



## Examination of the population attributable risk of different risk factor domains for suicidal thoughts and behaviors



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### ARTICLE INFO

#### Article history:

Received 7 May 2015

Received in revised form

22 July 2015

Accepted 29 July 2015

Available online 21 August 2015

### ABSTRACT

**Background:** Despite the fact that suicide is an important public health problem, the etiology is still not well understood. Especially lacking is a societal-level approach that takes into account the extent to which several risk factor domains are attributable to new onset of suicidal thoughts and behaviors (STB). **Methods:** Data stem from a cross-sectional population study of the non-institutionalized adult (18+) population from Belgium ( $N=2419$ ). The third version of the Composite International Diagnostic Interview (CIDI-3.0) was administered to assess lifetime STB and risk factor domains. Multivariate approaches, expressed in population attributable risk proportions, were used to estimate the proportion of new onset cases of STB related to the occurrence of different risk factors.

**Results:** Approximately 38% of cases of suicidal ideation onset were attributable to mental disorders, 20% to chronic physical conditions, and another 13% to parental psychopathology. Suicide attempts in the general population were attributable to mental disorders (PARP=48%), but attempts among persons with suicidal ideation were unrelated to mental disorders, but rather to trauma (PARP=17%) and childhood adversities (PARP=12%).

**Limitations:** This is an explorative study using multivariate additive general models that generates specific hypotheses on the development of STB onset rather than testing specific pathways in the process of STB.

**Conclusions:** New onset STB is mostly attributable to proximal risk factors such as mental disorders. However, distal risk factors like childhood adversities or trauma also play a considerable role in the new onset of STB, especially in the transition from suicide ideation to suicide attempt.

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### 1. Introduction

Suicide is one of the leading causes of death worldwide but the etiology of suicide is still not well understood. Previous studies have examined the extent to which different risk factors are associated with the subsequent onset of suicidality. Among those, mental disorders are perhaps the most studied risk factors for suicidal thoughts and behaviors (STB) (Nock et al., 2010; Hawton and van Heeringen, 2009). Compared to persons without mental disorders, persons with mental disorders are between two and

three times more likely to have STB (Nock et al., 2012). However, other risk factors such as negative life experiences and physical health problems also contribute to the onset of STB. For example, there is an association between a broad range of traumatic events during childhood and STB in adulthood (Gureje et al., 2011; Stein et al., 2010; Bruffaerts et al., 2010). The same applies for chronic physical conditions, although to a lesser extent (Scott et al., 2010; Harris and Barraclough, 1994). All-in-all, persons with adversities or traumas, physical conditions, or with parents with mental illness are generally around 50% more likely to subsequently develop STB.

Although these approaches are valuable in identifying risk factors for STB, there are two major limitations in the current literature. First, it is quite unlikely that these risk domains operate in isolation in their relation with the onset of STB (Nock et al., 2012). Indeed, it is relatively unknown to what extent different risk factors or domains of risk factors effectively cluster together and

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influence one another. In addition, most studies in this area tend to focus on proximal risk factors of STB despite the need to integrate proximal and distal risk factors (Drum et al., 2009). A second limitation is that most studies have examined STB on an individual level, i.e. studying the associations of particular risk factors for STB among those who are suicidal (Knox et al., 2004). The few studies that have taken into account the prevalence of different risk factors in determining the potential impact of key risk factors on STBs have focused mostly on depression (Beautrais et al., 1996; Pirkis et al., 2000; Goldney et al., 2000; Goldney, 2005; Cheung et al., 2006; Li et al., 2011). These studies have estimated that the attributable risk proportion of depression on STB in the 47–80% range. The extent to which STB is attributed to a broad domain of distal risk factors (like parental psychopathology or childhood adversities) is not well understood. Nonetheless, in an era where, from a public health perspective, a large emphasis lies in the prevention of suicide, it is important to estimate the impact of different risk domains on the new onset of STB because such data enable policy makers to better targeted interventions.

