

# The burden of suicidal ideation across Europe: a cross-sectional survey in five countries

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**Background:** Suicidal ideation (SI) is an associated risk of depression, affecting 30–40% of the depressed population. However, there is a paucity of studies investigating the impact of SI in Europe. This retrospective observational study examined the burden of SI among adults with major depressive disorder (MDD) in the 2017 National Health and Wellness Survey in five European countries: France, Germany, Italy, Spain, and the UK.

**Methods:** Bivariate analyses evaluated group differences between respondents with MDD with and without SI according to demographic characteristics, self-reported health-related quality of life, work productivity and activity impairment (WPAI), and healthcare resource utilization (HRU). Generalized linear models examined group differences country-wise, after controlling for relevant confounders.

**Results:** Among 52,060 respondents, 3,308 individuals were diagnosed with MDD, comprising SI (n=905) and non-SI (nSI) (n=2403) patients. Adjusted differences (ADs), compared to the general population, were observed using the Medical Outcomes Study Short Form Survey (SF-12v2) mental component summary scores (AD: SI=−20.02, nSI=−10.77), physical component summary scores (AD: SI=−4.49, nSI=−2.50), and EuroQoL-5 Dimensions (AD: SI=−0.34, nSI=−0.15) (for all,  $p<0.001$ ). Significantly greater WPAI and higher HRU were associated with SI compared to nSI.

**Conclusion:** The results illustrate the unique impact of SI within the MDD population and the need to reduce the burden.

**Keywords:** burden, healthcare resource utilization, major depressive disorder, suicidal ideation, work productivity and activity impairment

## Introduction

The societal burden of depression is further complicated by its association with suicidal ideation (SI).<sup>1</sup> SI is undertreated and carries social stigma, thereby affecting effective screening and management.<sup>1,2</sup> According to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), major depressive disorder (MDD) is a combination of five or more symptoms, with at least one of the symptoms being depressed mood or anhedonia.<sup>3</sup> These symptoms must be continuously present for at least 2 weeks; and cause distress and/or functional impairment in employment, social relationships, or other major life domains and social roles. MDD is a severe recurring illness accompanying depressed mood, state of guilt, low self-esteem, loss of interest, poor concentration, troubled sleep or appetite, and risk of suicide.<sup>4</sup> The Global Burden of Disease Study 2015 identified depressive disorders as the third leading cause of disability,<sup>5</sup> affecting nearly 4.4% of world's population<sup>6</sup> with a global prevalence of 4.7%.<sup>7</sup> In the European Union

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(EU), MDD is the most common psychiatric condition, with a lifetime prevalence of 12.8%.<sup>8</sup>

Approximately 30–40% of MDD patients experience SI.<sup>9</sup> A survey of 17 countries estimated SI prevalence in the general population as 9.2%.<sup>10</sup> Although there is evidence that SI risk factors may vary slightly by age group,<sup>11</sup> some of the major risk factors associated with SI are being female, younger, and divorced or widowed.<sup>12</sup> Pre-existing or coexisting health conditions, such as depressive disorders (major and bipolar), stroke, and cognitive impairment, are also important predictors for suicide, especially among younger adults.<sup>12,13</sup>

There is a strong connection between SI and health-related quality of life (HRQoL). A South Korean cross-sectional study found that each one-unit increase in HRQoL (as measured by the Euro-QoL-5 Dimensions [EQ-5D] Index score) was associated with 70% lower odds of SI among psychiatric center outpatients with MDD.<sup>14</sup> In the PATH survey between 1999 and 2019, an Australian longitudinal study, individuals with SI (vs no SI) had poorer physical and mental HRQoL over the 8-year study period.<sup>15</sup> In a US survey with a large cohort, higher levels of SI were associated with significantly lower scores for HRQoL compared with patients reporting no SI.<sup>16</sup>

SI and suicide are also linked to a substantial impairment of work productivity and a high economic burden. Depressive episodes and SI have consistently impacted absenteeism and presenteeism in the working population.<sup>17</sup> In 2000, the suicide-related cost of \$5.4 billion and workplace cost (absenteeism and presenteeism) of \$51.5 billion contributed to 7% and 62%, respectively, of the increased economic burden of depression (\$83.1 billion).<sup>18</sup> Evidently, absenteeism and presenteeism have increasingly contributed to impairments in work productivity. In the USA, the national cost of fatal and non-fatal suicidal injuries had alone incurred an increased cost of \$58 billion in 2013, and work productivity losses contributed 97% to this annual cost.<sup>19</sup>

Screening for MDD has been unequivocally suggested by community preventive services task forces and other institutions to reduce the clinical morbidity attributed to this condition.<sup>20</sup> Given the well-established link between depression and suicide, implementation of screening in primary care may potentially have the benefit of facilitating diagnosis and treatment for MDD patients, especially those with SI. Such an approach would be particularly timely in the European region, with six European nations ranking among the top 20 for highest rates of suicide globally.<sup>21</sup> However, there are few studies that have investigated the

multifaceted burden attributed to SI in the European region, and greater clarification on this important issue is warranted. In high-income countries (France, Germany, Italy, Spain, and the UK), suicidal mortality rates are still medium to high<sup>22</sup> with more than 90% of cases having MDD.<sup>10</sup> We hypothesize that in Europe there is an additional burden to patients with depression associated with SI, which, if identified, could be used to promote and establish improved disease prevention and management. The aim of the current study was to examine the health and economic burden of SI severity among adults with MDD in five countries in Europe: France, Germany, Italy, Spain, and the UK.

## Methods

### Data source

This retrospective observational study was based on subjects enrolled in the National Health and Wellness Survey (NHWS) 2017, which was conducted in five European countries: France, Germany, Italy, Spain, and the UK. The NHWS is a self-administered general health survey of the adult population (aged  $\geq 18$  years) administered via the Internet and designed to reflect the health of the general population of each country. The study was reviewed and approved by the Pearl Institutional Review Board (Indianapolis, IN, USA). Informed consent was provided by all respondents.

