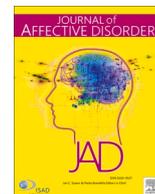




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Does social support prevent suicidal ideation in women and men? Gender-sensitive analyses of an important protective factor within prospective community cohorts

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ABSTRACT

Background: Suicidal ideation and behavior constitute important public mental health issues. In this study, we examined whether social integration prevents suicidal ideation over time and whether gender modifies this association.

Methods: Data from the Gutenberg Health Study (population-based representative community sample in midwest Germany) and the Study of Health in Pomerania (population-based cohort study in northeast Germany) were used. Participants reporting low social support were compared to those receiving middle or high social support. Within a longitudinal study design, we calculated multiple logistic regression models including interaction terms and relevant covariates to test whether gender modified the association of social support and suicidal ideation. **Results:** Suicidal ideation was present in 7.4% ($N = 982$) of the pooled cohorts' 13,290 participants. More women (8.6%, $N = 565$) than men (6.2%, $N = 417$) reported suicidal ideation. Middle or high social support was associated with a lower probability to report suicidal ideation five years later after controlling for sociodemographic factors, living situation, and cohort ($OR = 0.42$, 95%-CI = 0.34–0.52). Male gender was negatively related to suicidal ideation, but no statistically significant interaction of gender and social support was found (ratio of ORs = 1.00, 95%-CI = 0.73–1.35).

Limitations: The number of people reporting suicidal ideation in the SHIP study was small, especially for men. Suicidal ideation was measured using a single item.

Conclusions: Social support is an important protective factor in preventing suicidal ideation for both women and men. Future research should further clarify gender-specific effects of family variables in suicidal ideation and test similar predictive models of suicidal behavior.

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1. Introduction

Suicidal ideation and behavior are important public mental health issues. Worldwide, close to 800,000 deaths per year are estimated to occur as a result of suicide (World Health Organization, 2019). Overall lifetime prevalence rates are approximately 9.2% for suicidal ideation and 2.7% for suicide attempts (Nock et al., 2008). Suicidal ideation and behavior are increasingly viewed as a distinct clinical entity with complex biopsychosocial etiology (Glaesmer et al., 2020). Together, these terms cover a continuum which ranges from passive death wishes to dangerous attempts and deaths by suicide (Klonsky et al., 2016). Since non-fatal suicide attempts also have serious consequences and any expression of suicidal ideation indicates great emotional distress, all of these suicide outcomes should be taken seriously. According to the WHO, empirical research on risk factors is of paramount importance to identify particularly vulnerable individuals (World Health Organization, 2012). However, risk assessment is still a difficult task (Franklin et al., 2017; Large et al., 2018), partly because large-scale investigations that analyze factors from different areas of life in combination (such as genetic-biological, sociodemographic, psychological, and environmental variables) are scarce.

The role of a person's gender in shaping (mental) health has come to the fore of public health research in recent years (Mauvais-Jarvis et al., 2020). Health-related differences between women and men are not only influenced by genetics and biology, but also by socialization. Gender (in terms of both identity as well as self-concept, i.e. masculinity and femininity (Cleary, 2019)) correlates with suicide outcomes: While men are much more likely to die by suicide (Turecki and Brent, 2016), a systematic review on suicidal behavior in Europe and America has concluded that suicidal ideation and behavior are more common among women (Cano-Montalbán and Quevedo-Blasco, 2018). Women are generally more likely to report mental distress (i.e., in the form of internalizing disorders such as depression (Kuehner, 2017; Otten et al., 2021)). This included suicidal ideation, e.g., in investigations of the German general population and the state Rhineland-Palatinate (Forkmann et al., 2012; Michal et al., 2010). In addition, many risk factors for suicidal ideation and behavior that are common in the community differ considerably between women and men (Eikelenboom et al., 2019; May and Klonsky, 2016), such as depressive disorders, anxiety disorders, posttraumatic stress disorder (PTSD), drug and alcohol abuse, levels of education and socioeconomic status, and experiences of child maltreatment and sexual abuse.

Gender aspects are also of particular importance in social relationships (West and Zimmerman, 1987) and women and men have shown differences regarding the needs for and the use of social ties and coping strategies (Hajek et al., 2016; Liddon et al., 2018; Sieverding, 2005). This is relevant with respect to the emergence of suicidal ideation as the most influential etiological theories have highlighted social connectedness and community as central protective factors, for instance the Interpersonal Psychological Theory of Suicide (IPT) (Joiner, 2005). In fact, research has indicated that the effects of social risk and protective factors are modified by gender (Ernst et al., 2021; Xiao and Lindsey, 2021). Within an Australian community study, women and men differed with regard to the implications of perceived burdensomeness and thwarted belongingness (Donker et al., 2014), two constructs indicating difficulties relating to others which aggravate individual suicide risk according to the IPT (Joiner, 2005). Higher levels of thwarted belongingness increased suicidal ideation only in women. Furthermore, marriage per se appeared to be a protective factor for men, whereas this did not apply to married women the same way (for them, having a young child was found to be protective) (Hawton, 2000; Qin et al., 2000). Recent evidence has also suggested that men were at higher risk for suicide once a relationship ended (Evans et al., 2016). Male suicide attempters were prevented from seeking help by internalized hegemonic masculinity role expectations (Cleary, 2012).

