

Sexual violence in the workplace and associated health outcomes: a nationwide, cross-sectional analysis of women in Iceland



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Summary

Background Workplace sexual violence against women is a pressing global issue with scarce knowledge on its health implications. Existing research is largely limited to specific occupations, which calls for comprehensive, population-based studies. This study aimed to examine the associations between self-labelled workplace sexual violence and a variety of health outcomes in a nationally representative sample of Icelandic women aged 18–69 years.

Methods Participants in this cross-sectional study were women in the Stress-And-Gene-Analysis (SAGA) cohort who answered the question regarding workplace sexual violence, defined in our study as encompassing all work sectors, academic settings, and other school environments. Eligible participants were women, aged 18–69 years, residing in Iceland, who spoke Icelandic and were listed in the Icelandic Population Register or had a contact number registered with the online 1819 service. Poisson and binomial regressions were used to assess the associations between workplace sexual violence and validated measures of current mental and physical health outcomes (eg, probable depression, general anxiety, and severe sleep problems). Multiple imputation was performed to account for missing values in the dataset.

Findings The study was conducted from March 1, 2018, to July 1, 2019. Of the 113 814 women deemed eligible for study inclusion, 104 197 were invited to take part in the online survey. Of those invited, 30 403 women completed the survey and were included in the SAGA cohort. Among these participants, 15 812 provided answers to the question regarding exposure to workplace sexual harassment or violence. Exposure to sexual violence was associated with an increased prevalence of probable depression (prevalence ratio [PR] 1.50 [95% CI 1.41–1.60]), general anxiety (PR 1.49 [1.40–1.59]), social phobia (PR 1.62 [1.48–1.78]), self-harm (PR 1.86 [1.53–2.28]), suicidal ideation (PR 1.68 [1.44–1.68]), suicide attempts (PR 1.99 [1.62–2.44]), binge drinking (PR 1.10 [1.01–1.20]), sleep problems (PR 1.41 [1.48–1.91]), physical symptoms (PR 1.59 [1.48–1.70]), and sick leave (PR 1.20 [1.12–1.28]). The prevalence of the health outcomes among those exposed show age-related differences: younger women report anxiety or depression more frequently, while older women report sleep problems after experiencing workplace sexual violence.

Interpretation In this cross-sectional study self-reported experiences of sexual violence in the workplace were associated with several self-reported health outcomes. The findings suggest a need for targeted interventions to promote workplace safety and to mitigate adverse health implications among people who have experienced workplace sexual violence. Future research should explore factors such as the frequency, duration, and relationship dynamics of workplace sexual violence, as well as the effect on different genders and sexual orientations, to deepen our understanding of these experiences and inform effective prevention strategies.

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Introduction

Sexual harassment and violence represent a wide range of coercive sexual acts¹ that have long been issues in work and academic environments.² WHO¹ categorises sexual violence as any sexual act, attempt to obtain a sexual act, or an act directed against an individual's sexuality using coercion. This definition encompasses a spectrum of behaviours, including rape, attempted rape, and sexual harassment. Specifically, within the workplace, sexual harassment might involve requests for sexual favours

and verbal or physical harassment of a sexual nature. Such behaviours contribute to creating an environment that is intimidating, hostile, or offensive; interferes with work performance; or negatively impacts an individual's employment status.³ We will hereafter refer to workplace sexual harassment or violence as workplace sexual violence.

The reported prevalence of workplace sexual violence is inconsistent across studies, largely due to differences in methodology, definitions, and occupational setting.

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See [Comment](#) page e348

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Research in context

Evidence before this study

We conducted a literature search on workplace sexual harassment and violence and health outcomes, using the following databases: Web of Science, PubMed, Sage Journals, Science Direct, and Google Scholar. We searched for articles published in English from database inception up to April 11, 2024, using the search terms “workplace sexual harassment”, “workplace sexual violence”, “occupational violence”, “sexual harassment in academia”, “sexual violence in academia”, “sexual harassment among students”, and “sexual violence among students” in combination with “mental health”, “health outcomes”, “depression”, “general anxiety”, “social phobia”, “sleep problems”, “physical symptoms”, “alcohol consumption”, “binge drinking”, “sick leave”, “sickness absence”, “self-harm”, “suicidal ideation”, “suicidal attempts”, “trauma”, “adverse childhood experiences”, and “population-based study”. WHO defines sexual violence broadly, including any coerced sexual act, attempts of such acts, and actions against a person’s sexuality, including rape, attempted rape, and sexual harassment. In the workplace, sexual harassment can manifest as unsolicited sexual advances or other sexual verbal or physical conduct, creating a hostile environment that adversely affects work performance and employment status. Previous research observed associations between workplace sexual violence and various health outcomes including: depression among Danish adults; increased anxiety among US university employees; deaths by suicide and suicide attempts among Swedish adults and US soldiers; and back pain, headaches, and sleep disturbances among South Korean adults. Additionally, two US studies associated exposure with increased alcohol consumption among female military veterans and firefighters. However, previous studies have rarely been population-based and predominantly focused on depression, leaving other mental and physical health outcomes less examined. Notably, no studies were found that explore the association between workplace sexual violence and self-harm or social phobia.

Added value of this study

The study adds substantial value as one of the largest population-based studies on the association between sexual violence and various mental and physical health outcomes in the workplace or in academia. Our study is the first to assess probable social phobia and self-harm in this context and among the first to examine multiple health issues concurrently. Utilising an all-female cohort, the study also provides crucial insights into the specific effects of workplace sexual violence on women. Our findings reveal associations between experiences of workplace sexual violence and self-reported health outcomes, including depression, general anxiety, social phobia, self-harm, and suicidal attempts. Notably, the association between exposure and health outcomes demonstrates some variation by age, with younger women more frequently reporting anxiety and older women more often reporting sleep and physical health concerns.

Implications of all the available evidence

Overall, this population-based study elucidates the potential mental and physical health implications of workplace sexual violence among women, particularly among young women. These findings indicate clinical implications of this issue, which not only detrimentally influence women’s personal and professional lives but might also incur societal costs, including increased sickness absence and employee turnover. Our findings suggest a potential benefit of intervention strategies, health screenings, and mental health referrals for women affected by workplace sexual violence, as well as the importance of developing anti-violence policies and prevention measures within workplace and academic settings. However, given this study’s context in Iceland, a country with a high global equality ranking and comprehensive sexual violence policies, the broader applicability of these findings, particularly in regions with differing social and legal frameworks, warrants cautious interpretation.