MDD patients were classified based on the following inclusion criteria: 1) self-reported depression in the past 12 months, 2) self-reported physician diagnosis for depression (ever), and 3) self-reported current use of one or more medication for depression (i.e., monoamine oxidase inhibitor [MAOI], reversible inhibitor of monoamine oxidase A [RIMA]; melatonin receptor agonist [MRA]; norepinephrine–dopamine reuptake inhibitor [NDRI], norepinephrine reuptake inhibitor [NRI], selective serotonin reuptake inhibitor [SSRI], serotonin–norepinephrine reuptake inhibitor [SNRI], serotonin antagonist and reuptake inhibitor [SARI], noradrenergic and specific serotonergic antidepressant [NaSSA]; and/or tricyclic antidepressant [TCA], tetracyclic antidepressant [TeCA]). Patients were excluded if they had a self-reported physician diagnosis of (coexisting) bipolar disease or schizophrenia or a positive screen on the Mood Disorder Questionnaire, or were currently using a monotherapy (ie, an anticonvulsant, atypical or typical antipsychotic, benzodiazepine, lithium, or a -tryptophan).<sup>23</sup> Patients with SI were identified as having moderately severe to severe depressive symptoms based

on the nine-item validated scale using a 2-week recall period Patient Health Questionnaire (PHQ-9) and a score of 15 or higher.<sup>24</sup> Kroenke et al<sup>24</sup> showed that scores  $\geq 15$  had a high specificity and positive predictive value, and “signify the presence of major depression”. A score of 2 or more on the PHQ-9 question: “Over the past 2 weeks, how often have you been bothered by thoughts that you would be better off dead or of hurting yourself in some way?” (“Not at all”=0; “Several days”=1; “More than half of the days”=2; “Nearly every day”=3) was used to classify respondents as having no, low, moderate, or high SI, respectively, with non-SI (nSI) patients identified as all the MDD patients who were not in the SI subset (Figure S1).

## Demographics and health characteristics

Demographic variables included age, gender, marital status (married/living with a partner vs not married), education (university degree vs less), and annual household income (low <20,000 € or £, medium  $\geq 20,000$  and <40,000 € or £, high 40,000+ € or £, or declined to answer). NHWS respondents provided data on body mass index (BMI), smoking status, alcohol use, and exercise behavior for health characteristics. Information was collected according to country of residence.

## Depression-specific characteristics

Depression-specific variables for examination included family history of depression (yes or no), length of diagnosis (calculated by year of diagnosis, relative to year of the survey; <1 year vs 1–3 years vs 3–5 years vs >5 years), participation in talking therapy (yes or no), anxiety, SI, and current classes of MDD medications.

## Comorbidities

The Charlson Comorbidity Index (CCI) was used to measure the burden of comorbidities.<sup>25</sup> Specific physical comorbidities were also assessed, including a self-reported diagnosis of anemia, arrhythmia, cancer, chronic heart failure, chronic kidney disease, diabetes (type 1 or 2), hepatitis (A, B, or C), hypertension, and rheumatoid arthritis.

## Health status and HRQoL

Health status was assessed using the EuroQoL-5 Dimensions, 5-level (EQ-5D-5L) questionnaire examining mobility, self-care, usual activities, pain/discomfort, and anxiety/depression, with levels representing an increasing degree of severity of health status.<sup>26,27</sup> Descriptive scores

were converted into a single index value according to country-specific value sets. The EuroQoL visual analogue scale (EQ-VAS) is a single measure of self-rated health, with the endpoints being “Best imaginable health state” and “Worst imaginable health state”.

HRQoL was measured by the Medical Outcomes Study 12-item Short Form Survey version 2 (SF-12v2).<sup>28,29</sup> The instrument is designed to report on eight health domains (physical functioning, physical role limitations, bodily pain, general health, vitality, social functioning, emotional role limitations, and mental health). Two summary scores were calculated, the physical component summary (PCS) and mental component summary (MCS), each normalized to a mean of 50 and an SD of 10 for the general population of the USA. Higher scores indicate better health status. In addition, the six-dimensional health state short form (SF-6D) based on the SF-12v2 was used as a preference-based health utility (calibrated between 0=death and 1=perfect health).

## Work productivity and activity impairment

The Work Productivity and Activity Impairment (WPAI) questionnaire was used to assess work productivity loss among employed respondents and activity impairment among all respondents in the past week, as presenteeism (reduced productivity while at work), absenteeism (time absent from work), overall work productivity impairment (a combination of presenteeism and absenteeism), and activity impairment.<sup>30</sup> WPAI scores represent the percentage of time impaired in the past week.

## Healthcare resource utilization (HRU)

The number of each type of HRU event (healthcare professional [HCP] visits, emergency room [ER] visits, hospitalizations, other types of visits, psychiatrist visits, and psychologist/therapist visits) was provided by the participants. A binary response was created to represent the percentage who reported one or more event versus those who reported no resource utilization, for each type of event.

## Statistical analysis

Means and SDs (continuous variables) and frequencies and percentages (categorical variables) were reported for all study variables separately by country. Bivariate analyses were performed to evaluate differences between

respondents with MDD by level of SI severity in demographic characteristics, comorbidities, self-reported HRQoL, WPAI, and HRU. Chi-squared tests were used to examine differences between groups on categorical variables, with ANOVA tests to evaluate group differences on continuous variables.

Generalized linear models (GLMs) were used to examine group differences, controlling for relevant confounds, separately by country. All models were adjusted for socio-demographic (gender, age, country, marital status, education, household income, employment status) and health status (BMI, exercise, alcohol use, smoking status, CCI) variables. For the GLMs, a normal distribution with an identity function and a negative binomial distribution with a log-link function were specified for normally distributed and positively skewed outcome variables, respectively. The  $p$ -values  $<0.05$  (two-tailed) were considered to be statistically significant for the multivariable analyses. Adjusted differences (ADs), relative risks (RRs), or odds ratios (ORs) and 95% CIs for SI and nSI patients versus the general population were calculated, as well as estimated marginal means and 95% CIs for each group on all outcomes.

## Results

### Demographic and clinical characteristics

The present study, with a total of 52,060 respondents, identified adult patients diagnosed with MDD ( $n=3,308$ ), comprising SI ( $n=905$ ) and nSI ( $n=2,403$ ) patients, compared to healthy controls ( $n=48,752$ ). Symptoms of MDD were reported across Europe (France,  $n=513$ ; Germany,  $n=824$ ; Italy,  $n=287$ ; Spain,  $n=264$ ; and UK,  $n=1,420$ ). The baseline demographic and clinical characteristics among SI, nSI, and general population groups are shown in Table 1. The MDD population (with SI or nSI) was less likely to have a university education, be employed, or be married/living with a partner compared to the healthy group. Those in the MDD population were more likely to be obese, smokers, with high alcohol intake, and with a predominantly less active lifestyle and higher CCI than the healthy respondents. Within the MDD population, the SI group had a significantly higher incidence of anemia ( $p=0.002$ ), rheumatoid arthritis ( $p\leq0.001$ ), and HIV/AIDS ( $p=0.007$ ) than the nSI group. Compared to the general population, hypertension, diabetes, anemia, rheumatoid arthritis, chronic kidney disease, and chronic heart failure were more prevalent in SI and nSI patients (all  $p\leq0.001$ ).

