-sex sexual experiences. In terms of gender identity, 0.23% of women and 0.22% of men in our sample were firmly convinced that their experienced gender did not align with their biological sex. These individuals were classified as 'definitely transgender.' An additional 1.39% of women and 1.01% of men felt that the likelihood of a gender-sex mismatch was at least as high as the likelihood of a match; these individuals were classified as having 'serious gender doubt.' Together, 9.75% of women and 11.35% of men, which includes the 'definitely transgender' and 'serious gender doubt' groups, were contemplating the possibility of a mismatch between their experienced gender and biological sex. The prevalence of individuals aroused by sexual submissiveness or dominance was 40.19% for women and 50.03% for men, with 17.76% of women and 75.70% of men being more aroused by their own dominance than submissiveness, and 82.24% of women and 24.30% of men being more aroused by their own submissiveness than dominance.

The sample was not random in terms of internet access and willingness to participate in lengthy online studies without compensation. However, it was random concerning willingness to disclose sexual orientation, as the questions related to sexuality were posed at the end of a lengthy survey focused on other issues, and only 2% of participants declined to complete this section. Despite the option to skip any question, only about half a percent skipped questions related to sexual preferences. The numbers were slightly higher for questions about the number of same-sex and opposite-sex partners, but these variables were only used as dependent variables and were not used for categorization. Given these considerations, unless one assumes that the willingness to complete lengthy surveys for free is related to sexual orientation, gender identity, and sexual preferences, the prevalence rates in our sample should reflect those in the general internet population.

A challenge in any questionnaire research, and especially in sexual behavioral research, is the veracity of responses to sensitive questions. The nature of our questions minimized the risk of distortion. For example, we did not ask about sexual orientation but rather the extent to which individuals are sexually aroused by men and women. A measure of the truthfulness of the responses is the number of heterosexual contacts reported by heterosexual men and women. This number should be the same in sufficiently large samples; however, it often differs significantly as men tend to over-report and women under-report. In our dataset, this commonly observed gender disparity in self-reported counts of heterosexual partners, indicative of socially or culturally biased responses, was not apparent. On the contrary, heterosexual women, who were on average three years older than the men, reported a slightly higher number of partners (4.7) than men (4.3). When the comparison was made within individual age brackets of five years each, only in the 20-24 age category did the number of reported sexual partners significantly differ (men: 1.94 partners, women: 2.91 partners, $p = 0.025$). This pattern is consistent with broader social and behavioral trends, where men often initiate their sexual lives later than women (Wellings et al., 2006), and women frequently choose older partners (Walter et al., 2020). These factors could contribute to the observed differences in the number of sexual partners between men and women in the 20-24 age category.

Changes in Sexual Life Variables by Respondent Age

Our results showed that the intensity of arousal by same-sex individuals and feelings of sex-gender incongruence decrease with age, particularly among women. In contrast, arousal by opposite-sex individuals remains stable into advanced age, and among women, even shows a tendency to increase. Interestingly, the number of lifetime partners remains relatively constant

from around age 30 for women and age 40 for men, only to increase again after age 70. In our dataset, there were 66 women and 30 men older than 69, and it is likely that the lengthy and demanding questionnaire was completed by more vital seniors. The observed increase in the number of partners could be due to various factors, such as serial polygamy in conjunction with the death of long-term life partners, cohort effects, or even psychological artifacts like memory bias or exaggeration. Given the monotonic decrease in the number of same-sex partners among women from age 30 to 70, a cohort effect appears to be a particularly compelling explanation. The observed pattern suggests that the sexual behavior and experiences of earlier-born cohorts may differ significantly from those of later-born cohorts, at least in the case of same-sex relationships among women. The cohort effect thus emerges as a key factor in understanding these age-related changes. Intriguingly, the number of male sexual partners also increases among men after age 65, suggesting that some men may come to terms with their sexual orientation later in life. However, to fully substantiate these observations, data from longitudinal or qualitative research would be essential.

In our study, when women assessed their own gender identification, we observed a trend where they increasingly identified less with the male gender as they aged. Specifically, the inclination towards identifying with male characteristics showed a noticeable decline up until the age of 40. This trend then stabilized, remaining relatively constant until the age of 70, after which there was a slight further decrease. Among men, the tendency to identify with male characteristics remained constant until around age 65 and then declined significantly. This decline in self-identified gender among men after the age of 65 could potentially be linked to the often-cited decline in sexual function. For many men, sexual function is frequently perceived as a measure or proof of one's gender identity (Obstfeld, Lupfer, & Lupfer, 1985)

Arousal from both own and others' sexual submission decreases for the majority of one's lifetime in both men and women. In women aged 70 and older, arousal from own submission begins to rise again, and in senior men, arousal from others' submission similarly increases. In both scenarios, the decline in arousal from own submission occurs either more rapidly or earlier, resulting in older individuals having a higher average sexual dominance index than their younger counterparts. Unlike sexual dominance, dominance in everyday life changed very little with age; it mildly increases until around the age of 30 and then declines very slowly thereafter.