Besides gender differences, research has also highlighted substantial

regional disparities. In Germany the former existence of the German Democratic Republic (Eastern states) and Federal Republic of Germany (Western States) caused differences in socialization within the population which is reflected in individual health and health behaviors (Ryder, 1965), e.g., suicide rates were higher in the eastern federal states than in the western federal states (Helbich et al., 2017). Suicide rates were higher among men compared to women (DESTATIS, 2019). However, suicide attempts were most prevalent among young women, closely followed by young men (Bogdanovica et al., 2011).

1.1. Objective of this study

The present study operationalized the interplay of sociodemographic, social, and environmental factors in a common statistical model: In order to better understand the potentially different mechanisms underlying suicidal ideation in women and men, this study explored the interaction of social support and gender within a longitudinal study design. We tested whether gender modified the association of social support and suicidal ideation while taking previously established risk factors into account and testing for potential socialization effects in Germany within a large population sample of pooled cohorts from two different German regions.

2. Methods

2.1. Study design and sample

The present investigation included data drawn from two studies of the GESA consortium (Gender-Sensitive Analyses of mental health trajectories and implications for prevention: A multi-cohort consortium) (Burghardt et al., 2020) whose main aims comprise identifying gender differences in prevalence rates of mental health outcomes and determining gender differences and similarities in risk- and protective factors for mental health in different regional cohorts. The two included studies were the Gutenberg Health Study (GHS) representing midwest Germany (Beutel et al., 2020; Wild et al., 2012) and the Study of Health in Pomerania (SHIP) representing northeast Germany (Völzke et al., 2010) which includes an area of the former German Democratic Republic. For our baseline sample, we included data from the GHS S-1 wave (2007–2012) (age range 35–74) and the SHIP FF-1 (2008–2012) and Legend (2007–2010) waves (age range 31–93), which complement each other. For our follow-up sample, we included data from the GHS F-1 wave and the SHIP FFF-1 wave, including data from the years 2012–2017 and 2014–2016. We only included respondents who participated in the baseline and follow-up study. Data are comparable regarding the timing of the baseline collection and duration of follow-up assessments. Respondents with missing values on the social support scale and suicidal ideation were excluded (GHS: $N = 517$ (4.2%); SHIP: $N = 46$ (3.2%)), which led to a final sample of $N = 13,290$ ($N = 6568$ women and $N = 6722$ men). For an overview of the included studies, see Supplementary Fig. 1.

2.2. Measures

2.2.1. Social support

Within the GHS, social support was measured using the Brief Social Support Scale (BS6) which includes both emotional-informational and tangible social support (Beutel et al., 2017). For example, items assessed the availability of a person who understands one's problems or who could offer support when being sick. Respondents indicated on a four-point scale how often such a person was available for them. The response options were "always" (1), "mostly" (2), "sometimes" (3), and "never" (4). Internal consistency of the total scale was satisfactory (Cronbach's $\alpha = 0.86$) (Beutel et al., 2017). Within SHIP, social support was measured using the Social Support Questionnaire (F-SozU). Fourteen items assessed general perceived social support, e.g., availability of

a person who offers emotional or practical support, social integration, and social strain. Respondents could answer on a five-point scale. Response categories were “does not apply at all” (1), “does rather not apply” (2), “partially applies” (3), “applies” (4), and “applies exactly” (5). The F-SozU was shown to have a high internal consistency (Cronbach's $\alpha = 0.94$) (Fydrich et al., 2009).

In order to allow for a comparison of these scales, a sum score for each was calculated. For the GHS, the items were first inverted. After this transformation, a higher score on an item indicated higher social support, as was already the case for SHIP. In order to derive a categorical variable from these sum scores with a comparable interpretation in both cohorts, the sum scores of both social support scales were divided into three equal parts (33% quantile and 66% quantile). They indicated low (1), medium (2), and high social support (3) with reference to the respective underlying population. In the present analyses, we compared people with medium or high social support with people with low social support.