Women,⁴ particularly those who are young,⁵ university educated,⁵ and working shifts,⁵ are most frequently affected. In a previous study, we observed a 33% lifetime prevalence of such violence among women in Iceland, with substantial sector-specific variations.⁵ Exposure to workplace-related violence has been reported to extend beyond individual distress, affecting job satisfaction, work stress, and overall performance,^{6,7} and leading to increased staff turnover and reduced productivity,⁸ posing substantial societal costs. Thus, these challenges have recently gained attention as important public health concerns requiring an effective response.^{4,9}

Although existing studies^{10–13} have reported a link between workplace sexual violence and adverse health outcomes, considerable knowledge gaps persist. Notably, comprehensive population-based studies are scarce, and

existing research is often confined to specific work sectors or focus predominantly on depression.^{10,11,13} Among the available population-based studies from Europe, a Danish study of 4116 adults¹⁰ reported higher levels of depressive symptoms among women who had experienced workplace sexual violence, and a previous Swedish cohort study of 86 451 adults¹² observed an elevated risk of suicide and suicide attempts among those experiencing workplace harassment, even after adjusting for baseline health-related and work-related factors.

Another Swedish study of 64 297 individuals¹⁴ found that both women and men frequently exposed to workplace sexual violence were more likely to experience long-term sickness leave than those who were not. A US study linked workplace sexual violence to poor sleep quality and sexual assault to heightened depression and

anxiety among women aged 40–60 years.¹⁵ In the UK, adolescents exposed to sexual violence showed increased psychological distress and self-harm risks, with girls being particularly vulnerable.¹⁶ Another US study found that 19% of college students faced sexual violence from faculty or staff and 30% from peers, with sexual minorities facing higher rates of sexual violence.¹⁷ However, the association between sexual violence in the workplace and other potential outcomes such as social phobia, self-harm, physical symptoms, sleep problems, and alcohol consumption remain largely unexplored.

Expanding on these findings, we leveraged a nationally representative cohort of Icelandic women to examine the relationships between workplace sexual violence in previous or current working environments and an array of health outcomes. Specifically, the aim of the study was to evaluate associations of workplace sexual violence with probable depression, general anxiety, social phobia, self-harm, suicidal ideation, suicide attempts, binge drinking, sleep disturbances, and high physical symptom severity, as well as sick leave. Importantly, recognising age as a potential modifier of these associations, we also aimed to stratify our analyses by age.

Methods

Study design and participants

By use of a cross-sectional cohort design, this study utilised de-identified data collected from women participants in the Icelandic Stress-and-Gene-Analysis (SAGA) cohort, a nationwide study on the impact of trauma on women's health. The baseline assessments were conducted online and were open to all Icelandic-speaking women residing in Iceland, aged 18–69 years. Women with a registered address or telephone number were directly invited to participate. Participants were invited through text messages, telephone calls, or letters to a registered address and provided informed written consent with their identification verified through electronic identification before completing an extensive web-based survey. Further details about the study procedure are presented in the appendix (p 2). The study was approved by the National Bioethics Committee of Iceland (VSNb2017110046/03.01) and the Icelandic Data Protection Authority. The study is reported in accordance with the STROBE guidelines, the Checklist for Reporting of Survey Studies, and the Checklist for Reporting Results of Internet E-Surveys (appendix pp 27–35).

Procedures

A complete list of variables used in our study can be found in the appendix (pp 3–12). We defined the term workplace as encompassing all work, academic settings, and school environments (from elementary school to higher education), recognising the diverse contexts of potential sexual violence. Following previous research,¹⁸ the exposure was assessed with the question: “Have you experienced sexual harassment or violence in your

working environment?” The response options were no; yes, in my current working environment; yes, in my former working environment; and yes, in both my current and former working environment. We analysed the exposure groups—previous, current, and both—individually. For assessing lifetime exposure, we considered any positive response (previous, current, or both) as part of the ever exposure group.

Outcomes

The past 2 weeks of probable depression and general anxiety were assessed using the 9-item depression module of the Patient Health Questionnaire-9 (PHQ-9)¹⁹ and the 7-item Generalised Anxiety Disorder questionnaire (GAD-7).²⁰ A total score of 12 on the PHQ-9 and 10 on the GAD-7 was used as the cutoff for probable diagnosis of depression and general anxiety, respectively. These tools are widely recognised for their reliability and validity and have been validated for use in the Icelandic population.²¹

To assess probable social phobia, four questions from the MINI-International Neuropsychiatric Interview²² were adapted to a format suitable for a written questionnaire. Participants who answered yes to all four questions were considered to meet criteria for probable social phobia.

We adapted questions from the World Mental Health–Composite International Diagnostic Interview²³ from their original interview format to a format suitable for a written questionnaire, to assess self-harm and suicidal ideation within the past year, and suicide attempts over the past 4 years. Participants confirming self-harm were asked why they self-harmed (“I felt the need to”, “it made me feel better”, “it was a cry for help”, “I wanted to die”, and cannot or will not answer). Only those indicating self-harm with thoughts of dying or having a specific plan were asked about suicide attempts. To identify incidents of self-harm, suicidal ideation within the past year, and suicide attempts within the past 4 years, participants were asked about the age of their most recent incident, which was then subtracted from their current age at participation.

Our study utilised the Alcohol Use Disorders Identification Test-Concise to assess binge drinking, due to its important implications for health and its role as a robust indicator of alcohol-related harm.²⁴ Binge drinking was defined as consuming six or more drinks in a single occasion at least once a month for the past 12 months, with one drink equivalent to a standard serving of spirits.

The Pittsburgh Sleep Quality Index (PSQI)²⁵ was used to measure sleep problems over the past 4 weeks, using a self-report format of 19 items. A score of at least 10 on the PSQI was used as a cutoff for severe sleep problems.

The PHQ-15 was used for measuring somatic symptoms over the past 4 weeks. It is a reliable and valid screening tool used worldwide.²⁶ The score ranges from 0 to 30, with high physical symptom severity defined as a total score of at least 15.²⁶

See Online for appendix

Sick leave from work was measured with the question “How often have you been on sick leave for 15 or more consecutive days in the past 12 months?” with response choices of never, once, or more than once. These responses were converted into binary variables for analysis (never, 0; once or more, 1).