The current study examines the relative predictive associations of different suicide risk domains with subsequent STB in Belgium, the country with the highest suicide rate within Europe. We use representative population-based data from the World Health Organization (WHO) World Mental Health (WMH) Survey Initiative ([www.hcp.med.harvard.edu/WMH](http://www.hcp.med.harvard.edu/WMH)). The WMH initiative consists of a series of psychiatric epidemiologic studies conducted worldwide. The present study builds on earlier work that identified risk factors for STB (Nock et al., 2012; Bruffaerts et al., 2010; Van Rijsselberghe et al., 2011; Kovess-Masfety et al., 2011; Nock et al., 2008). In this study, we use population attributable risk proportions (PARPs) to identify the unique population-level effects of each risk factor domain on the new onset of STB. In more detail, our aim is to investigate to what extent parental psychopathology, childhood adversities, traumatic events, chronic physical conditions, and mental disorders attribute to the subsequent new onset of (a) suicidal ideation, (b) suicide attempt, and (c) suicide attempt among suicide ideators.

## 2. Materials and methods

This study uses data from a cross-sectional face-to-face household interview survey, based on probability samples representative of the adult population of Belgium. The target population is the non-institutionalized adult population in Belgium (aged 18 years or older), residing in private households. The sample frame was the National register of residents in Belgium. A stratified multistage random sample was drawn by Statistics Belgium, formerly National Institute of Statistics. In total, 2419 respondents were interviewed between April 2001 and June 2002 by lay interviewers that were trained by the Scientific Institute of Public Health, using a computer-assisted personal interview (CAPI). The overall response rate was 50.6%. This study is part of the European Study of the Epidemiology of Mental Disorders (ESEMeD), as a part of the World Mental Health Survey Initiative (WMH – see <http://www.hcp.med.harvard.edu/wmh>).

The central WMH staff trained bilingual supervisors in Belgium. Consistent interviewer training documents and procedures were used. The WHO translation protocol was used to translate instruments and training materials. The Belgian survey was carried out in bilingual form (Dutch and French). Persons who could not speak these languages were excluded. Standardized descriptions of the goals and procedures of the study, data uses and protection, and the rights of respondents were provided in both written and verbal form to all potentially eligible respondents before obtaining verbal informed consent for participation in the survey. Quality

control protocols, described in more detail elsewhere (Pennell et al., 2008; Harkness et al., 2008), were standardized across the WMH countries where this study took place, in order to check on interviewer accuracy and to specify data cleaning and coding procedures. The institutional review board of the organization that coordinated the survey in Belgium approved and monitored compliance with procedures for obtaining informed consent and protecting human subjects (Demarest et al., 2011).

Internal sub-sampling was used to reduce respondent burden by dividing the interview into two parts. Part 1 included the core diagnostic assessment of mental disorders. Part 2 included additional information relevant to a wide range of survey aims, including the assessment of other risk domains than mental disorders. Details of the sub-sampling are described elsewhere (Pennell et al., 2008). All respondents completed part 1. All part-1 respondents ( $N=2419$ ) who met criteria for any mental disorder and a probability sample of other respondents were administered part 2. Part 2 ( $N=1043$ ) respondents were weighted by the inverse of their probability of selection for part 2 of the interview to adjust for differential sampling. Analyses in this article were based on the weighted part 2 sample. Additional weights were used to adjust for differential probabilities of selection within households and for post-stratification (i.e. to match the samples to population socio-demographic distributions).

## 3. Measures

All measures are part of the third version of the Composite International Diagnostic Interview developed for the World Mental Health initiative (Kessler and Üstün, 2004). The CIDI is a fully structured diagnostic interview that assesses mental disorders, their treatment, and a wide range of possible risk factors. The WHO translation, back-translation, and harmonization protocol was used to translate instruments and training materials. For the present study, we used the following modules from the CIDI-3.0: suicidal ideation and attempts, mental disorders, childhood experiences, trauma, and chronic physical conditions. Only traumatic events that occurred prior to the onset of either suicide ideation or attempt were tested as predictors in the model.

### 3.1. STB

The CIDI-3.0 module includes an assessment of the lifetime occurrence and age-of-onset of suicide ideation, plan, and attempt. This module includes an assessment of the lifetime occurrence, age-of-onset, and age of most recent episode of suicide ideation (“Have you ever seriously thought about committing suicide?”), plans (“Have you ever made a plan for committing suicide?”), and attempts (“Have you ever attempted suicide?”). For the purpose of this study, we only used lifetime suicide ideation and attempt as dependent variables. We also asked for age-of-onset of the STB because our main research question was to examine the associations between the different risk factor domains and the subsequent onset of STB. We therefore included only those respondents with STB that occurred after the occurrence of the specific risk factor.