2.2.2. Suicidal ideation

Suicidal ideation was measured using the ninth item of the Patient Health Questionnaire's (PHQ-9) depression module: “Over the last two weeks, how often have you been bothered by thoughts that you would be better off dead or hurting yourself in some way?”. Response options for this item were the same as for all PHQ-9 items: 0=“not at all”, 1=“several days”, 2=“more than half the days”, and 3=“nearly every day”. We applied the standard coding for suicidal ideation as assessed by the PHQ-9 (see e.g., Ernst et al., 2020): participants who reported to not have these thoughts at all were categorized as reporting no suicidal ideation (0) and participants who reported to be bothered by these thoughts at least on several days were coded as reporting suicidal ideation (1).

2.2.3. Sociodemographic variables

The sociodemographic variables gender, age, level of education, household income, and employment status at baseline were included as covariates in the analyses. Gender was measured as self-report (participants reported whether they were women or men). Sex and gender are important modifiers of (mental) health and illness within the population (Mauvais-Jarvis et al., 2020). Sex (biological aspects) and gender (social aspects) are related constructs; however, the present paper focuses social and interpersonal ramifications, which is why we use the term *gender*.

Age was derived from birthday and study entry date. Education (in years) was derived from educational and work degrees. Years of education were assigned to the different educational, vocational and professional levels, with all respondents receiving a score ranging from 7 to 18 years. Household income was included as a continuous variable, based on mean values of the respective income categories of the monthly household income variables used in the two cohorts. Current employment status was categorized as “no employment” (including unemployed people, homemakers, retirees, etc.) or “employment” (including full-time, part-time and marginal employment).

2.2.4. Living situation and family

This study included several variables representing living situation and family status. Marital status was recoded into two categories: married and not married (including singles, divorced people, and widowers and widows). For the GHS cohort, the categories “registered partnership” and “married but living separately” and for the SHIP cohort, the category “married, but living separately” were added to the category “married”. The categories “single”, “divorced” and “widowed” were combined in the category “not married”. The number of persons in a household was a continuous variable based on self-reported household members (including participant and spouse, children etc.). Living alone was included as a dichotomous variable. Having children and number of children were self-reported. In the GHS, these questions specifically

focused on biological children, whereas in the SHIP study, adopted and foster children were included as well.

2.2.5. Region

In order to control for regional effects in analyses of the pooled sample, we included a variable for the GHS cohort (representing mid-west Germany) and a variable for the SHIP cohort (representing Eastern Germany).

2.3. Data analysis

Analyses were performed in DataSHIELD version 4.1 (Gaye et al., 2014; Jones et al., 2012; Wilson et al., 2017), a system for privacy-preserving analyses where individual-level data of different cohorts do not have to be pooled for joint analyses. DataSHIELD allows for analyses via several R packages, based on R-version 3.5.2 (Rosseel, 2012).

First, we performed descriptive analyses in DataSHIELD in order to provide information on the overall sample and the separate cohorts. Descriptive analyses were stratified by social support and we have used statistical tests to compare respondents who received low social support to respondents receiving middle or high social support. Additionally, we calculated Cohen's *d* to determine the magnitude of the observed effects.

Secondly, we calculated simultaneous multiple logistic regression models of suicidal ideation within the pooled sample and within each cohort including interaction terms to investigate gender as a potential effect modifier. Applying a longitudinal study design, we attempted to examine the effects of social support on suicidal ideation five to seven years later. In the first model, we tested the direct effect of social support on suicidal ideation. In the second model, we added gender as a covariate. Model 3 additionally comprised interaction terms of social support and gender. In the final model, model 4, all potentially confounding variables such as sociodemographic covariates, living situation and family status, and cohort were added.

3. Results

3.1. Sample characteristics

In total, the present analyses included 13,290 participants. Their mean age was 54.42 ($SD = 11.02$) years and almost half of them were women.

3.2. Prevalence of suicidal ideation

Of the 13,290 participants, 7.4% ($N = 982$) reported suicidal ideation. In general, more women (8.6%, $N = 565$) than men (6.2%, $N = 417$) reported suicidal ideation. The gender-specific distribution of suicidal ideation, disaggregated into social support categories, is shown in Fig. 1.

3.3. Associations between measures of interest

There was a strong, statistically significant association between low social support and suicidal ideation both within the pooled sample (see Table 1) and the individual cohorts (Supplementary Table 1). This association applied to both women and men (Supplementary Table 2).