Statistical analysis

Demographic variables included age in years (18–24, 25–34, 35–44, 45–54, or 55–69), country of birth (Iceland, other Nordic country, outside the Nordic countries), marital status (married or in a relationship, and single, divorced, or widowed), education (elementary, high school or vocational, university, or other), monthly income (low income, medium income, medium-high income, or high income), and residence region (capital, north or east, west or westfjords, south, or south peninsula). Weekly work hours were categorised as less than 20 h, 20–39 h, 40–59 h, 60–79 h, or 80 h or more. For employment status, options allowed for multiple responses to capture a range of conditions: working full-time, part-time, self-employed, student, student and work, not working or student, on sick leave, or on maternity leave. To focus our analysis on those engaged in work or education, we categorised participants with multiple statuses into work or student groups. This approach recognises that individuals temporarily absent from the workforce, such as when on sick leave or maternity leave, might still encounter sexual violence in connection to their current or most recent employment. Additionally, the not working nor student category might encompass individuals engaged in volunteer work.

Based on previous research,^{5,27} we included work schedule (day job, shift work, or irregular), number of lifetime traumatic events (none, one, two, or three or more) according to the Life Events Checklist for DSM-5, adverse childhood experiences (none, one, two, three, or four or more) according to the Adverse Childhood Experiences International Questionnaire (ACE-IQ), and sexual orientation (heterosexual, sexual minority, or no information). In 2018, a question regarding sexual orientation was added. Participants who had already completed the survey before this question was added were categorised in the analysis under no information for sexual orientation. For all questions, participants had the option to respond with cannot or will not answer, except for queries regarding age, weekly work hours, and work schedule.

For each binary version of the health outcomes (depression, general anxiety, social phobia, self-harm, suicidal ideation, suicidal attempts, binge drinking, severe sleep problems, high physical symptom severity, and sick leave), we constructed separate models to evaluate the association with exposure to workplace sexual violence. Both conventional logistic regression models and Poisson log-linear models with robust error

variance and adjustments for age, marital status, education level, income, and work schedule were used. Within each of these models, we evaluated the exposure groups previous, current, and both in one model, and the ever group in another. The R package *emmeans* was used to calculate the prevalences of the exposures and outcomes as well as the marginal prevalence ratios (PRs) and 95% CIs from each model.

To assess the fit, we used the function *HLfit()* from R package *modEvA* to conduct a Hosmer-Lemeshow goodness-of-fit test for the binomial models. The results indicated that all models fit well, confirming the suitability of the Poisson approximation. Unlike logistic regression, the robust Poisson approach allows us to interpret the outcomes directly as risk or PRs.²⁸ We examined potential effect modifications by age, sexual orientation, marital status, education, income, employment status, work schedule, lifetime traumatic events, and adverse childhood experiences. Regressions with interaction terms were limited to complete cases. Hochberg’s method was used to adjust the *p* values, using R package *emmeans* and function *p.adjust()*.

The ACE-IQ assesses experiences before age 18 years. To prevent redundancy with our primary exposure, we omitted sexual abuse from our analysis. For assessing lifetime traumatic events, our criteria included only those events directly experienced by the participants or witnessed in specific scenarios such as suicide or murder and accidents. We deliberately excluded sexual violence (rape, attempted rape, and coercion into any kind of sexual acts through force or threat of harm) and other unwanted or uncomfortable sexual experiences to maintain a clear distinction from our exposure variable.

To assess the effect of missing data, a sensitivity analysis was conducted comparing complete case analysis with results obtained through multiple imputation. Our conclusions remained consistent across both analyses, with some variation in PRs and CIs for self-harm and suicide attempts. This was to be expected as they are rare outcomes and have the most missing values of the outcomes (appendix pp 13–14). Notably, with an 88·4% completion rate, most missing values occurred towards the end of the questionnaire, indicating a pattern in which participants were more likely to skip questions located later in the survey. This pattern suggests minimal bias in missing values relative to demographics. Multiple imputation was performed using predictive mean matching (with *m*=30) via the *mice* package²⁹ to account for these missing values. Thus, results reported in this study are based on the multiple imputation approach.

Sensitivity analysis was conducted in which adjustments for history of lifetime traumatic events and adverse childhood experiences were made separately (appendix pp 16–17). We chose not to adjust for traumatic events in our main analyses to prevent potentially over-controlling