Exploring Sexual Orientations, Preferences, and Gender Identities

The complexity of our study's design, coupled with a relatively large sample size, enabled us to scrutinize the interrelationships among variables related to sexual life, as well as their relationships with other participant characteristics. This analysis yielded several non-trivial findings.

Asexual individuals (0.34% women, 0.11% men)

In our study, the representation of asexual individuals, defined as those not sexually attracted to either men or women, was quite low. Beyond their lack of sexual attraction to either gender, asexual individuals also reported lower arousal by sexual dominance and submission. The correlation between asexuality and the SM index was not statistically significant for either women ($p = 0.308$) or men ($p = 0.063$). However, it is important to note that our large sample included only 14 asexual women and 2 asexual men. (The partial Kendall correlation test can be used even with such strongly unbalanced samples, as it is an exact test).

Interestingly, our results suggest that asexual individuals do not experience any health issues. In fact, asexual men reported better mental health than other study participants, although this result was not statistically significant ($p = 0.128$) likely due to the low number of asexual men in the sample. Emotional stability, as measured by the TIPI questionnaire, however, was significantly higher among asexual men compared to controls ($Tau = 0.34$, $p = 0.048$). In terms of sexual history, asexual women reported fewer male sexual partners, and asexual men were more likely to be single and had fewer children, although this was not statistically significant ($p = 0.072$). Both asexual men and women scored lower on the personality trait of conscientiousness. Women appeared to be more honest, while men appeared less so. Both asexual women and men reported feeling less attractive to the opposite sex, but overall self-esteem was not significantly lower among asexual individuals.

Homosexual individuals (2.17% women and 3.47% men)

The proportion of homosexuals—individuals exclusively attracted to persons of the same sex—was relatively low in our sample population. This is primarily because the majority of individuals who reported being attracted to the same sex also indicated some level of attraction to the opposite sex, leading them to be categorized as bisexuals in our study. Compared to other groups, homosexual individuals did not display any significant differences, except for the expected lower number of opposite-sex partners and higher number of same-sex partners. Homosexual men were less frequently married and had fewer children; however, these associations were not observed among homosexual women. Also, only among men was there a significant decline in both physical and, particularly, mental health. Homosexual men reported lower attractiveness to opposite-sex individuals and lower courage. Women exhibited lower

educational attainment and intelligence, although this difference was only noticeable when compared to bisexual women, not heterosexual women. Homosexual women also reported lower openness to experience, courage, and higher sexual disgust. Regarding arousal by their own submission, homosexual men reported higher levels while women reported lower levels.

Bisexual individuals (40.02% women and 25.35% men)

In our study, individuals categorized as bisexual, i.e. those reporting sexual attraction to both men and women, constituted the second-largest group in terms of sexual orientation, following heterosexuals. Bisexual women were particularly attracted to the same sex, even more so than homosexual women, and less attracted to the opposite sex compared to heterosexual women. They were highly aroused by their own submission and even more so by the submission of others. They had more male sexual partners than heterosexual women and exceeded even homosexual women in the number of female sexual partners they had. Despite these differences, they were less frequently married, had fewer children, and reported poorer physical and mental health. In cognitive tests like IQ and the Stroop test, they outperformed other women, exhibited faster reaction times, and better memory. They also scored lower on traits such as agreeableness, conscientiousness, and emotional stability while showing higher openness to experience, lower levels of sexual and moral disgust, and higher scores in dark triad traits. They reported lower empathetic abilities but higher IQ and dominance.

Bisexual men were also more attracted to same-sex individuals than were homosexual men and less attracted to the opposite sex individuals than heterosexual men. They found both the submission of others and, even more so, their own submission to be highly arousing. They reported more male sexual partners than heterosexual men but fewer than homosexual men. Like

bisexual women, they were less frequently married and had fewer children. They reported poorer physical and mental health, even when compared to homosexual men. Despite having the lowest levels of educational attainment among all sexual orientation groups, they performed best in IQ and Stroop tests and had the fastest reaction times. Like the women, they scored lower in agreeableness, conscientiousness, and emotional stability, while showing higher openness to new experiences. They also scored lower in pathogen, sexual, and moral disgust but higher in Machiavellianism and psychopathy. Furthermore, they rated themselves highly in intelligence but low in knowledge and courage.