Within the pooled sample, higher levels of social support were associated with more years of education and a higher household income, however, effect sizes were small. Further, being married, living with a partner, living in a larger household and having children were significantly associated with middle-high social support (rather than low social support) with small to medium effect sizes. These associations were found within the pooled sample, within both cohorts, and in women and men. However, the association between having children and middle-high social support was stronger for men ($p < .001$) compared to women ($p = .043$). In the pooled sample, social support was not

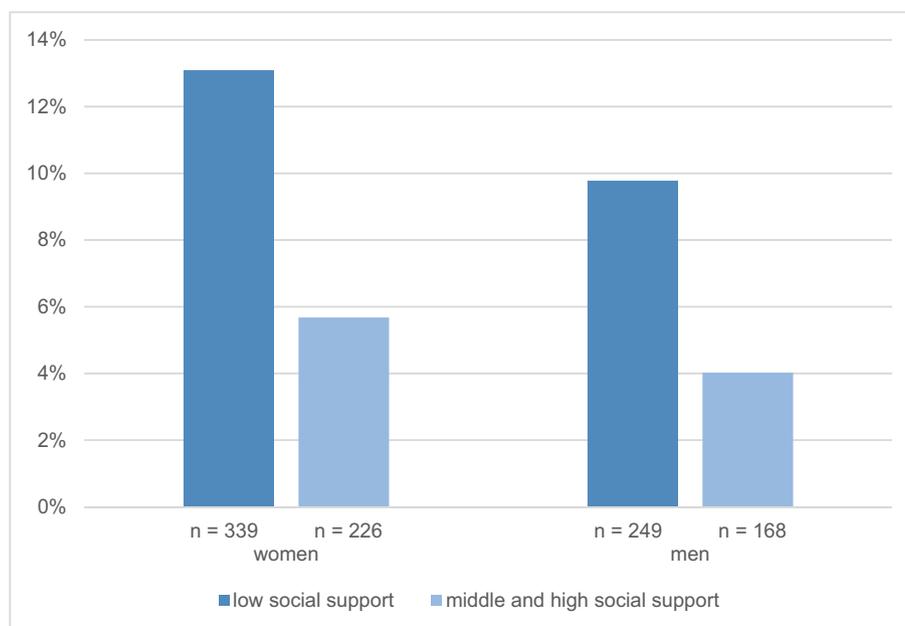


Fig. 1. Suicidal ideation for women and men, subdivided into social support categories.

Figure legend: With regard to the whole sample, more women than men reported suicidal ideation. In both women and men, suicidal ideation was especially common among those with low levels of social support.

associated with gender, age, or employment status.

Within the individual cohorts, we observed statistically significant effects of gender, although in different directions, and effect sizes were small: Within the GHS cohort, men were more likely to indicate receiving middle and high social support, whereas in the SHIP cohort, women were more likely to receive middle and high social support. In both cohorts, years of education and household income were significantly associated with social support with small to medium effect sizes. Being married was (compared to being single, divorced or widowed), only associated with social support within the GHS cohort. Furthermore, having children was associated with middle and high social support, yet within SHIP, only a trend was found.

3.4. Main analyses

We observed a strong association of social support and suicidal ideation within the pooled longitudinal cohorts: After controlling for sociodemographic factors, living situation and cohort effects, middle or high social support was associated with a significantly lower probability to report suicidal ideation five years later (final model 4: OR = 0.42, CI = 0.34–0.52). This effect was highly significant in all models. There was no statistically significant interaction of gender and social support (final model 4: ratio of ORs = 1.00, 95%-CI = 0.73–1.35).

Furthermore, male gender was negatively related to suicidal ideation in all models in which it was included as a covariate. With regard to sociodemographic factors, age, employment status and household income were significantly associated with suicidal ideation: Higher age, being employed, and having a higher household income reduced the probability to report suicidal ideation. There was also a cohort effect in the sense that living in northeast Germany was associated with a higher likelihood of reporting suicidal ideation compared to living in midwest Germany. For details, see Table 2.

3.5. Gender-stratified analyses

In order to better understand the observed interaction effect, we conducted gender-stratified analyses. They revealed that negative associations of social support and suicidal ideation applied to both women

(OR = 0.42, CI = 0.34–0.53) and men (OR = 0.41, CI = 0.33–0.51) and that they were slightly stronger in women (see Fig. 2). Furthermore, the effects of sociodemographic factors, living situation, and family factors differed between women and men: In women, higher age, higher household income, employment, and having children were associated with a lower probability to report suicidal ideation. In men, only a higher household income was associated with a decreased likelihood to report suicidal ideation. For details, see Supplementary Table 3.

3.6. Cohort-specific analyses

When examining GHS and SHIP individually, the strong protective effect of middle or high social support was present in both cohorts. Higher age and being employed were negatively associated with suicidal ideation in both cohorts, but the negative effect of higher household income was only present in the GHS cohort. The protective effect of male gender was only present in the SHIP cohort. With respect to living situation and family status, in the GHS cohort, living with a partner was associated with a lower probability to report suicidal ideation. This was not the case in SHIP. Lastly, an interaction effect of social support with gender was found for SHIP. For details, see Table 3.