	Only previous (n=4112)	Only current (n=622)	Both (n=557)	Ever (n=5291)	Never (n=10 521)	Total (n=15 812)
Age, years						
18–24	401 (9.8%)	101 (16.2%)	66 (11.8%)	568 (10.7%)	1060 (10.1%)	1628 (10.3%)
25–34	811 (19.7%)	134 (21.5%)	126 (22.6%)	1071 (20.2%)	1696 (16.1%)	2767 (17.5%)
35–44	933 (22.7%)	154 (24.8%)	120 (21.5%)	1207 (22.8%)	2020 (19.2%)	3227 (20.4%)
45–54	916 (22.3%)	119 (19.1%)	125 (22.4%)	1160 (21.9%)	2435 (23.1%)	3595 (22.7%)
55–69	1051 (25.6%)	114 (18.3%)	120 (21.5%)	1285 (24.3%)	3310 (31.5%)	4595 (29.1%)
Country of birth						
Iceland	3905 (95.0%)	594 (95.5%)	530 (95.2%)	5029 (95.0%)	9960 (94.7%)	14 989 (94.8%)
Other Nordic country	90 (2.2%)	11 (1.8%)	<10/557 (<1.8%)	110 (2.1%)	21 (2.0%)	323 (2.0%)
Outside the Nordic countries	106 (2.6%)	16 (2.6%)	18 (3.2%)	140 (2.6%)	33 (3.1%)	470 (3.0%)
Cannot or will not answer	<10/4112 (<0.2%)	0/622	0/577	<10/5291 (<0.2%)	<10/10 521 (<0.1%)	<10/15 812 (<0.1%)
Unknown	10 (0.2%)	<10/622 (<1.6%)	0/577	11 (0.2%)	17 (0.2%)	28 (0.2%)
Sexual orientation						
Heterosexual	2737 (66.6%)	434 (69.8%)	378 (67.9%)	3549 (67.1%)	6998 (66.5%)	10 547 (66.7%)
Sexual minorities	291 (7.1%)	24 (3.9%)	46 (8.3%)	361 (6.8%)	382 (3.6%)	743 (4.7%)
Cannot or will not answer	<10/4112 (<0.1%)	<10/622 (<0.3%)	<10/557 (<0.5%)	10 (0.2%)	28 (0.3%)	38 (0.2%)
No information*	1079 (26.2%)	162 (26.0%)	130 (23.3%)	1371 (25.9%)	3113 (29.6%)	4484 (28.4%)
Marital status						
Married or in a relationship	3007 (73.1%)	446 (71.7%)	393 (70.6%)	3846 (72.7%)	8266 (78.6%)	12 112 (76.6%)
Single, divorced, or widowed	1083 (26.3%)	174 (28.0%)	162 (29.1%)	1419 (26.8%)	2200 (20.9%)	3619 (22.9%)
Cannot or will not answer	22 (0.5%)	<10/622 (<0.3%)	<10/557 (<0.4%)	26 (0.5%)	55 (0.5%)	81 (0.5%)
Education						
Elementary	631 (15.3%)	75 (12.1%)	75 (13.5%)	781 (14.8%)	1850 (17.6%)	2631 (16.6%)
High school or vocational	1086 (26.4%)	169 (27.2%)	155 (27.8%)	1410 (26.6%)	2774 (26.4%)	4184 (26.5%)
Other	296 (7.2%)	28 (4.5%)	45 (8.1%)	369 (7.0%)	652 (6.2%)	1021 (6.5%)
University	2085 (50.7%)	350 (56.3%)	282 (50.6%)	2717 (51.4%)	5189 (49.3%)	7906 (50.0%)
Cannot or will not answer	14 (0.3%)	0/622	0/557	14 (0.3%)	56 (0.5%)	70 (0.4%)
Employment status						
Working full-time	1597 (38.8%)	344 (55.3%)	269 (48.3%)	2210 (41.8%)	4798 (45.6%)	7008 (44.3%)
Working part-time	509 (12.4%)	103 (16.6%)	85 (15.3%)	697 (13.2%)	1674 (15.9%)	2371 (15.0%)
Self-employed	293 (7.1%)	19 (3.1%)	29 (5.2%)	341 (6.4%)	639 (6.1%)	980 (6.2%)
Student only	307 (7.5%)	30 (4.8%)	27 (4.8%)	364 (6.9%)	610 (5.8%)	974 (6.2%)
Student and work	345 (8.4%)	85 (13.7%)	72 (12.9%)	502 (9.5%)	771 (7.3%)	1273 (8.1%)
Not working nor student†	1019 (24.8%)	36 (5.8%)	73 (13.1%)	1128 (21.3%)	1962 (18.6%)	3090 (19.5%)
Cannot or will not answer	42 (1.0%)	<10/622 (<0.8%)	<10/557 (<0.4%)	49 (0.9%)	67 (0.6%)	116 (0.7%)
Monthly income						
Low income	1427 (34.7%)	145 (23.3%)	143 (25.7%)	1715 (32.4%)	3112 (29.6%)	4827 (30.5%)
Medium income	1120 (27.2%)	175 (28.1%)	160 (28.7%)	1455 (27.5%)	3193 (30.3%)	4648 (29.4%)
Medium-high income	840 (20.4%)	174 (28.0%)	159 (28.5%)	1173 (22.2%)	2399 (22.8%)	3572 (22.6%)
High income	552 (13.4%)	117 (18.8%)	75 (13.5%)	744 (14.1%)	1340 (12.7%)	2084 (13.2%)
Cannot or will not answer	173 (4.2%)	11 (1.8%)	20 (3.6%)	204 (3.9%)	477 (4.5%)	681 (4.3%)

(Table 1 continues on next page)

	Only previous (n=4112)	Only current (n=622)	Both (n=557)	Ever (n=5291)	Never (n=10 521)	Total (n=15 812)
(Continued from previous page)						
Weekly work hours						
<20	269 (6.5%)	55 (8.8%)	28 (5.0%)	352 (6.7%)	675 (6.4%)	1027 (6.5%)
20–39	980 (23.8%)	172 (27.7%)	141 (25.3%)	1293 (24.4%)	2974 (28.3%)	4267 (27.0%)
40–59	1607 (39.1%)	315 (50.6%)	269 (48.3%)	2191 (41.4%)	4473 (42.5%)	6664 (42.1%)
≥60	195 (4.7%)	39 (6.3%)	44 (7.9%)	278 (5.3%)	370 (3.5%)	648 (4.1%)
Not working	1061 (25.8%)	41 (6.6%)	75 (13.5%)	1177 (22.2%)	2029 (19.3%)	3206 (20.3%)
Work schedule						
Day job	1893 (46.0%)	318 (51.5%)	247 (44.3%)	2458 (46.5%)	5921 (56.3%)	8379 (53.0%)
Shift work	367 (8.9%)	150 (24.1%)	125 (22.4%)	642 (12.1%)	912 (8.7%)	1554 (9.8%)
Irregular	484 (11.8%)	83 (13.3%)	83 (14.9%)	650 (12.3%)	1049 (10.0%)	1699 (10.7%)
Not working or student only‡	1326 (32.2%)	66 (10.6%)	100 (18.0%)	1492 (28.2%)	2572 (24.4%)	4064 (25.7%)
Cannot or will not answer	42 (1.0%)	<10/622 (<0.8%)	<10/557 (<0.4%)	49 (0.9%)	67 (0.6%)	116 (0.7%)
Residence region						
Capital	2853 (69.4%)	435 (69.9%)	399 (71.6%)	3687 (69.7%)	6633 (63.0%)	10 320 (65.3%)
North or east	468 (11.4%)	88 (14.1%)	53 (9.5%)	609 (11.5%)	1517 (14.4%)	2126 (13.4%)
West or westfjords	248 (6.0%)	38 (6.1%)	26 (4.8%)	312 (5.9%)	771 (7.3%)	1083 (6.8%)
South	280 (6.8%)	42 (6.8%)	31 (5.6%)	353 (6.7%)	858 (8.2%)	1211 (7.7%)
South peninsula	182 (6.2%)	17 (2.7%)	34 (6.1%)	233 (4.4%)	607 (5.8%)	840 (5.3%)
Unknown	81 (2.0%)	<10/622 (<0.3%)	14 (2.5%)	97 (1.8%)	135 (1.3%)	232 (1.5%)
Lifetime traumatic events§						
None	820 (19.9%)	155 (24.9%)	96 (17.2%)	1071 (20.2%)	3219 (30.6%)	4290 (27.1%)
One	1072 (26.1%)	193 (31.0%)	151 (27.1%)	1416 (26.8%)	3160 (30.0%)	4576 (28.9%)
Two	888 (21.6%)	123 (19.8%)	130 (23.3%)	1141 (21.6%)	1945 (18.5%)	3086 (19.5%)
Three or more	1016 (24.7%)	106 (17.0%)	141 (25.3%)	1263 (23.9%)	1447 (13.8%)	2710 (17.1%)
Unknown	316 (7.7%)	45 (7.2%)	39 (7.0%)	400 (7.6%)	750 (7.1%)	1150 (7.3%)
Adverse childhood experiences¶						
None	719 (17.5%)	134 (21.5%)	86 (15.4%)	939 (17.7%)	3196 (30.4%)	4135 (26.2%)
One	833 (20.3%)	147 (23.6%)	84 (15.1%)	1064 (20.1%)	2568 (24.4%)	3632 (23.0%)
Two	671 (16.3%)	104 (16.7%)	90 (16.2%)	865 (16.3%)	1664 (15.8%)	2529 (16.0%)
Three	671 (11.9%)	104 (11.6%)	67 (12.0%)	627 (11.9%)	1044 (9.9%)	1671 (10.6%)
Four or more	1243 (30.2%)	145 (23.3%)	206 (37.0%)	1594 (30.1%)	1714 (16.3%)	3308 (20.9%)
Unknown	58 (3.8%)	20 (3.2%)	24 (4.3%)	202 (3.8%)	335 (3.2%)	537 (3.4%)
In alignment with Stress-And-Genes Analysis cohort publication policy, we have omitted numbers under ten to maintain confidentiality. *The survey was updated in June, 2018 to include a question on sexual orientation. As a result, 11 328 of the 15 812 participants were presented with this question. †Comprises individuals who were neither working nor students, including those on disability allowance, more than 2 months sick leave, staying at home, on parental leave, retired, and unemployed. ‡Students were not asked about their work schedule. §According to the Life Events Checklist for DSM-5, excluding sexual harassment and violence. ¶According to the Adverse Childhood Experiences International Questionnaire, excluding sexual harassment and violence.						