### 3.2. Mental disorders

The disorders included are lifetime DSM-IV mood disorders (MDE and dysthymia), anxiety disorders (generalized anxiety disorder [GAD], panic disorder and/or agoraphobia, posttraumatic stress disorder [PTSD], and social phobia), alcohol abuse and/or dependence, and externalizing disorders (attention deficit disorder and intermittent explosive disorder) (Kessler and Üstün, 2004). Clinical reappraisal studies carried out in four WMH

countries provided evidence showing good concordance between CIDI-3.0 diagnoses and diagnoses based on blinded re-interviews, with area under the receiver operator characteristics curve ranging between 0.73 and 0.93 for lifetime mood/anxiety disorders, and 0.83 and 0.88 for 12-month mood/anxiety disorders (Haro et al., 2006). Because our main aim was to include mental disorders as one specific risk factor domain, individual lifetime disorders were recoded into a binary variable, as either present or absent.

### 3.3. Parental mental illness

Parental mental illness was assessed with the expanded version of the Family History Research Diagnostic Criteria Interview (Andreasen et al., 1977) included in the CIDI-3.0. This instrument has high interrater reliability (Kendler et al., 1991), good predictive validity (Kendler and Roy, 1995), and good diagnostic agreement between offspring reports and parent interviews (Prescott et al., 2005). Five different forms of parental psychopathology during respondents' childhood were the focus: major depression, panic disorder, generalized anxiety disorder, substance dependence, and antisocial behavior (e.g., illegal behavior, arrest, imprisonment). A parental mental disorder was classified as present if the respondent gave an affirmative response to questions on the core symptoms of that particular disorder occurring in the mother or the father. For example, for mother depression, we asked respondents if his/her mother ever had periods lasting longer or equal to 2 weeks when she was sad or depressed for most of the time. If yes, we also asked whether, at the time her depression was at its worst, she also had other symptoms like low energy, changes in sleep or appetite, and problems with concentration; whether she ever got professional treatment for her depression; and whether her depression interfered a lot with her life or activities (Gureje et al., 2011)

### 3.4. Childhood adversities

We also included the following childhood adversities: physical abuse, sexual abuse, neglect, parental death, parent divorce, other parental loss, family violence, physical illness, and financial adversity before the age of 18. This module included adversities that occurred within the family context. Respondents who reported that the experience occurred before the age of 18 years and who met the criteria specified for a given adversity were coded as having experienced childhood adversity. There is consistent evidence for the validity of the recall of childhood adversities (Hardt and Rutter, 2004).

### 3.5. Trauma

As a part of the PTSD module of the CIDI-3.0, the events in this module include the following traumata occurring outside the family context: natural and man-made disasters and accidents, combat, war, and refugee experiences, sexual and interpersonal violence, witnessing or perpetrating violence, and death or trauma to a loved one (Stein et al., 2010). Each type of event was asked for separately. For instance, if a respondent experienced a natural disaster in which a loved one was killed, both traumatic events were endorsed. This allowed us to investigate independent effects of each type of event on the outcome measures. The assessment of these traumatic events using surveys has proven to be valid and reliably (Willis and Gonzalez, 1998).

### 3.6. Chronic physical conditions

Physical conditions were assessed with a standard chronic disorders checklist adapted from the U.S Health Interview Survey

National Center for Health Statistics (1994). Such checklists yield more complete and accurate reports than those based on open-ended questions (Baker et al., 2001). In addition, there is moderate to good concordance between such reports and medical records (Baker et al., 2001, Revicki et al., 2004). Ten physical disorders were included in the current report: arthritis, cancer, cardiovascular disease (heart attack, heart disease, hypertension, and stroke), chronic back or neck pain, diabetes, frequent or severe headache or migraine, insomnia, neurological (multiple sclerosis, Parkinson's disease, and epilepsy or seizures), digestive disease (stomach or intestine ulcer or irritable bowel disorder), and respiratory disease (seasonal allergies like hay fever, asthma, or COPD or emphysema). The medical diagnoses were ascertained by the following question: "Did a doctor or other health professional ever tell you that you had... heart disease; asthma; diabetes or high blood sugar..." Symptomatic conditions were ascertained with the question: "Have you ever had...arthritis or rheumatism; chronic back or neck problems; frequent or severe headaches..." (Scott et al., 2010).