4. Discussion

The aim of the present study was to disentangle the effects of social, sociodemographic, and regional risk and protective factors shaping suicidal ideation in women and men. The grave mental distress which underlies all expressions of suicidal ideation and the high numbers of suicide deaths observed each year (World Health Organization, 2002) make prevention an urgent mental health issue. Along these lines, this study deepened the knowledge about the interplay and relative importance of variables from different areas of life with respect to the statistical prediction of suicidal ideation years later by combining two cohorts from different regions.

In this pooled sample, a total of 7.4% of respondents reported suicidal ideation. Women reported suicidal ideation more often than men (respectively 8.6% versus 6.2%). The main analyses showed a strong association between social support and suicidal ideation: Middle or high

Table 1
Sample characteristics of the overall population, stratified by the level of social support.

	All (N = 13,290)	Low social support (N = 5135; 38.6%)	Middle/ high social support (N = 8155; 61.4%)	p	d
Sociodemographic					
Gender					
women (%)	6568 (49.4)	2589 (50.4)	3979 (48.8)	0.071	0.03
men (%)	6722 (50.6)	2546 (49.6)	4176 (51.2)		
Age (M ± SD)	54.42 ± 11.02	54.35 ± 10.81	54.47 ± 11.15	0.564	0.01
Educational years (M ± SD)	13.98 ± 2.87	13.86 ± 2.84	14.05 ± 2.88	<0.001	0.07
Household income (M ± SD)	3457 ± 2445	3107 ± 2132	3676 ± 2591	<0.001	0.23
Employment status					
No employment (%)	4854 (36.6)	1917 (37.4)	2937 (36.1)	0.123	0.03
Employment (%)	8402 (63.4)	3203 (62.6)	5199 (63.9)		
Living situation/family					
Marital status					
Married (%)	10,154 (76.4)	3525 (68.7)	6629 (81.3)	<0.001	0.29
Not married (%)	3133 (23.6)	1607 (31.3)	1526 (18.7)		
Living with partner					
No (%)	2370 (17.8)	1379 (26.9)	991 (12.1)	<0.001	0.38
Yes (%)	10,917 (82.2)	3753 (73.1)	7164 (87.9)		
Number of persons in household (M ± SD)	2.49 ± 1.10	2.37 ± 1.15	2.56 ± 1.06	<0.001	0.17
Children					
No (%)	1774 (14.4)	823 (17.4)	951 (12.5)	<0.001	0.14
Yes (%)	10,543 (85.6)	3899 (82.6)	6644 (87.5)		
Mental distress					
Suicidal ideation					
No (%)	12,308 (92.6)	4547 (88.5)	7761 (95.2)	<0.001	0.25
Yes (%)	982 (7.4)	588 (11.5)	394 (4.8)		

Note: Not married includes singles, divorced people and widowers and widows. Employment includes fulltime, part-time and marginal employment; no employment includes unemployed people, homemakers, retirees etc.

social support was associated with a lower probability to report suicidal ideation approximately five years later after controlling for socio-demographic factors, living situation and region (OR = 0.42, CI = 0.34–0.52). This effect was found in women and men. Yet, the mitigating effect of social support on suicidal ideation was slightly stronger for women (OR = 0.42, CI = 0.34–0.53) compared to men (OR = 0.41, CI = 0.33–0.51). Additionally, in both cohorts, middle and high social support was associated with a lower probability to report suicidal ideation. This effect was stronger in the GHS cohort (OR = 0.47, CI = 0.37–0.59) compared to the SHIP cohort (OR = 0.16, CI = 0.08–0.32).

The present results corroborate previous findings that social factors are important statistical predictors of suicidal ideation in the community. In particular, they show the protective impact of positive social connectedness (Handley et al., 2012; Mackin et al., 2017), supporting current, influential theories of suicidal ideation and behavior (Joiner, 2005). Within the regression models, the effects of subjective reports of social support were comparatively stronger than those of more objective indicators of social integration, such as participants' living situation. This observation is in line with recent research which has highlighted that in the context of the COVID-19 pandemic, only the subjective experience of loneliness (and not physical distancing) was associated with suicidal ideation at a later time point (Antonelli-Salgado et al., 2021). Previous studies showed that even after controlling for other mental disorders, the beneficial effects of social support and social integration remained strongly significant (Duberstein et al., 2004). Our investigation expands previous research by explicitly testing gender-dependent effects (using interaction terms) within large, prospective population cohorts. The results demonstrate the important protective effects of social support irrespective of an individual's living situation in both women and men. Likewise, a recent nationwide German study reported strong associations between loneliness and suicidal ideation in both genders (Ernst et al., 2021).

With regard to regional differences, our results showed in both the overall sample and the gender-specific analyses that living in northeast Germany was associated with a lower probability to report suicidal ideation compared to living in midwest Germany. This is in line with a recent study which demonstrated higher rates of depression in West

Germany (Farugie et al., 2021), which was shown to be associated with suicidal ideation (Forkmann et al., 2012; Keilp et al., 2012).