In summary, our findings indicate that individuals classified as bisexual report poorer physical and mental health outcomes compared to other groups, potentially pointing to unique emotional challenges. Additionally, they reported having a greater number of sexual partners across genders and scored higher on all cognitive performance tests. One way to interpret these findings could be through the lens of life history theory: the health-related challenges faced by this group might lead to a faster life history strategy, characterized by increased sexual desire and a lower likelihood of long-term commitments like marriage (Luoto et al., 2019). This hypothesis will be further discussed in the following section on heterosexuals.

The elevated cognitive performance in bisexuals could be the result of a compensatory adaptation to health challenges, potentially linked to a 'resilience effect' (Flood & Keegan, 2022). This aligns with research showing that mild stress can improve specific cognitive functions (Hidalgo et al., 2012). Additionally, stress may have an adverse effect on the personality trait of conscientiousness (Lindová, Příplatová, & Flegr, 2012; Zhu et al., 2022). We observed this significant effect in both men and women in the present study as well. High levels of conscientiousness have been found to negatively influence performance on specific types of

cognitive tests, possibly because of a tendency toward overcaution or overthinking (LePine, Colquitt, & Erez, 2000).

Heterosexual individuals (57.82% women and 71.18% men)

In our sample, heterosexuals had constituted the largest group. Although they had notably outnumbered bisexuals, especially among men, these two groups had collectively accounted for over 96% of the total population. In contrast, other sexual orientations such as homosexuals and asexuals had made up less than 4%. This implied that in comparisons involving heterosexuals or bisexuals with the rest of the population, these smaller groups had minimal impact. Consequently, the characteristics of heterosexuals had closely mirrored those of bisexuals, differing merely in polarity. For this reason, we chose to omit heterosexuals from the relevant tables to focus on the unique features of other groups. A distinct variable had been the index of sexual dominance: it had been virtually neutral for both bisexual men and women, who found arousal in both their own and others' submission. On the contrary, heterosexual men had exhibited a positive index, being considerably more aroused by others' submission than their own, while for heterosexual women the index had been negative, indicating they found their own submission more arousing. Homosexual individuals had shown the opposite pattern. Generally, heterosexuals had been less aroused by both submission and dominance compared to bisexuals. An essential attribute of heterosexual individuals in our sample was their relatively better health status, which affected mental health for women and both mental and physical health for men. It's conceivable that this difference in health status could have been the primary driver for other disparities observed between heterosexual and bisexual individuals. One hypothetical explanation for the observed patterns suggests that those with poorer health might

subconsciously adopt a faster life history strategy, a phenomenon shown by Sýkorová and Flegr in 2022 (Sykorova, Fiala, Hlavacova, Kankova, & Flegr, 2022). Individuals with higher sexual desire might also be more responsive to a wider range of sexual stimuli, including individuals of their own sex and their own and others' submission. This poorer health could have either directly or indirectly affected other personality traits, such as higher scores in dark triad attributes observed in our sample. Additionally, certain traits like lower sexual disgust and greater openness to new experiences might have been secondarily influenced by bisexuality itself. Both the faster life history strategy and the varied sexual preferences could ultimately stem from poorer health conditions. However, it should be emphasized that this is a speculative ex-post hypothesis warranting further investigation.

Transgender individuals (0.23% women and 0.22% men sure, 9.75% women and 11.35% men contemplating)

Both male and female transgender individuals showed a significantly higher prevalence of non-heterosexual orientations compared to cisgender individuals. However, even among those who were certain that they were in a body of the wrong sex, a high percentage remained heterosexual—approximately 40% for individuals assigned female at birth but identifying as male, and about 50% for those assigned male at birth but identifying as female. This could complicate the search for one's own gender identity and could significantly influence decisions about potential gender transition.

Transsexuality is associated with a significantly higher SM index in both men and women. Specifically, transgender women are more aroused by sexual dominance compared to cisgender women, while transgender men are more aroused by sexual submission. The same

effects were also observed in transgender individuals who were entirely certain about their gender identity. While these effects remained statistically significant (with the exception of arousal by others' submission in men), their magnitude (partial Kendall Tau) was 3-5 times lower compared to individuals who were not entirely certain about their gender identity. As could be expected, cisgender men are generally more aroused by sexual dominance, and cisgender women by sexual submission—see below.