## 4. Statistics

Discrete-time analyses with person-years as the unit of analysis were used to study the onset of STB in order to deal appropriately with the temporal sequence between independent (i.e. the risk factor domains) and dependent variables (i.e. the three main outcome STB). Respondent age at the time of occurrence of each risk factor domain was recorded and the risk domains were treated as time-varying covariates in each statistical model. Only those events that occurred temporally prior to the STB being examined were tested as predictors in each model.

We calculated population attributable risk proportions (PARP) for each risk factor domain in five different models for suicide ideation, suicide attempt, and attempt among ideators. In each series of models, we started by investigating the PARP for the most distal domain of risk factors (i.e. parental psychopathology). In each subsequent model, the next most proximal risk factor domain was added to the model. This resulted in a series of different models with parental psychopathology as the only predicting factor in the first model, parental psychopathology and childhood adversities in the second model, parental psychopathology, childhood adversities, and trauma in the third model, parental psychopathology, childhood adversities, trauma, and chronic physical conditions in the fourth model, and finally the full model including: parental psychopathology, childhood adversities, trauma, chronic physical conditions, and mental disorders. Some of the PARPs we calculated resulted in negative population attributable risk. We provide these estimates but in fact these values can be systematically reassigned to zero in order to convey that there would be no change in the outcome variables. All models included controls for person-years and sociodemographic variables. Standard errors were estimated with the Taylor series method (Wolter, 1985) using SUDAAN software (SUDAAN9.0.2, 2005) to adjust for weighting and clustering. Multivariate significance was evaluated with Wald  $\chi^2$  tests based on design-corrected coefficient variance-covariance matrices. All significance tests were evaluated using .05-level two-sided tests.

## 5. Results

### 5.1. Sample

The mean age of the study sample was 47 years, with the majority of respondents (28.8%) between 18 and 34 years old. In

total, 52% of the respondents were female. More than a half (57.3%) of the sample was married, and about one in four (26.6%) was single. The majority of respondents were living in a mid-size urban environment, and most respondents were in paid employment at the time they participated in the study. A more detailed description of the sample can be found elsewhere (Bruffaerts et al., 2008).

## 5.2. How common are STB in Belgium?

Lifetime suicidal ideation and attempt were 8.4% and 2.5%, respectively; and the lifetime prevalence of suicidal attempt among ideators was 29.4%. The mean age-of-onset of STB in Belgium was 29. More information on prevalence of STB can be found elsewhere (Nock et al., 2008).

## 5.3. How common are the risk factor domains?

About 8% of the respondents reported that they had at least one parent with a mental disorder (either depression, panic disorder, generalized anxiety disorder, or antisocial personality disorder). Childhood adversities prior to the age of 18 were reported by 1.0–12.0% of the respondents, with a median of 3.1%. Traumatic events were reported by 7.5% of the respondents. In addition, 54.4% of the population had a chronic physical condition, and 19.1% met criteria for a lifetime mental disorder.

## 5.4. Society-level risk factor domains for the onset of suicide ideation

The first set of analyses showed that approximately 1/5 (i.e. 20.3%) of the new onset cases of suicidal ideation in Belgium is associated with a history of parental psychopathology (Table 1, Model 1). When the next risk factor domain (i.e. childhood adversities) was entered in the model (Table 1, Model 2), the PARP of parental psychopathology decreases (from 20.3% to 17.1%) but it is still higher than the PARP of childhood adversities (i.e. 5.5%). This suggests that the effect of parental psychopathology on the subsequent onset of suicidal ideation is partially mediated by childhood adversities. In the next model trauma is entered in the equation (Table 1, Model 3). This leads to a further drop of the PARP of childhood adversities (from 5.5% to 5.2%) but also of the PARP of parental psychopathology (from 17.1% to 16.9%). In the following model (Table 1, Model 4), the PARPs of the already included risk domains further decrease. When all the risk factors domains are taken into account (Table 1, Model 5), 71.0% of the new onset cases of suicidal ideation in Belgium can be attributed to these five domains. Mental disorders accounted for the highest PARP (38.4%). This can be interpreted as the proportion of new onset cases of suicidal ideation that possibly could be prevented when mental disorders would be fully treatable.