Furthermore, the present results revealed similarities as well as slightly different patterns of other factors influencing the probability to report suicidal ideation in women and men. In accordance with other studies which showed an inverse association between income and psychological distress, especially for suicidal ideation and suicide attempts (McMillan et al., 2010), higher household income was negatively associated with suicidal ideation. However, only for women, employment and children constituted protective factors. A previous study had shown that especially low job control and high job demands were associated with suicidal ideation (Choi, 2018). Work demand is positively associated with work satisfaction when the individual evaluation of job demands is positive (Gerich and Weber, 2020) and is furthermore influenced by job control and social support: Presence of social support and job control foster well-being (Gerich and Weber, 2020). Especially for women, job control was found to be beneficial to reduce stress levels and positively influence mental health (Fila et al., 2017). In general, women report higher job satisfaction than men (Bender et al., 2005; Gazioglu and Tansel, 2006), which could explain why employment was a relevant protective factor against suicidal ideation only for them. The present finding that being a parent was a protective factor in women is in line with the results of previous studies (Hawton, 2000; Qin et al., 2000). However, other investigations showed that parenthood was more strongly associated with positive well-being for men than for women (Nelson-Coffey et al., 2019). An explanation for these diverging observations could be found in the different areas in which mothers and fathers experience parenthood-related stress (Widarsson et al., 2013): it has been suggested that women experience more stress in the sub-areas of incompetence and role restriction, whereas fathers tend to suffer more from social isolation, a well-established risk factor for several suicide outcomes (Calati et al., 2019). We did not find associations of marital status or living alone with suicidal ideation, although previous evidence suggested that being married was a protective factor for men (Hawton, 2000; Qin et al., 2000), whereas ending a relationship was a risk factor for men (Evans et al., 2016). Future research should focus on further clarify the role of family in women and men's suicidal ideation.

Table 2
Results of multiple logistic regression models of suicidal ideation on social support.

	Model 1			Model 2			Model 3			Model 4			p
	OR	95% CI (L; U)	P	OR	95% CI (L; U)	p	OR	95% CI (L; U)	p	OR	95% CI (L; U)	p	
Social support													
Low (ref)													
Middle and high	0.393	0.344; 0.449	<0.001	0.394	0.345; 0.450	<0.001	0.400*	0.335; 0.477	<0.001	0.418*	0.336; 0.520	<0.001	
Gender													
Women (ref)													
Men				0.710	0.622; 0.810	<0.001	0.719	0.605; 0.856	<0.001	0.760	0.618; 0.934	0.009	
Interactions													
Social support * gender													
Ratio: middle/high vs. low in men vs. women							0.967	0.740; 1.265	0.809	0.997	0.734; 1.354	0.985	
Sociodemographic													
Age										0.985	0.975; 0.995	0.004	
Educational years										1.003	0.974; 1.033	0.851	
Household income										0.928	0.881; 0.975	0.003	
Employment status													
No employment (ref)													
Employment										0.742	0.607; 0.908	0.004	
Living situation and family													
Marital status													
Married (ref)													
Not married										0.910	0.694; 1.194	0.494	
Living with partner													
No (ref)													
Yes										0.757	0.559; 1.025	0.072	
Number of persons in household										0.957	0.864; 1.061	0.407	
Children													
No (ref)													
Yes										0.846	0.666; 1.075	0.170	
Region													
Cohort													
GHS (ref)													
SHIP										0.554	0.417; 0.735	<0.001	
Deviance model (R ²)	6835.581			6784.692			6784.633			5209.350			

Note: Not married includes singles, divorced people and widowers and widows. Employment includes fulltime, part-time and marginal employment; no employment includes unemployed people, homemakers, retirees etc. For interpretability reasons, household income was in the regression analyses divided by 1000, which means regression coefficients for household income represent a 1000 unit increase in household income. OR = Odds Ratio. 95% CI (L, U) = Lower and upper bounds of the Confidence Interval (95%). Statistically significant Odds Ratios are printed in bold.
* Refers to Odds Ratio valid for women in models 3 and 4 which contain an interaction effect social support x gender.

5. Limitations

While a strength of our study refers to the large overall sample size and the combined investigation of cohorts from two different German regions that also differ with respect to social, cultural and economic factors, we need to point out that the number of people reporting suicidal ideation in the SHIP study was small, especially for men. A widespread difficulty in suicide research is that suicidal ideation and behavior are comparatively rare events in the population (with suicidal ideation still much more common than suicide attempts or deaths (Turecki and Brent, 2016)), while some risk factors concern many citizens (e.g., male gender) (Sareen et al., 2014). In the current study, we also observed low numbers of individuals reporting suicidal ideation. Since the sample drawn from the SHIP cohort in particular was rather small, the importance of the diverging gender-specific findings within the regions should not be overstated. Due to this limitation, we refrain from drawing further conclusions on these observations.