Table 1: Baseline characteristics overall and stratified by exposure to workplace sexual violence

for factors that might contribute to the causal pathway between exposure and outcomes. The relationship between previous adverse experiences and their influence on subsequent traumatic events is complex and might not be entirely independent. The statistical analysis was conducted in R software (version 4.1.3).

Role of the funding source

The funders of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report.

Results

All data were collected during the survey period from March 1, 2018, to July 1 2019. The study had a high completion rate with 88.4% of the participants (26 905 of 30 403) completing the survey. Of the 113 814 women deemed eligible for study inclusion, invitations were sent to 104 197 to partake in the online survey. Of these, 30 403 women completed the survey and were added to the SAGA cohort. Among these participants, 15 812 provided answers to the question regarding exposure to workplace sexual harassment or violence,

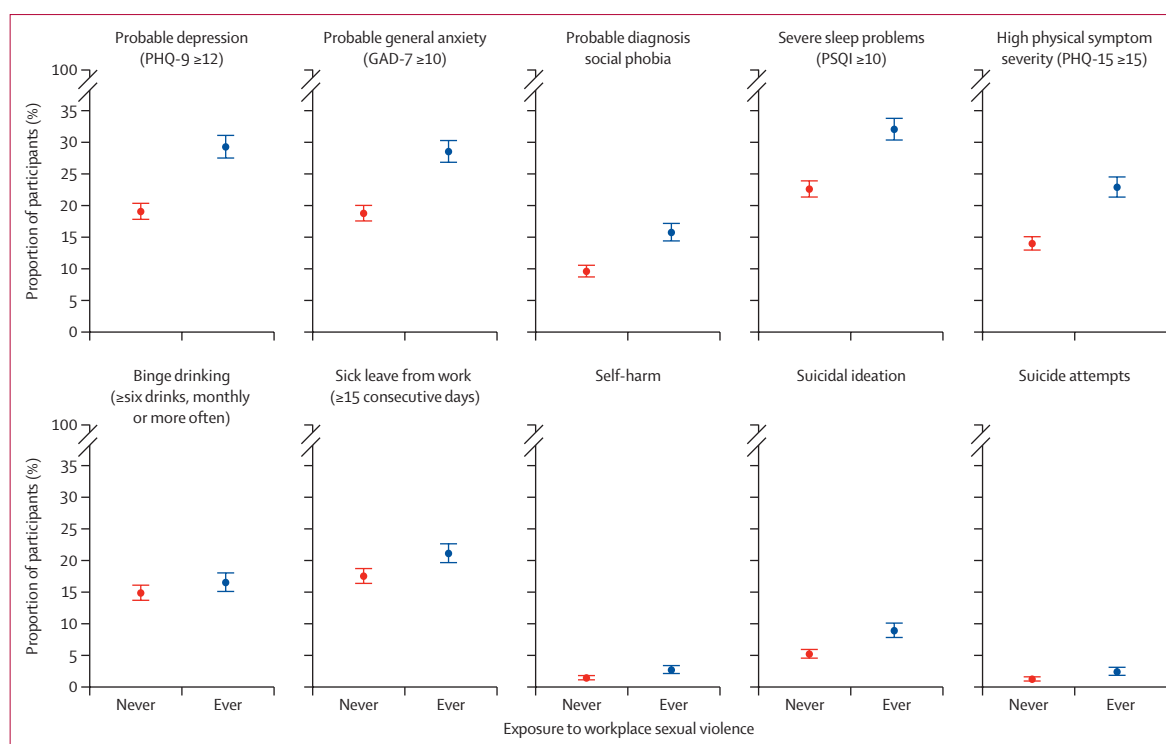


Figure 1: Prevalence of health outcomes, stratified by exposure to workplace sexual violence (ever vs never)

Data are presented with 95% CIs. Adjustments were made for age, marital status, education, personal income, and work schedule. GAD=Generalised Anxiety Disorder questionnaire. PHQ=Patient Health Questionnaire. PSQI=Pittsburgh Sleep Quality Index.

which was added to the questionnaire on May 4, 2018 (appendix p 13). On June 22, 2018, the question regarding sexual orientation was added. Of the 15 812 participants in our study, 11 328 were presented with this question. The remaining 4484 participants, who had completed the survey before this addition, were categorised in the analysis under no information for sexual orientation.