### Depression-related characteristics

Depression-related characteristics were comparable among SI and nSI respondents for family history of depression, and use of depression medication, such as TeCA/TCA, and potential augmentation/combination medications such as benzodiazepine, antipsychotics, NDRI/NRI, and MAOI/RIMA (Table 2). However, compared to nSI, SI patients more frequently reported participation in talking therapy ( $p\leq0.001$ ). Between 82% and 84% of adult patients with MDD who had a PHQ-9  $\geq15$  across countries had some degree of SI, and 57% reported moderate to severe SI (range 45–65%) (Figure 1).

### HRQoL

The absolute differences for HRQoL among SI and nSI respondents compared to general population controls were obtained after adjusting for demographics and health characteristics (Table 3). Both the SI and nSI groups had significantly poorer health status compared to the general population (EQ-5D Index,  $-0.34$  and  $-0.15$  for SI and nSI, respectively, both  $p\leq0.001$  vs general population). SI patients reported significantly lower scores than the general population in MCS ( $-20.02$ ), PCS ( $-4.49$ ), EQ-VAS ( $-29.44$ ), and all the components of the SF-12, including for bodily pain ( $-8.70$ ), general health ( $-11.00$ ), mental health ( $-17.40$ ), physical functioning ( $-6.68$ ), emotional role functioning ( $-18.94$ ), physical role functioning ( $-9.74$ ), social functioning ( $-16.20$ ), and vitality ( $-11.68$ ) (all  $p\leq0.001$ ), implying lower HRQoL compared to general population respondents. The findings showed a similar trend in HRQoL across countries (Table S1).

### WPAI

Higher absenteeism (RR: 5.06; 95% CI 4.56 to 5.63), presenteeism (RR: 2.67; 95% CI 2.38 to 3.00), work productivity impairment (RR: 2.91; 95% CI 2.62 to 3.23), and activity impairment (RR: 2.53; 95% CI 2.37 to 2.71) were associated with the SI population compared to the nSI population (Figure 2A), with a considerably higher relative risk than the general population. WPAI scores were similar across Europe for SI patients compared to nSI patients, except for absenteeism, which was observed to be higher in France, Germany, and the UK. Compared to the general population, SI in all five European countries resulted in comparable work productivity loss and activity impairment (Table S2).

**Table I** Demographic and clinical characteristics among SI, nSI, and general population groups<sup>a</sup>

	(a) SI (n=905)		(b) nSI (n=2,403)		(c) General population (n=48,752)		p-value		
	%	n	%	n	%	n	a vs b	a vs c	b vs c
Gender									
Male	32.0	290	35.5	852	47.4	23,095	0.066	<0.001	<0.001
Female	68.0	615	64.5	1551	52.6	25,657			
Age (years)									
18–29	17.1	155	12.7	304	16.7	8,140	<0.001	<0.001	<0.001
30–39	14.9	135	13.9	334	15.7	7,652			
40–49	28.1	254	21.7	521	17.3	8,449			
50–59	25.3	229	25.7	617	16.3	7,926			
≥60	14.6	132	26.1	627	34.0	16,585			
Country									
France	15.2	138	15.6	375	26.5	12,910	0.024	<0.001	<0.001
Germany	22.9	207	25.7	617	24.1	11,728			
Italy	46.7	423	41.5	997	20.8	10,153			
Spain	6.9	62	9.4	225	17.3	8,410			
UK	8.3	75	7.9	189	11.4	5,551			
Marital status (married or living with partner) <sup>b</sup>	47.2	427	52.0	1249	62.7	30,561	0.025	<0.001	<0.001
Education (completed university) <sup>c</sup>	26.1	236	29.3	704	38.3	18,673	0.040	<0.001	<0.001
Household income							0.043	<0.001	<0.001
Low (<20,000 € or £)	40.7	368	36.1	868	23.1	11,257			
Medium (≥20,000 to <40,000 € or £)	33.0	299	33.7	810	37.5	18,281			
High (≥40,000 € or £)	20.1	182	22.0	529	29.1	14,180			
Declined to answer	6.2	56	8.2	196	10.3	5,034			
Employed	44.8	405	48.8	1173	55.3	26,951			
CCI (mean, SD)	0.72	1.22	0.56	1.02	0.29	0.77	0.037	<0.001	<0.001
BMI							0.018	<0.001	<0.001
Underweight (<18.5 kg/m <sup>2</sup> )	4.4	40	3.1	75	3.3	1,617	0.001	<0.001	<0.001
Normal weight (≥18.5 to <25.0 kg/m <sup>2</sup> )	27.8	252	31.4	754	43.7	21,328			
Overweight (≥25.0 to <30.0 kg/m <sup>2</sup> )	27.6	250	30.3	728	31.4	15,293			
Obese (≥30.0 kg/m <sup>2</sup> )	30.1	272	26.0	625	14.9	7,243			
Declined to answer	10.1	91	9.2	221	6.7	3,271			
Exercised	41.5	376	51.6	1239	62.2	30,342	<0.001	<0.001	<0.001
Alcohol use (daily)	6.3	57	5.5	132	8.0	3,881	0.102	<0.001	<0.001
Current smoker	36.7	332	30.3	728	22.4	10,900	0.714	<0.001	<0.001
Comorbidities									
Hypertension	27.0	244	26.7	641	19.1	39,450	0.868	<0.001	<0.001
Diabetes (type 1 or 2)	12.4	112	11.7	281	7.3	3,579	0.589	<0.001	<0.001
Anemia	9.1	82	6.0	144	2.5	1,202	0.002	<0.001	<0.001
Rheumatoid arthritis	7.8	71	4.5	107	2.2	1,050	<0.001	<0.001	<0.001
Cancer	5.7	52	6.6	158	5.2	2,552	0.383	0.494	0.004
Arrhythmia	2.9	26	3.5	84	2.3	1,107	0.373	0.229	<0.001
Chronic kidney disease	1.8	16	1.2	29	0.7	347	0.214	<0.001	0.006

(Continued)



**Table 1** (Continued).

	(a) SI (n=905)		(b) nSI (n=2,403)		(c) General population (n=48,752)		p-value		
	%	n	%	n	%	n	a vs b	a vs c	b vs c
Hepatitis A	1.1	10	1.0	24	0.9	421	0.787	0.438	0.486
HIV/AIDS	0.8	7	0.2	4	0.2	100	0.007	<0.001	0.681

**Notes:** <sup>a</sup>Data are shown as % and n, except for CCI values (mean, SD); <sup>b</sup><0.3% had missing values; <sup>c</sup>approximately 1% declined to answer.

**Abbreviations:** BMI, body mass index; CCI, Charlson Comorbidity Index; nSI, non-suicidal ideation; SI, suicidal ideation.