Another limitation of this study is the way suicidal ideation was

assessed. Suicidal ideation was measured using a single item at one measurement point. Therefore, the present investigation cannot give insight into the temporal dynamics of suicidal ideation (Kleiman et al., 2017). Further, as the evaluated measurement points were years apart, the study yields no information about temporally closer (i.e., same-day) links of social support and suicidal ideation. These aspects restrict the interpretation of the present results, also because previous research has suggested that individuals who show greater variability in their reports of suicidal ideation might be particularly vulnerable (Oquendo et al., 2020). A potential solution for future research could lie in a combination of the strengths of large-scale longitudinal cohort studies with ambulatory assessment designs (see e.g., Stange et al., 2019). While structured, in-depth clinical interviews are the gold standard for assessing suicidal ideation, this was not a feasible procedure within the present cohort studies. However, suicidal ideation measured using the PHQ-9 item, has shown relevant relations to subsequent suicide mortality in previous studies (Louzon et al., 2016). Social support was measured by two different, standardized self-report scales in the two cohorts. In order to

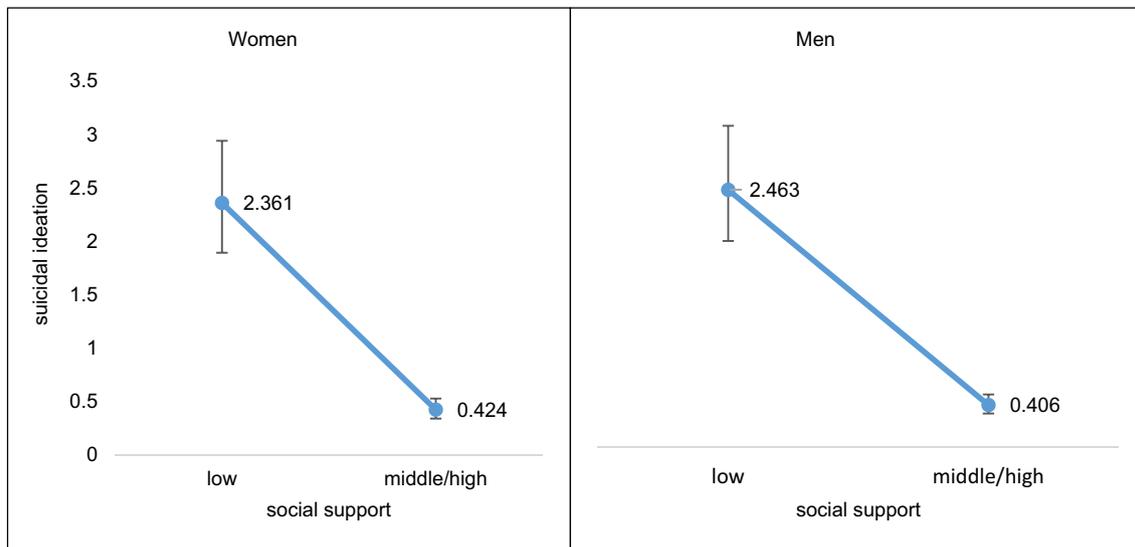


Fig. 2. Associations of social support and suicidal ideation for women and men. Figure legend: Odds Ratios (incl. 95% CI) for the associations of low social support and medium and high social support with suicidal ideation by gender. For both women and men, the association reached statistical significance ($p < .001$). Suicidal ideation was considerably less common among those with middle/high social support compared to those with low social support.

Table 3
Results of multiple logistic regression models of suicidal ideation on social support for GHS and SHIP.

	GHS			SHIP				
	OR	95% CI		p	OR	95% CI		p
		LB	UB			LB	UB	
Social support								
Low (ref)								
Middle and high	0.467	0.371	0.587	<0.001	0.155	0.076	0.319	<0.001
Gender								
Women (ref)								
Men	0.816	0.657	1.012	0.064	0.306	0.137	0.682	0.004
Sociodemographic								
Age	0.987	0.976	0.998	0.019	0.967	0.936	0.998	0.040
Educational years	1.005	0.975	1.037	0.732	0.980	0.861	1.116	0.763
Household income	0.929	0.881	0.976	0.003	0.742	0.338	1.146	0.211
Employment status								
No employment (ref)								
Employment	0.786	0.636	0.971	0.026	0.471	0.227	0.977	0.043
Living situation and family								
Marital status								
Married (ref)								
Not married	0.857	0.642	1.144	0.296	1.464	0.651	3.294	0.357
Living with partner								
No (ref)								
Yes	0.725	0.527	0.999	0.050	1.439	0.530	3.910	0.476
Number of persons in household	0.969	0.872	1.077	0.564	0.712	0.434	1.170	0.180
Children								
No (ref)								
Yes	0.811	0.634	1.039	0.097	1.706	0.598	4.870	0.318
Interactions								
Interactions social support * gender								
Low * women (ref)								
Middle and high * men	0.864	0.628	1.189	0.371	4.770	1.504	15.131	0.008
Deviance model (R^2)	4755.452				431.781			