Characteristics of the 15 812 women studied are shown in table 1. They had an average age of 44.5 years (SD 14.1), with 12 606 (79.7%) being employed or students and 3090 (19.5%) not working nor students. The prevalence of exposure to workplace sexual violence was 33.5% overall: 26.0% in previous workplace only, 3.9% in the current workplace only, and 3.5% in both previous and current workplace. Based on previous research, we adjusted the results for age, marital status, education level, personal income, and work schedule.⁵

Women who had ever been exposed to workplace sexual violence had higher prevalences of adverse health outcomes than those who had never experienced such exposures (figure 1). Among women ever exposed, the most common outcomes included probable depression (29.3% [95% CI 27.5–31.1]), general anxiety (28.5% [26.9–30.3]), and severe sleep problems (32.1% [30.4–33.8]), with suicide attempts being the least prevalent (2.3% [1.8–3.0]; appendix p 15).

The adjusted prevalence rates and 95% CIs of the health outcomes by age, comparing those who had ever

been exposed versus never been exposed to workplace sexual violence are presented in figure 2. The most common health outcome varies by age group among those exposed. Specifically, general anxiety was the most common for women aged 18–24 years (37.6% [95% CI 33.0–42.4]) and 25–34 years (39.1% [35.6–42.8]). Depression was the most prevalent outcome among those aged 35–44 years (40.1% [95% CI 36.6–43.7]), while severe sleep problems are most frequent in the 45–54 years (37.1% [33.8–40.5]) and 55–69 years age groups (33.4% [30.5–36.4]).

The association between exposure to workplace sexual violence and the likelihood of adverse health outcomes, compared with non-exposure, is presented in table 2. Comparing ever exposed versus never exposed to workplace sexual violence, the prevalence ratios were significant for all outcomes. Binge drinking did not differ significantly between women exposed in previous workplace, current workplace, or both, compared with those never exposed (table 2; data for adjustments for age only are presented in the appendix p 18).

Exposure was associated with increased likelihood of self-harm (highest PR 2.21 [95% CI 1.35–3.60] for those with both current and previous workplace exposures) and suicide attempts (highest PR 2.13 [95% CI 1.20–3.81] also for both current and previous workplace exposure). Notably, suicidal ideation peaked (PR 2.23 [95% CI 1.64–3.05]) among women with violence experiences in

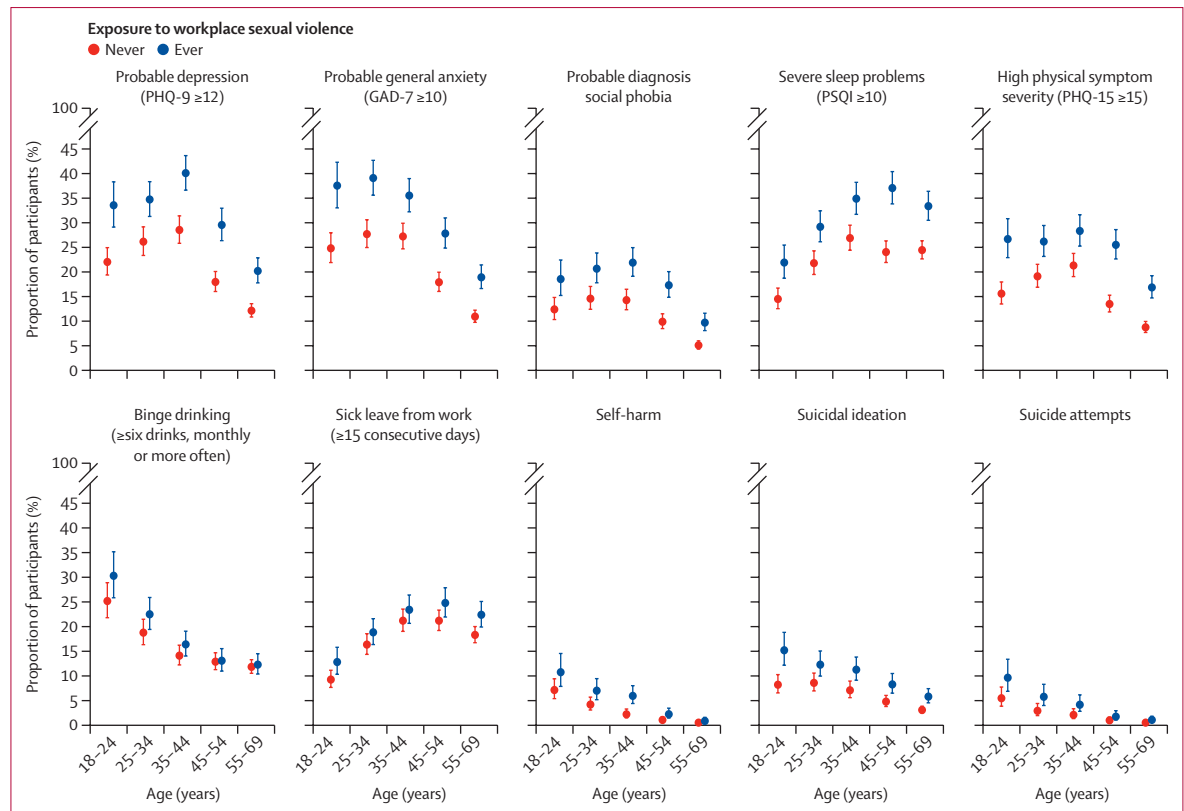


Figure 2: Prevalence of outcomes by age and exposure to workplace sexual violence (ever vs never)

Data are presented with 95% CIs. Adjustments were made for marital status, education level, personal income, and work schedule. GAD=Generalised Anxiety Disorder questionnaire. PHQ=Patient Health Questionnaire. PSQI=Pittsburgh Sleep Quality Index.

both current and previous workplaces. For current workplace exposure only, prevalence of suicide attempts did not significantly differ (PR 1.26 [95% CI 0.66–2.39]) from non-exposed women.

In a sensitivity analysis, adjustments were separately made for history of lifetime traumatic events and adverse childhood experiences (appendix pp 16–17). Despite these adjustments, the association between workplace sexual violence and adverse outcomes remained statistically significant.