**Table 2** Depression-related characteristics among respondents with SI or nSI

	SI (n=905)		nSI (n=2403)		p-value
	%	n	%	n	
Family history of depression	44.1	399	38.5	924	0.003
Length of diagnosis					0.266
<1 year	4.7	41	6.1	139	
1–3 years	16.3	143	17.7	403	
3–5 years	10.3	91	10.3	234	
≥5 years	68.8	605	65.9	1,497	
Participation in talking therapy	30.6	277	22.7	546	<0.001
Prescription medication use for depression					
SSRI/SNRI/SARI/NaSSA	90.2	816	90.6	2,177	0.708
TeCA/TCA	13.4	121	11.5	276	0.137
Benzodiazepine	3.9	35	2.8	67	0.109
Antipsychotic	2.7	24	2.2	52	0.404
NDRI/NRI	1.3	12	1.3	31	0.935
MAOI/RIMA	0.4	4	0.1	3	— <sup>a</sup>
Lithium	0.2	1	0.3	3	— <sup>a</sup>

**Notes:** <sup>a</sup>Valid comparison not applicable.

**Abbreviations:** MAOI, monoamine oxidase inhibitor; NaSSA, noradrenergic and specific serotonergic antidepressant; NDRI, norepinephrine–dopamine reuptake inhibitor; NRI, norepinephrine reuptake inhibitor; nSI, non-suicidal ideation; RIMA, reversible inhibitor of monoamine oxidase A; SI, suicidal ideation; SNRI, serotonin–norepinephrine reuptake inhibitor; SSRI, selective serotonin reuptake inhibitor; TCA, tricyclic antidepressant; TeCA, tetracyclic antidepressant.

## HRU

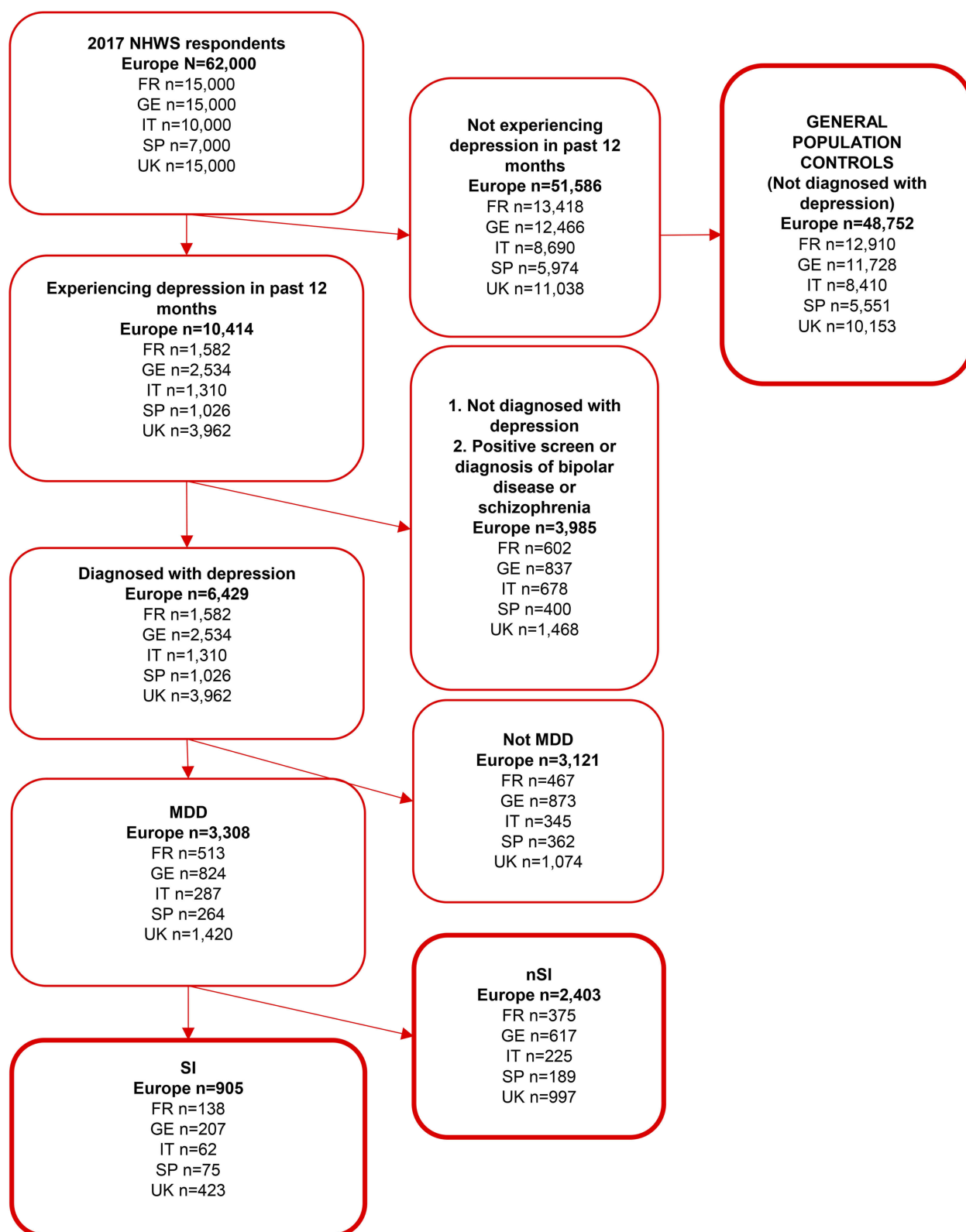
SI patients had higher numbers of HCP visits (RR: 7.84; 95% CI 5.34 to 11.51), general/family practitioner visits (RR: 3.88; 95% CI 3.20 to 4.70), hospitalizations (RR: 2.48; 95% CI 2.06 to 2.99), and ER visits (RR: 2.38; 95% CI 2.01 to 2.82) compared to nSI patients (Figure 2B). HRU for the SI and nSI population was higher compared to the general population. The SI population was associated with generally higher HRU than nSI across all five European countries, with statistically significant differences between the SI or nSI populations compared to the general population for each HRU outcome (Table S3).

## Discussion

The current multinational study reports the burden of SI by assessing the health and healthcare resource burden across

five European countries. Upon comparing SI patients to nSI and general population controls (without a diagnosis of depression), SI was found to be associated with severe depressive symptoms. Furthermore, SI has significant impacts on health status, quality of life, productivity impairment, and HRU.