Transgender women reported fewer male sexual partners but significantly more female sexual partners. Both the likelihood of marriage and the number of children were lower for transgender women compared to cisgender individuals. This was particularly pronounced for those who were not entirely certain about their gender-sex incongruence. A similar pattern was even more evident in the case of mental and physical health. Those who were certain of their transgender identity showed no signs of deteriorated health, whereas those uncertain about their identity reported worse physical and even more strongly worse mental health.

Educational attainment was notably lower for transgender women, despite their higher scores on Cattell's intelligence test. For men who were uncertain about their gender, educational attainment was even lower still. Interestingly, the impact on intelligence was only discernible for men who were certain about their gender-sex incongruence, and the trend was opposite to that observed for women—lower than in cisgender individuals.

Overall, the influence of transgender identity on cognitive test performance varied both between men and women and between those certain and uncertain about their gender identity. The impact of this certainty was even more pronounced for personality traits. With the exception of higher agreeableness in men, lower extroversion in women, lower sexual disgust in women, lower narcissism in both genders, and lower self-esteem and attractiveness to the opposite sex in

women, transgender individuals who were certain about their gender identity showed no significant differences compared to cisgender individuals. In contrast, those who had doubts about their gender exhibited far more numerous and stronger differences. Women who were uncertain about their gender identity reported lower levels of Extroversion, Agreeableness, Conscientiousness, and Emotional Stability, but higher levels of Openness to Experience. They also reported lower levels of pathogen disgust, sexual disgust, and moral disgust, but higher levels of Machiavellianism and psychopathy. Additionally, they had lower self-esteem, reported lower empathic ability, and basic educational knowledge, as well as reduced attractiveness to the opposite sex, but higher levels of courage. Men who were uncertain about their gender identity had lower levels of Extroversion, Conscientiousness, Emotional Stability, moral disgust, self-esteem, and reported lower basic educational knowledge, attractiveness to the opposite sex, dominance, and courage. The observed differences were not due to the higher number of individuals uncertain about their gender identity compared to those certain they were transgender. This was evident from the fact that not only were the results of statistical tests less significant, but also the size of the effects (measured by Kendall's Tau in absolute value) were much lower among individuals who were certain about being transgender compared to those who were uncertain.

In general, it appears that being transgender in itself does not have a negative impact on physical and mental health or overall well-being. However, uncertainty regarding one's gender identity may have such effects. It is also conceivable that the causality could be reversed—individuals with health issues, particularly mental health problems, may become uncertain about their gender identity as a result.

Sexual Dominance and Submissiveness (40.19% women and 50.03% men)

In the questionnaire, a surprisingly large proportion of participants indicated that they are sexually aroused by either their own or another's submissiveness. Among these women, the majority (82.24%) were more aroused by their own submissiveness compared to another's. Conversely, for men, the pattern favored arousal by another's submissiveness over their own (75.70%). This pattern extended within same-sex individuals who differed in gender identity: biological women who identified as men exhibited higher sexual dominance than other women, while biological men who identified as women displayed lower sexual dominance, i.e., were more aroused by their own submissiveness compared to other men. This trend was more pronounced among those uncertain of their sexual identity than those confident they were of the opposite gender; individuals assigned as females at birth who were certain of their male identity did not display this trend.

The same pattern was observed, to a lesser extent, among homosexual individuals. Homosexual women showed higher sexual dominance compared to other women, while homosexual men demonstrated higher submissiveness compared to other men—although the latter finding did not reach the threshold for statistical significance ($p = 0.052$). This association between homosexuality and sexual dominance might be secondary and influenced by a higher prevalence of homosexuality among transgender individuals (around 50%).

A different scenario emerged among bisexuals: bisexual women displayed lower sexual dominance compared to other women, whereas bisexual men exhibited only a very weak and absolutely nonsignificant trend toward lower sexual dominance ($p = 0.269$).

It's important to note that these differences and shifts pertain exclusively to sexual dominance and not to everyday life dominance. For women, everyday life dominance is neither

correlated with gender identity nor sexual orientation. However, bisexual women display increased, not decreased, everyday life dominance. For men, sexual orientation had no influence on everyday life dominance, but transgender men exhibited both lower everyday life and sexual dominance compared to cisgender men. Moreover, a relatively strong positive correlation exists between the two types of dominance for both men and women, which contradicts the older notion that sexually submissive men compensate for their everyday life dominance.