Our analysis showed that age modified the association between workplace sexual violence and both severe sleep problems and high physical symptom severity, peaking for those aged 45–54 years (severe sleep problems, PR 1.67 [95% CI 1.42–1.97]; high physical symptom severity, PR 2.07 [1.69–2.54]; appendix p 19). Education level modified the association with binge drinking. Notably, women with a university education were the only group with a significant prevalence ratio for binge drinking (PR 1.27 [95% CI 1.11–1.47]) (appendix p 21). Additionally, the number of adverse childhood experiences modified the association with suicide attempts, and was particularly strong for those with no such experiences (PR 19.63 [95% CI 2.38–162.30]) (appendix p 26). These factors did not significantly

modify associations with other health outcomes. Detailed analyses of these and additional potential effect modifiers are presented in the appendix (pp 19–26).

Discussion

This study is one of the largest population-based studies examining the relationship between workplace sexual violence and mental and physical health outcomes among women. A third of the women surveyed reported sexual violence in their current or previous workplace during their lifetime, and this exposure was associated with 11–90% increase in prevalence of various adverse health outcomes.

Women who had experienced workplace sexual violence over their lifetime were at an elevated risk of probable depression, general anxiety, social phobia, self-harm, suicidal ideation, suicide attempts, binge drinking, severe sleep problems, and high physical symptom severity. These findings align with previous research,^{11–13} but to our knowledge, this is the first study to link workplace sexual violence to probable social phobia and self-harm. Furthermore, exposed women were more likely than non-exposed to have taken one or more long periods of sick leave from work in the past year, consistent with findings from a 2021 study.¹⁴

	Only previous		Only current		Both		Ever		Never	
	n=2629	n=4112; PR (95% CI)	n=467	n=622; PR (95% CI)	n=392	n=557; PR (95% CI)	n=3488	n=5291; PR (95% CI)	n=7413	n=10 521; PR (95% CI)
Past 2 weeks										
Probable depression (PHQ-9 ≥12)	633 (24.1%)	1.52 (1.40–1.64)	100 (21.4%)	1.21 (1.00–1.48)	105 (26.8%)	1.66 (1.41–1.97)	838 (24.0%)	1.50 (1.41–1.60)	1069 (14.4%)	1 (ref)
Probable general anxiety (GAD-7 ≥10)	654 (24.9%)	1.51 (1.39–1.64)	102 (21.8%)	1.25 (1.03–1.51)	114 (29.1%)	1.65 (1.40–1.96)	870 (24.9%)	1.49 (1.40–1.59)	1107 (14.9%)	1 (ref)
Past 4 weeks										
Probable social phobia	377 (14.3%)	1.63 (1.45–1.84)	59 (12.6%)	1.43 (1.10–1.86)	56 (14.3%)	1.73 (1.36–2.22)	492 (14.1%)	1.62 (1.48–1.78)	607 (8.2%)	1 (ref)
Severe sleep problems (PSQI ≥10)	667 (25.4%)	1.42 (1.32–1.52)	101 (21.6%)	1.24 (1.03–1.50)	108 (27.6%)	1.49 (1.27–1.76)	876 (25.1%)	1.41 (1.33–1.49)	1277 (17.2%)	1 (ref)
High physical symptom severity (PHQ-15 ≥15)	553 (21.0%)	1.59 (1.46–1.74)	77 (16.5%)	1.26 (1.01–1.57)	98 (25.0%)	1.89 (1.58–2.26)	728 (20.9%)	1.59 (1.48–1.70)	873 (11.8%)	1 (ref)
Past 12 months										
Binge drinking (≥six drinks, monthly or more often)	374 (14.2%)	1.11 (0.99–1.25)	74 (15.8%)	1.04 (0.81–1.32)	62 (15.8%)	1.20 (0.94–1.53)	510 (14.6%)	1.11 (1.02–1.21)	931 (12.6%)	1 (ref)
Sick leave from work (≥15 consecutive days)	509 (19.4%)	1.15 (1.05–1.27)	98 (21.0%)	1.43 (1.18–1.74)	90 (23.0%)	1.33 (1.10–1.62)	697 (20.0%)	1.20 (1.12–1.28)	1215 (16.4%)	1 (ref)
Self-harm	69 (2.6%)	1.84 (1.42–2.40)	13 (2.8%)	1.71 (1.03–2.83)	15 (3.8%)	2.21 (1.35–3.60)	97 (2.8%)	1.86 (1.53–2.28)	76 (1.0%)	1 (ref)
Suicidal ideation	201 (7.6%)	1.62 (1.37–1.92)	37 (7.9%)	1.60 (1.13–2.27)	43 (11.0%)	2.23 (1.64–3.05)	281 (8.1%)	1.68 (1.48–1.91)	295 (4.0%)	1 (ref)
Past 4 years										
Suicide attempts	75 (2.9%)	1.98 (1.50–2.63)	11 (2.4%)	1.26 (0.66–2.39)	15 (3.8%)	2.13 (1.20–3.81)	101 (2.9%)	1.90 (1.53–2.37)	86 (1.2%)	1 (ref)

Data are percentages for the outcomes from a complete case dataset (n=10 901) and adjusted PRs and 95% CIs derived from multiple imputation analysis (n=15 812). The PRs are adjusted for age, marital status, education level, personal income, and work schedule. PR=prevalence ratio. PHQ=Patient Health Questionnaire. GAD=Generalised Anxiety Disorder questionnaire. PSQI=Pittsburgh Sleep Quality Index.

Table 2: Association between exposure to workplace sexual violence and adverse outcomes

In our study, exposure to sexual violence in the workplace (whether in the previous workplace, current workplace, or both) was associated with a range of adverse health outcomes. Although not all associations were significant, the data suggest the possibility of lasting health associations. This might be particularly relevant for suicide attempts within the past 4 years, where strong associations were observed for those with exposure to workplace sexual violence ever versus never (PR 1.90), and with previous workplace exposure (PR 1.98) but a non-significant association was shown for current workplace exposure. Longitudinal research supports the link between workplace sexual violence and heightened risk of suicide attempts over time.¹² Exposure frequency could also influence the associations, as indicated by a study on flight cabin crew members (n=4459), for which repeated incidents were linked to a greater prevalence of depression.¹³ Additionally, a Swedish study (n=64 297) found that frequent exposure was related to higher rates of long-term sickness absence in both women and men,¹⁴ and another study (n=921) associated frequent experiences of workplace sexual harassment with an increased risk of arthritic or rheumatic conditions and migraines.³⁰

Our analysis revealed that women aged 18–44 years report workplace sexual harassment or violence more

frequently than do their older counterparts. This variation might be attributed to generational shifts in reporting behaviours and the influence of societal movements such as the #MeToo movement, which have led to increased awareness, specifically among young women.³¹ The most prevalent health outcome among those exposed to workplace sexual violence varied across age groups. General anxiety was most prevalent among women aged 18–24 years, probable depression was most common among those aged 35–44 years, and severe sleep problems were most prevalent among women aged 45–69 years. Age modified the relationship between workplace sexual violence and both severe sleep problems and high physical symptom severity. Notably, women aged 45–54 years exhibited the highest prevalence ratios for both severe sleep issues (PR 1.67) and physical symptom severity (PR 2.07).