In the present study, poorer health behaviors and health status, compounded by comorbidities including hypertension, diabetes, anemia, rheumatoid arthritis, chronic kidney disease, and HIV/AIDS, were much more prevalent in the MDD population than in generally healthy respondents. Furthermore, rheumatoid arthritis was more prevalent for SI than for nSI patients within the MDD population. Prior studies have reported similar observations on the association of SI with clinical characteristics such as comorbidities,<sup>31–33</sup> obesity,<sup>34</sup> smoking,<sup>35</sup> and alcohol status.<sup>36</sup>



**Figure 1** Study flowchart: cohort identification.

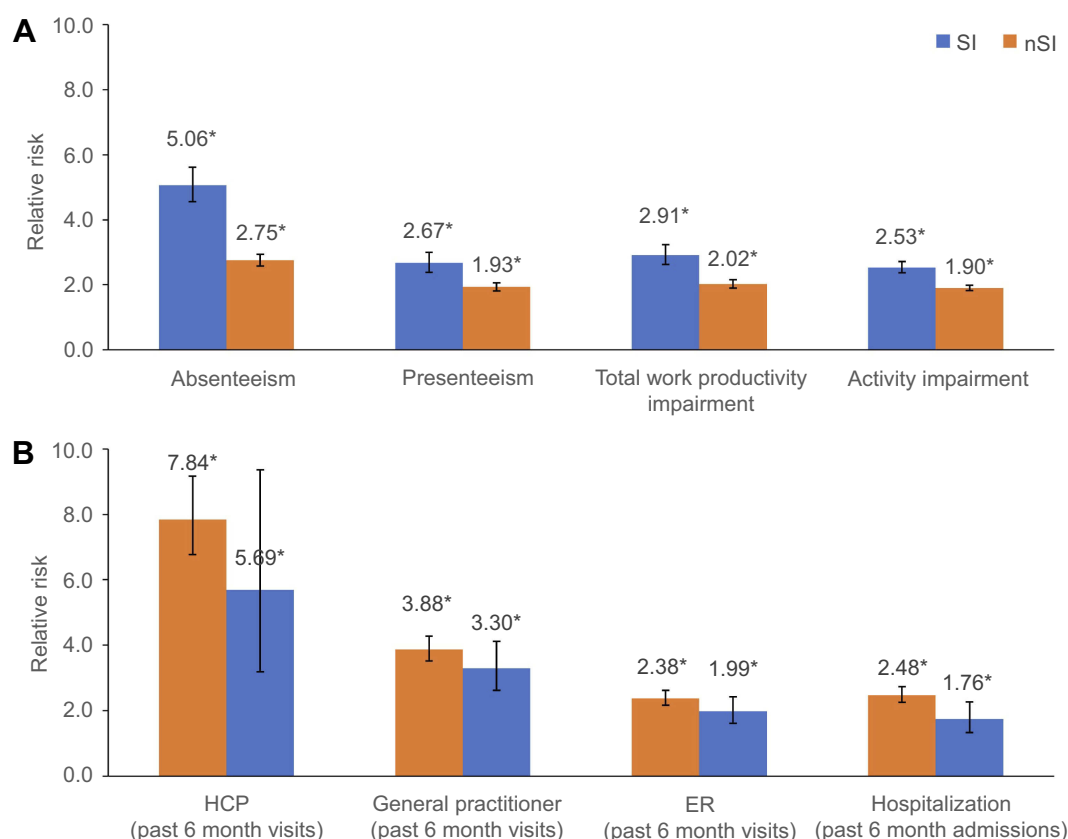
**Abbreviations:** MDD, major depressive disorder; NHWS, National Health and Wellness Survey; nSI, non-suicidal ideation; SI, suicidal ideation; FR, France; GE, Germany; IT, Italy; SP, Spain.

**Table 3** Adjusted differences for health-related quality of life among respondents with SI or nSI compared to general population controls

	General population controls versus	
	SI <sup>a</sup>	nSI <sup>a</sup>
	Adjusted difference (LCL to UCL)	Adjusted difference (LCL to UCL)
EQ-5D Index	-0.34 (-0.35 to -0.33)	-0.15 (-0.16 to -0.14)
Health status, EQ-VAS	-29.44 (-30.73 to -28.16)	-14.75 (-15.56 to -13.95)
MCS	-20.02 (-20.57 to -19.47)	-10.77 (-11.12 to -10.43)
PCS	-4.49 (-5.00 to -3.98)	-2.50 (-2.82 to -2.18)
SF-12 Bodily Pain	-8.70 (-9.30 to -8.08)	-4.75 (-5.13 to -4.37)
SF-12 General Health	-11.00 (-11.50 to -10.44)	-6.28 (-6.61 to -5.94)
SF-12 Mental Health	-17.40 (-17.95 to -16.85)	-9.27 (-9.61 to -8.92)
SF-12 Physical Functioning	-6.68 (-7.21 to -6.15)	-3.53 (-3.87 to -3.20)
SF-12 Role Emotional	-18.94 (-19.60 to -18.28)	-10.14 (-10.55 to -9.73)
SF-12 Role Physical	-9.74 (-10.30 to -9.18)	-5.09 (-5.44 to -4.74)
SF-12 Social Functioning	-16.20 (-16.76 to -15.64)	-8.45 (-8.80 to -8.10)
SF-12 Vitality	-11.68 (-12.26 to -11.11)	-6.78 (-7.14 to -6.42)

**Notes:** <sup>a</sup>Generalized linear models were adjusted for sociodemographic and health status variables. Comparisons versus the general population were statistically significant at  $p \leq 0.001$ .

**Abbreviations:** EQ-5D, EuroQol-5 Dimensions; EQ-VAS, EuroQol visual analogue scale; LCL, lower confidence level; MCS, mental component summary score; nSI, non-suicidal ideation; PCS, physical component summary score; SF-12, 12-item Short Form Health Survey; SI, suicidal ideation; UCL, upper confidence level.

**Figure 2** Adjusted risk for (A) WPAI and (B) HRU among respondents with SI or nSI compared to the general population controls.<sup>a</sup>

**Note:** <sup>a</sup>Generalized linear models adjusted for socio-demographic and health status variables were used. \* $p < 0.001$ .

**Abbreviations:** ER, emergency room; HCP, healthcare professional; HRU, healthcare resource use; nSI, non-suicidal ideation; SI, suicidal ideation; WPAI, work productivity and activity impairment.