Examining additional characteristics, sexual dominance in women correlated with the number of children and female sexual partners; submissive women tended to have more children but fewer female sexual partners. Submissive women also scored higher on agreeableness and lower on psychopathy, reported less elementary school knowledge, and higher attractiveness to the opposite sex. Men with higher indices of sexual dominance had more female and fewer male sexual partners and exhibited higher levels of extraversion, emotional stability, narcissism, and reported higher courage.

Strengths and limitations

One of the most significant strengths of this study lies in its comprehensive design, encompassing a wide range of questionnaires and cognitive tests. Additionally, the robust sample size adds credibility to our findings. A particularly noteworthy advantage is the strategic placement of questions regarding sexuality at the end of the questionnaire, ensuring that our sample is more likely to be representative in terms of attitudes toward sexuality. Remarkably, only 2% of participants chose not to answer the sexuality-related questions and subsequently dropped out of the study. This low drop-out rate further strengthens the study's

representativeness. Additionally, the absence of material incentives for participation minimized the risk of data corruption from bots or professional survey respondents.

However, the study has its limitations. The primary concern is that participation relied on self-selection and internet access, potentially skewing the sample toward individuals who are more curious and altruistic. Furthermore, while health-related data proved to be a significant parameter in understanding different aspects of sexuality, the information was solely based on self-reported measures rather than corroborated medical records. However, it is worth noting that these self-reports included concrete and relatively objective details, such as the number of medications the respondent was currently taking, which ensured a higher level of reliability.

Conclusions

In a large sample from a general internet-based population, we determined the frequency of individuals with diverse sexual orientations, gender identities, and preferences for sexual dominance and submission. Participants completed an extensive panel of psychological questionnaires and performance-based tests, as well as providing detailed information on their physical and mental health. Our study reports the prevalence of heterosexual, homosexual, bisexual, asexual, transgender individuals, and individuals exhibiting preferences for sexual dominance and submission within male and female populations. We reveal how sexual orientation, gender identity, and sexual preferences interrelate and how they correlate with age, health status, psychological well-being, and cognitive performance. Among the most intriguing findings of this descriptive analysis is the observation that asexual individuals, as well as those with a clear understanding of their transgender identity, exhibit no significant issues with physical or mental health. In contrast, bisexual individuals and those uncertain about their gender

identity show an elevated prevalence of such issues. Unlike the conventional approach of categorizing sexual orientation based on self-identification, we employed a method rooted in participants' responses to two questions: the extent to which they are sexually aroused by individuals of the same sex and individuals of the opposite sex. This approach allowed us to sharply distinguish bisexual individuals (who experience at least some arousal from both sexes) from homosexual individuals (aroused exclusively by the same sex) and heterosexual individuals (aroused exclusively by the opposite sex). This classification revealed that bisexual individuals constitute a distinct and sizeable category, differing significantly from both heterosexual and homosexual individuals. Bisexual individuals, compared to other groups (heterosexuals, homosexuals, and the rare asexual individuals), demonstrated poorer physical and mental health, superior performance in certain cognitive tests, and higher sexual arousal and activity levels.

In the discussion, we proposed the fast-life hypothesis of bisexuality. This hypothesis suggests that individuals in poorer health subconsciously adopt a fast-life strategy aimed at early reproduction. While evolutionary logic favors delaying reproduction to an optimal age when individuals have accumulated sufficient physiological and material resources, those in poorer health and with a less promising health prognosis may benefit from prioritizing earlier reproduction, potentially at the expense of offspring quality. This fast-life strategy is characterized by heightened sexual desire, which manifests as arousal to a broader range of stimuli, including individuals of any sex, orientation, and sexual dominance/submission preference. It is important to emphasize that the fast life-history hypothesis of bisexuality is a post hoc hypothesis based on the current dataset and should be approached as such. Its validity must be tested in future studies using independent datasets. To further evaluate arousal to same-sex and opposite-sex individuals, future research should employ not only subjective self-rating

methods but also more objective, instrumental techniques. Similarly, the validity of categorizing sexual orientation based on arousal should be tested by analyzing the relationships between various dependent variables and sexual orientation as determined simultaneously through self-categorization and arousal-based classification within the same sample.

Our study provides a novel perspective on human sexuality by linking the diversity of sexual arousal to broader life-history strategies shaped by health status. This perspective suggests that sexual preferences and orientations are not fixed traits but may be influenced by adaptive mechanisms related to an individual's reproductive strategy and overall well-being. Future research should focus on clarifying how health and life-history strategies affect sexuality to improve scientific understanding and develop more effective support systems for individuals navigating their sexual identities.

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