Our findings indicated that the number of past traumatic events did not notably alter the relationships with most health outcomes associated with workplace sexual violence. Notably, women with adverse childhood experiences reported a less pronounced relationship with workplace sexual violence for outcomes including suicide attempts. However, the absence of evidence, as indicated by p values greater than 0.05, does not equate to evidence

of absence. Future studies should thus aim to thoroughly analyse an individual's entire history of trauma in context with their current socioeconomic circumstances. Additionally, investigating the frequency, duration, and recency of workplace sexual violence; the relationship with perpetrators; work sector type; geographical location (urban or rural); and the inclusion of all genders would yield deeper insights into the dynamics of these experiences.

Strengths of the study include that it is one of the largest population-based studies conducted on the association between workplace sexual violence and health outcomes. By targeting the entire Icelandic female population aged 18–69 years, a total cohort approach was employed and the SAGA cohort was found representative of the adult female population in Iceland in terms of age, education, income, and residential area.²⁷ It included a large sample of participants. We compared our included sample of 15 812 participants with registries from Statistics Iceland and found it to be representative of the female population overall with slight underrepresentation in younger age groups and a slightly higher proportion of university-educated participants than the general population.⁵ Most of the instruments selected to assess the health outcomes were standardised and validated for the Icelandic population, thereby enhancing the reliability and accuracy of our findings. Furthermore, our cohort study design offered a substantial advantage in examining multiple outcomes, allowing us to investigate the association between workplace sexual violence and these health outcomes.

In addressing the limitations of our study, we explicitly acknowledge biases that might influence our results. First, our study's reliance on self-reported data introduces the potential for recall bias, as participants might not accurately remember their experiences of sexual violence, and reporting bias, because they might not have felt comfortable to disclose information due to the sensitive nature of the topics. This is compounded by the subjective nature of self-reported sexual violence experiences, which varies among individuals and can substantially affect the reporting rates.¹⁸ Additionally, considering the phrasing of the question (“have you experienced sexual harassment or violence in the workplace?”), we cannot rule out the possibility that some women reported on physical, rather than sexual, violence within the workplace. Because our study targeted Icelandic-speaking women registered in Iceland, its findings might not be generalisable to non-Icelandic-speaking residents or fully capture the diversity of gender identities, given that invitations were based on registration without inquiries into participants' gender identity. Due to limitations of case numbers, our current analysis did not differentiate associations by work sector which were found to vary in degree of exposure.⁵

The cross-sectional design of our study further limited our ability to infer temporal sequences, highlighting the

risk of reverse causation or the influence of conditions such as depression or general anxiety on the likelihood of reporting workplace sexual violence.³² Furthermore, the study design cannot determine whether the effect of workplace violence on health changes or deteriorates over time. Due to varying timeframes of the assessed health outcomes, we were unable to assess comorbidity, an important factor for understanding how multiple health outcomes might interact and collectively affect women's health. A potential limitation of our study is the uniform sequence of the survey items, which might contribute to a gradual decrease in response rates for questions appearing later in the survey. Despite our current sample (n=15 812) being representative, it slightly underrepresents women younger than 35 years and individuals with only high school or vocational education, indicating a minor socioeconomic disparity in survey completion.⁵ Finally, although we adjusted for potential confounders, residual or unmeasured confounding might still exist, and several additional variables of interest such as participants' geographical location (urban or rural) and types or severities of sexual violence experienced could not be investigated.

In conclusion, our study highlights the association between workplace sexual violence and a broad spectrum of health issues among women, including symptoms of depression, anxiety, social phobia, self-harm, suicidal ideation, suicide attempts, binge drinking, severe sleep issues, and physical symptoms. The findings reveal that women reporting exposure to such workplace conditions also report higher instances of these health issues. Notably, there were age-related variations in the prevalence of health outcomes among exposed women, with younger women most frequently reporting anxiety or depression, and older women most frequently reporting sleep problems after workplace sexual violence. Our study highlights the important implications of workplace sexual violence on women's wellbeing and its consequences to women's working lives and their employers with higher frequency of sickness absence¹⁴ and employee turnover.⁸ Our findings from previous and current research on predictive factors—such as age, education, income, work schedule, and sexual orientation—could become directional for potential targeted interventions for mitigating adverse outcomes. But above all, it is essential to identify interventions within workplaces to address and prevent workplace sexual violence in the first place.

Contributors

The study design and protocol were developed by AH, UAV, EBT, and TH. UAV, AH, EBT, TA, JJ, GT, and HR collaboratively conducted the data collection. GT, TA, JJ, HR, and SAG were responsible for preparing the data for analysis. SDJ led the data analysis with support from AH, TA, SAG, TH, EBT, JJ, and UAV. SDJ drafted the manuscript, and all authors contributed to data interpretation and provided critical revisions. Data access was granted to SDJ, TA, JJ, SAG, and GT, with SDJ, JJ, TA, and SAG directly accessing the data to conduct analyses in this study. The integrity of the underlying data was verified by TA, JJ, and SAG. The decision to submit the manuscript was made by SDJ and AH, and

all authors have reviewed and given their approval to the final version of the manuscript. All authors accept responsibility for the decision to submit for publication.

Declaration of interests

We declare no competing interests.

Data sharing

The data utilised in this study are compiled in the Stress-And-Genes-Analysis (SAGA) cohort. According to our ethical approval by the National Bioethics Committee (NBC) of Iceland, individual-level data cannot be made publicly available. The SAGA cohort contains highly sensitive data, and access is limited to scientific research purposes with approval from NBC (email: vsn@vsn.is). The raw data used in our study is not publicly available, but interested researchers can request access to de-identified data by submitting a proposal to the SAGA cohort data management board (email: afallasaga@hi.is), which will help to propose an amendment to NBC. The corresponding author of the study was only granted access to de-identified data after submitting a research proposal to the SAGA cohort data management board and the NBC, which cannot be shared in any way. The R codes used in the analysis are available in the appendix (pp 36–75).

Acknowledgments

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