After adjusting for demographics and health characteristics, compared to the nSI patients and general population, SI group respondents had significantly lower HRQoL, including EQ-5D Index, EQ-VAS, MCS, PCS, and SF-12 components. A previous cross-sectional study in an elderly population showed similar lowered EQ-5D and EQ-VAS being more prevalent in those with SI.<sup>37</sup> Moreover, cross-sectional and multicenter studies have also shown comparable lower MCS, PCS, and SF-12 scores to be strongly associated with suicidality.<sup>14,38,39</sup>

Work productivity losses were generally found to be higher in SI respondents than in the nSI and general population controls. The relative risk of absenteeism for SI was about 1.8-fold and 5-fold higher compared to the nSI and general population, respectively. In our study, work-related productivity losses were comparable across Europe. While presenteeism, work productivity impairment, and activity impairment were higher for the SI population, absenteeism was associated with a much greater relative risk for SI than for nSI patients and the general population. Previous studies have reported absenteeism being attributable to depression, similar to our results. It has also been suggested that the persistence of work-related stress-induced depression may lead to suicidality.<sup>17,40</sup>

SI patients were consistently associated with higher HRU parameters compared to nSI patients and the general population, including the numbers of HCP and family practitioner visits, which were considerably higher compared to the general population. The relative risk associated with HCP visits for SI patients was about 1.4-fold and 7.8-fold higher compared to the nSI and general population, respectively. The relative risk associated with family practitioner visits for SI patients was about 1.2-fold and 3.8-fold higher compared to the nSI and general population, respectively. SI patients showed notable differences in France and Germany for HCP visits and in the UK for family practitioner visits compared to nSI patients and the general population. However, less difference was noticed for hospitalization and ER visits across all the countries between SI, nSI, and the general population.

Although interventions for depression have been explored and typically related to cost-effectiveness, such studies for suicidality are limited.<sup>41</sup> A prospective cohort study showed that cost and burden were significant for SI patients utilizing emergency department resources.<sup>42</sup> According to a US retrospective analysis including 39,557 MDD patients, the discontinuation and resumption of antidepressant treatment had incurred the highest healthcare cost.<sup>43</sup> In the EU region in particular,

insufficient funding and unavailability of mental health professionals are considered to be common barriers to accessing mental health services.<sup>44,45</sup> The gap in care is further illustrated by approximately one-third of the European population experiencing some form of mental disorder, for which only about half of individuals receive treatment.<sup>46</sup> Currently, pharmacological and non-pharmacological strategies are available to attenuate the physical, cognitive and psychosocial impairments related to major depression.<sup>47–50</sup> Antidepressants are widely used and include various classes of first- and second-generation medications, with varying efficacy and acceptability or treatment discontinuation over time.<sup>51</sup> Non-pharmacological treatments, such as psychotherapy, repetitive transcranial magnetic stimulation, electroconvulsive treatment, and meditative movements, alone or in conjunction with pharmacological treatments, have been demonstrated as advantageous in the patient's long-term care.<sup>48–50,52</sup> Investment in care that includes early recognition of this disabling condition can thus reduce the disability and the consequent burden of disease.<sup>45</sup>

## Strengths and limitations

The notable strengths of the study include the relatively large sample size to estimate the burden of disease across several European cities and the survey-specific information available to identify at-risk patients and their burden.

However, the present study also has a few limitations that should be considered when interpreting the results. First, MDD is defined using self-reported data and could not be objectively confirmed via claims data, electronic medical records, or another independent source. Thus, findings may be influenced by any inaccuracies in participants' recall about diagnoses, medications taken, and other study variables. Second, the cross-sectional design of the study precludes the ability to infer causality from the results or to ascertain whether the relationships between study variables change over time. Third, as this was a retrospective study of pre-existing data, only those variables collected in the NHWS were included in the analyses. Therefore, we cannot rule out the possibility that variables not included in the study may be relevant to explaining the observed pattern of findings.

## Conclusion

SI patients had significantly poorer HRQoL, greater work productivity loss and activity impairment, and higher HRU compared to nSI patients and the general population. The

results illustrate the unique impact that SI has within the MDD population by further affecting HRQoL, work and activity loss, and HRU across Europe. A better, more effective mode of treatment is needed to reduce the economic and humanistic burden experienced by the SI patients.

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## Author contributions

All authors contributed to data analysis, drafting or revising the article, gave final approval of the version to be published, and agree to be accountable for all aspects of the work.

## Disclosure

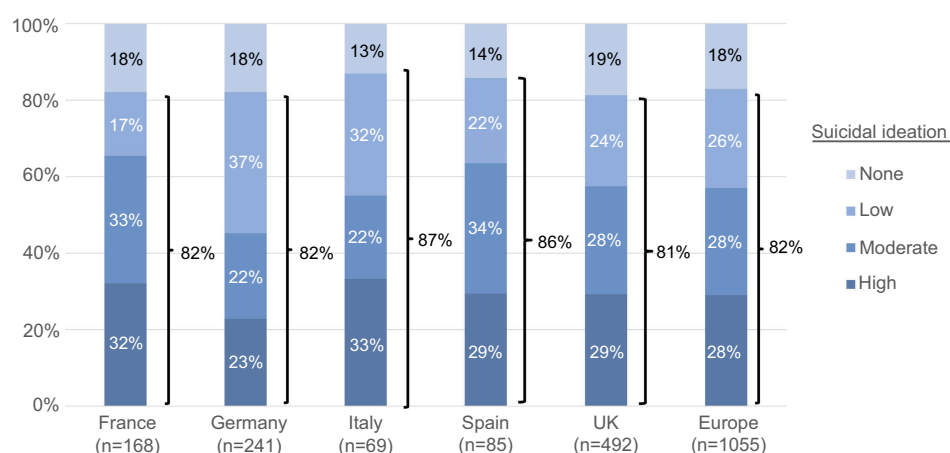
DHJ is an employee of Kantar and TRD and BR are employees of Janssen-Cilag. Kantar received funding from Janssen-Cilag to conduct this study, report on the results, and consult as needed. The authors report no other conflicts of interest in this work.

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## Supplementary materials



**Figure S1** Percentage of patients with major depressive disorder at risk for suicidal ideation.

**Table S1** Adjusted means for health-related quality of life among respondents with SI and nSI compared to general population controls