Note: Not married includes singles, divorced people and widowers and widows. Employment includes fulltime, part-time and marginal employment; no employment includes unemployed people, homemakers, retirees etc. For interpretability reasons, household income was in the regression analyses divided by 1000, which means regression coefficients for household income represent a 1000 unit increase in household income. OR = Odds Ratio. 95% CI (L, U) = Lower and upper bounds of the Confidence Interval (95%). Statistically significant Odds Ratios are printed in bold.

be able to compare predictors for suicidal ideation we stratified social support for each scale separately into terciles increasing the generalizability of our findings across measures and cohorts from different regions. Additionally, this study considers suicidal ideation separately

from other depressive symptoms, although suicidal ideation is often conceptualized as a part of depressive disorders. However, there is a growing recognition that depressive disorders in particular or mental illness in general are neither prerequisites nor sufficient causes for

suicidal crises (O'Connor and Nock, 2014). Furthermore, this study only assessed risk factors for suicidal ideation. While suicidal ideation is a risk factor for suicidal behavior, there are important further, specific risk factors distinguishing the two (as conceptualized by e.g., the ideation-to-action framework (Klonsky and May, 2015; Klonsky et al., 2016)). Exposure to suicidal behavior in the social environment was not found to moderate the relation between lifetime suicidal ideation and suicide attempt (Roland et al., 2022). Thus, the present study does not give insight into gender-dependent risk constellations underlying suicide attempts and suicide deaths. There is a need for gender-sensitive research regarding specific risk factors for suicidal behavior, such as the role of acquired capability for suicide (including fearlessness of pain and death) which differed between women and men (e.g., Witte et al., 2012).

6. Conclusion

Based on two prospective community samples with more than 13,000 participants spanning over five years, social support was a highly significant protective factor preventing suicidal ideation in both women and men. This effect was observed in statistical models that controlled for sociodemographic factors, living situation, and family status, highlighting the importance of the subjective perception of social connectedness. Future research could further clarify potential gender-dependent ramifications of family variables. There is also a need to expand respective gender-sensitive approaches to the empirical study of suicidal behavior.

Ethics approval and consent to participate

GHS: The GHS and its procedure were approved by the ethics committee of the Statutory Board of Rhineland-Palatinate, Germany (approval at 22.3.2007, latest update 20.10.2015, reference no. 837.020.07). Participation was voluntary and written informed consent was obtained from each subject upon entry into the study.

SHIP: This institutional ethics committee of the University Medicine Greifswald evaluated the study, design and instruments and testified its compliance with ethical requirements (reference no. BB 39/08).

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Conflict of interest

SHIP is part of the Community Medicine Research net of the University of Greifswald, which is funded by the Federal Ministry of Education and Research (01ZZ9603, 01ZZ0103, and 01ZZ0403), the Ministry of Cultural Affairs and the Social Ministry of the Federal State of Mecklenburg-West Pomerania.

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Further, the authors have no conflicts of interest to declare. All co-authors have seen and agree with the contents of the manuscript. We declare that this submission is original work and not under review

elsewhere.

Availability of data and materials

GESA is a multi-cohort project building on GHS, SHIP, and KORA. Within the GESA project, data were uploaded into the program DataSHIELD. This is a system for privacy-preserving analyses where individual-level data of different cohorts does not have to be pooled for joint analyses. The researchers within the project only accessed the data via DataSHIELD. Data access rights must be requested at each cohort and subsequently data access can be granted by the authors of this paper via DataSHIELD. Codes are available from the authors upon reasonable request.

CRedit authorship contribution statement

This research article was written as part of the GESA Project. All authors contributed to the development and refinement of the GESA consortium. MB, EB, HB, HJG, JK, GS, KHL and PSW are grant holders. DO, ANT, EB and MB devised the research question and the main conceptual ideas. The harmonization of the variables was an interactive process in which DO, ANT, DZ, TF, HJ and SA participated. The statistical analysis plan and statistical analyses were performed by DO. Results were interpreted by DO, ME, ANT and MB. The manuscript was written by DO, ME and ANT. EB, HJG, GS, DZ, HB, TF, PSW, TM, JK, HV, KHL and MB provided critical feedback on the manuscript and herewith contributed to the final manuscript.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jad.2022.03.031>.

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