Parameter	Adjusted means (SE) <sup>a</sup>					
	France	Germany	Italy	Spain	UK	Europe
EQ-5D Index						
SI	0.479 (0.017)	0.639 (0.011)	0.734 (0.013)	0.520 (0.018)	0.367 (0.011)	0.504 (0.006)
nSI	0.601 (0.011)	0.768 (0.007)	0.813 (0.007)	0.738 (0.012)	0.599 (0.008)	0.691 (0.004)
General population	0.787 (0.004)	0.879 (0.003)	0.896 (0.003)	0.889 (0.004)	0.778 (0.004)	0.843 (0.002)
EQ-VAS						
SI	50.515 (1.718)	46.996 (1.357)	48.897 (2.359)	44.761 (2.303)	42.417 (1.036)	45.659 (0.666)
nSI	60.385 (1.073)	59.657 (0.853)	63.661 (1.278)	62.807 (1.518)	58.765 (0.734)	60.349 (0.432)
General population	73.109 (0.383)	76.390 (0.421)	76.666 (0.452)	77.524 (0.543)	72.770 (0.437)	75.102 (0.194)
MCS score						
SI	28.961 (0.746)	29.714 (0.591)	29.255 (1.071)	33.047 (0.946)	27.751 (0.430)	28.374 (0.287)
nSI	36.384 (0.466)	38.815 (0.372)	37.705 (0.580)	40.501 (0.624)	37.981 (0.305)	37.625 (0.186)
General population	46.659 (0.166)	50.277 (0.183)	46.736 (0.205)	49.443 (0.223)	49.235 (0.182)	48.395 (0.084)
PCS score						
SI	47.171 (0.639)	45.123 (0.570)	45.905 (0.895)	43.338 (0.823)	44.176 (0.460)	45.223 (0.267)
nSI	47.916 (0.399)	45.874 (0.359)	48.697 (0.485)	47.130 (0.542)	46.514 (0.326)	47.213 (0.173)
General population	49.563 (0.143)	49.145 (0.177)	50.592 (0.171)	51.288 (0.194)	48.389 (0.194)	49.711 (0.078)
SF-12 Bodily Pain						
SI	40.723 (0.779)	40.657 (0.683)	39.983 (1.102)	38.602 (1.016)	39.764 (0.514)	40.152 (0.317)
nSI	43.648 (0.487)	43.027 (0.429)	44.565 (0.597)	44.805 (0.670)	44.242 (0.364)	44.097 (0.206)
General population	47.802 (0.174)	48.863 (0.212)	48.864 (0.211)	51.027 (0.240)	48.182 (0.217)	48.848 (0.092)
SF-12 General Health						
SI	41.419 (0.620)	36.974 (0.560)	38.398 (1.041)	37.819 (0.894)	37.298 (0.483)	37.693 (0.277)
nSI	43.777 (0.387)	42.219 (0.352)	43.112 (0.564)	43.268 (0.589)	41.840 (0.343)	42.392 (0.180)
General population	48.912 (0.138)	48.534 (0.174)	48.323 (0.199)	49.513 (0.211)	48.309 (0.204)	48.664 (0.081)

(Continued)

Table S1 (Continued).

Parameter	Adjusted means (SE) <sup>a</sup>					
	France	Germany	Italy	Spain	UK	Europe
SF-12 Mental Health						
SI	31.351 (0.733)	34.418 (0.569)	32.598 (1.069)	35.723 (0.933)	30.727 (0.447)	32.099 (0.285)
nSI	38.475 (0.458)	41.848 (0.358)	40.660 (0.579)	42.307 (0.616)	39.720 (0.317)	40.232 (0.185)
General population	48.105 (0.164)	50.724 (0.177)	48.720 (0.205)	50.851 (0.220)	49.405 (0.189)	49.499 (0.083)
SF-12 Physical Functioning						
SI	45.016 (0.680)	45.636 (0.563)	44.852 (0.947)	43.297 (0.893)	41.747 (0.475)	44.009 (0.277)
nSI	47.020 (0.425)	46.661 (0.354)	49.639 (0.513)	47.183 (0.589)	45.798 (0.337)	47.156 (0.180)
General population	50.184 (0.152)	50.940 (0.174)	51.789 (0.181)	51.895 (0.211)	48.964 (0.201)	50.689 (0.081)
SF-12 Role Emotional						
SI	30.462 (0.868)	27.902 (0.688)	29.146 (1.232)	30.691 (1.144)	27.742 (0.539)	27.904 (0.341)
nSI	36.755 (0.542)	36.173 (0.432)	36.878 (0.667)	38.227 (0.754)	37.979 (0.382)	36.700 (0.221)
General population	45.834 (0.194)	48.497 (0.213)	45.586 (0.236)	46.971 (0.270)	47.759 (0.228)	46.843 (0.099)
SF-12 Role Physical						
SI	40.630 (0.721)	37.732 (0.600)	39.969 (0.992)	38.812 (0.937)	37.897 (0.497)	38.418 (0.292)
nSI	43.670 (0.450)	41.639 (0.377)	43.622 (0.537)	43.395 (0.618)	43.488 (0.352)	43.066 (0.190)
General population	47.858 (0.161)	47.942 (0.186)	48.329 (0.190)	49.330 (0.221)	47.881 (0.210)	48.156 (0.085)
SF-12 Social Functioning						
SI	34.422 (0.734)	34.119 (0.598)	33.335 (1.029)	34.549 (0.929)	30.876 (0.473)	32.030 (0.291)
nSI	39.404 (0.459)	40.243 (0.376)	40.372 (0.557)	41.410 (0.613)	40.320 (0.335)	39.773 (0.188)
General population	47.075 (0.164)	49.594 (0.185)	46.313 (0.197)	49.403 (0.219)	49.140 (0.200)	48.226 (0.085)
SF-12 Vitality						
SI	38.740 (0.753)	39.440 (0.606)	40.066 (1.041)	42.761 (0.981)	38.651 (0.495)	39.524 (0.299)
nSI	43.195 (0.471)	44.904 (0.381)	45.835 (0.564)	48.235 (0.647)	42.936 (0.351)	44.431 (0.194)
General population	48.818 (0.168)	52.191 (0.188)	51.419 (0.200)	54.038 (0.231)	50.103 (0.209)	51.208 (0.087)

**Notes:** <sup>a</sup>Generalized linear models were adjusted for sociodemographic and health status variables. All comparisons were  $p < 0.05$  with the exception of the following cases, where SI and nSI patients were not statistically different: France, PCS; Germany, PCS and Physical Functioning.

**Abbreviations:** EQ-5D, EuroQol-5 Dimensions; EQ-VAS, EuroQol visual analogue scale; MCS, mental component summary; nSI, non-suicidal ideation; PCS, physical component summary; SF-12, 12-Item Short Form Health Survey; SI, suicidal ideation.

**Table S2** Adjusted mean percentage work productivity and activity impairment among respondents with SI and nSI compared to general population controls

Parameter	Adjusted means (SE) <sup>a</sup>						Europe
	France	Germany	Italy	Spain	UK		
Absenteeism (%)							
	SI	31.040 (3.976) <sup>##</sup>	35.910 (4.212) <sup>##</sup>	15.227 (2.924) <sup>#</sup>	13.508 (2.541) <sup>#</sup>	45.584 (4.131) <sup>##</sup>	29.190 (1.633) <sup>##</sup>
	nSI	18.910 (1.621) <sup>#</sup>	20.992 (1.520) <sup>#</sup>	9.497 (1.046) <sup>#</sup>	12.727 (1.562) <sup>#</sup>	20.944 (1.347) <sup>#</sup>	15.851 (0.578) <sup>#</sup>
General population	5.978 (0.242)	7.602 (0.288)	4.194 (0.185)	3.929 (0.204)	6.589 (0.253)	5.765 (0.105)	
Presenteeism (%)							
	SI	37.499 (5.428) <sup>#</sup>	47.136 (6.061) <sup>##</sup>	44.847 (8.477) <sup>#</sup>	37.712 (7.055) <sup>#</sup>	47.954 (4.673) <sup>##</sup>	44.022 (2.653) <sup>##</sup>
	nSI	29.545 (2.680) <sup>#</sup>	30.356 (2.237) <sup>#</sup>	36.337 (3.783) <sup>#</sup>	34.869 (4.157) <sup>#</sup>	33.062 (2.021) <sup>#</sup>	31.882 (1.155) <sup>#</sup>
General population	15.393 (0.604)	14.756 (0.558)	18.221 (0.749)	14.486 (0.696)	17.848 (0.648)	16.481 (0.288)	
Total work productivity impairment (%)							
	SI	53.909 (6.778) <sup>#</sup>	61.813 (7.152) <sup>##</sup>	51.024 (9.623) <sup>#</sup>	45.214 (8.198) <sup>#</sup>	67.340 (5.922) <sup>##</sup>	57.951 (3.177) <sup>##</sup>
	nSI	40.443 (3.401) <sup>#</sup>	41.555 (2.929) <sup>#</sup>	40.734 (4.222) <sup>#</sup>	40.950 (4.807) <sup>#</sup>	42.293 (2.540) <sup>#</sup>	40.282 (1.411) <sup>#</sup>
General population	19.396 (0.741)	19.801 (0.726)	20.719 (0.844)	17.101 (0.808)	20.977 (0.752)	19.915 (0.342)	
Activity impairment (%)							
	SI	52.687 (4.637) <sup>##</sup>	55.451 (4.071) <sup>##</sup>	55.452 (7.236) <sup>#</sup>	47.248 (5.628) <sup>#</sup>	63.252 (3.398) <sup>##</sup>	56.703 (1.986) <sup>##</sup>
	nSI	41.747 (2.301) <sup>#</sup>	42.920 (1.985) <sup>#</sup>	41.181 (2.931) <sup>#</sup>	38.059 (3.010) <sup>#</sup>	45.508 (1.761) <sup>#</sup>	42.522 (0.973) <sup>#</sup>
General population	22.976 (0.454)	21.907 (0.504)	22.649 (0.577)	18.144 (0.517)	23.886 (0.548)	22.380 (0.231)	

**Notes:** <sup>a</sup>Generalized linear models were used adjusted for sociodemographic and health status variables. <sup>\*</sup>Compared to the nSI population, values for SI patients differed at  $p<0.05$ . <sup>##</sup>Compared to the general population, values for SI and nSI patients differed at  $p<0.05$ .

**Abbreviations:** nSI, non-suicidal ideation; SI, suicidal ideation.



**Table S3** Adjusted means for healthcare resource use among respondents with SI and nSI compared to general population controls

Parameter	Adjusted means (SE) <sup>a</sup>					
	France	Germany	Italy	Spain	UK	Europe
HCP visits						
SI	14.524 (1.311) <sup>*#</sup>	15.338 (1.159) <sup>*#</sup>	11.517 (1.558) <sup>#</sup>	14.276 (1.753) <sup>*#</sup>	7.669 (0.443) <sup>*#</sup>	12.209 (0.445) <sup>*#</sup>
nSI	10.013 (0.575) <sup>#</sup>	10.626 (0.514) <sup>#</sup>	9.371 (0.698) <sup>#</sup>	8.175 (0.683) <sup>#</sup>	5.826 (0.246) <sup>#</sup>	8.678 (0.210) <sup>#</sup>
General population	4.046 (0.088)	4.406 (0.110)	4.092 (0.114)	3.693 (0.116)	2.654 (0.069)	3.764 (0.043)
General/family practitioner						
SI	3.773 (0.373) <sup>#</sup>	4.010 (0.328) <sup>*#</sup>	4.065 (0.587) <sup>*#</sup>	4.382 (0.576) <sup>*#</sup>	3.311 (0.209) <sup>*#</sup>	4.303 (0.171) <sup>*#</sup>
nSI	3.203 (0.202) <sup>#</sup>	2.732 (0.147) <sup>#</sup>	2.734 (0.226) <sup>#</sup>	2.876 (0.263) <sup>#</sup>	2.480 (0.117) <sup>#</sup>	3.051 (0.082) <sup>#</sup>
General population	1.658 (0.040)	1.609 (0.046)	1.814 (0.055)	1.472 (0.053)	0.988 (0.030)	1.504 (0.019)
Hospitalized						
SI	0.307 (0.052) <sup>#</sup>	0.227 (0.036) <sup>*#</sup>	0.224 (0.061) <sup>#</sup>	0.314 (0.077) <sup>#</sup>	0.257 (0.036) <sup>#</sup>	0.235 (0.019) <sup>*#</sup>
nSI	0.206 (0.026) <sup>#</sup>	0.152 (0.018) <sup>#</sup>	0.109 (0.023) <sup>#</sup>	0.195 (0.043) <sup>#</sup>	0.201 (0.022) <sup>#</sup>	0.164 (0.010) <sup>#</sup>
General population	0.107 (0.006)	0.101 (0.007)	0.058 (0.006)	0.067 (0.007)	0.160 (0.009)	0.106 (0.003)
ER visits						
SI	0.331 (0.057) <sup>#</sup>	0.288 (0.043) <sup>*#</sup>	0.747 (0.149) <sup>*#</sup>	1.415 (0.220) <sup>*#</sup>	0.361 (0.041) <sup>#</sup>	0.463 (0.029) <sup>*#</sup>
nSI	0.230 (0.030) <sup>#</sup>	0.185 (0.021) <sup>#</sup>	0.168 (0.028) <sup>#</sup>	0.728 (0.091) <sup>#</sup>	0.404 (0.033) <sup>#</sup>	0.313 (0.015) <sup>#</sup>
General population	0.120 (0.007)	0.110 (0.008)	0.106 (0.008)	0.288 (0.017)	0.196 (0.010)	0.162 (0.004)

**Notes:** <sup>a</sup>Generalized linear models were adjusted for sociodemographic and health status variables. \*Compared to the nSI population, values for SI patients differed at  $p < 0.05$ . <sup>#</sup>Compared to the general population, values for SI and nSI patients differed at  $p < 0.05$ .

**Abbreviations:** ER, emergency room; HCP, healthcare professional; nSI, non-suicidal ideation; SI, suicidal ideation.

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