## 5.5. Society-level risk factor domains for the onset of suicide attempts

The data from the analyses predicting suicide attempt are generally similar to those predicting suicide ideation. We ran 5 different models, with an additional risk domain entered in each next model. The first model (Table 2, Model 1) shows that the PARP of parental psychopathology is 12.3%, i.e. the proportion of new onset suicide attempts attributable to parental psychopathology. When childhood adversities were then entered in the model (Table 2, Model 2), the PARP of parental psychopathology decreases substantially from 12.3% to 3.2%. This indicates that the effect of parental psychopathology on the onset of suicide attempt is relatively low when childhood adversities are taken into account. Still in Model 2, about one third (34.5%) of the new onset suicide attempts are attributable to childhood adversities. In the next models (Models 3–5), trauma, chronic physical conditions, and mental disorders are subsequently entered into the equations. The final model (Table 2, Model 5) shows that, from a societal-level viewpoint, almost half of the new onset suicide attempts (or, 48.8%) are attributable to mental disorders and about one in five (or, 21.0%) to childhood adversities.

## 5.6. Society-level risk factor domains for the onset of suicide attempts among suicide ideators

In the third model we investigated to what extent new onset suicide attempts among those with suicide ideation were attributable to each of the risk factor domains. Two main findings stand out. First, when we look at those risk factors domains that were attributable to new onset attempt, the PARPs are relatively modest, independently upon the model under consideration (Table 3). As such, the final model suggests that 36.7% of the new onset suicide attempts could be avoided when all the risk factor domains were taken into account. Trauma and childhood adversities were the domains with the highest PARPs in this final model. Second, some of the risk domains were not useful in predicting new onset of suicide attempts. Most interestingly, in the final model (Table 3, Model 5), new onset suicide attempt among suicide ideators was not attributable to mental disorders.

## 6. Discussion

This is the first study in Europe that estimated the proportion of cases of STB that can be attributed to a range of different risk factor domains. Whereas most studies examine the magnitude of the association between individual risk factors and suicide ideation or attempt, our analyses took into account the prevalence of different risk factors and so provide an estimate of the proportion

**Table 1**

Population attributable risk proportions of risk factor domains on onset of suicide ideation in Belgium, general population.

Conditions cured	Parental psychopathology	Childhood adversities	Trauma	Chronic physical conditions	Mental disorders
Parental psychopathology	20.3%	17.1%	16.9%	16.6%	13.5%
Childhood adversities	–	5.5%	5.2%	4.9%	10.9%
Trauma	–	–	6.7%	6.2%	9.6%
Chronic physical conditions	–	–	–	8.6%	20.4%
Mental disorders	–	–	–	–	38.4%
All conditions	–	–	–	–	71.0%

NOTE: all models control for the influence of a subsequent added risk factor domain. Each row shows the PARP of new onset suicidal ideation a number of times while adding more controls each time. In the first column, only sociodemographic variables and parental psychopathology were controlled for, in the next column, childhood adversities are controlled for on top of the previous controls. The last column includes all controls. For parental psychopathology, childhood adversities, trauma, chronic physical conditions, and mental disorders, only these disorders that were significantly related to suicidal ideation were controlled for.

**Table 2**  
Population attributable risk proportions of risk factor domains on onset of suicide attempts in Belgium, general population.

Conditions cured	Parental psychopathology	Childhood adversities	Trauma	Chronic physical conditions	Mental disorders
Parental psychopathology	12.3%	3.2%	2.0%	–3.1%	–2.5%
Childhood adversities	–	34.5%	31.8%	30.5%	21.0%
Trauma	–	–	38.4%	34.6%	14.2%
Chronic physical conditions	–	–	–	27.9%	18.7%
Mental disorders	–	–	–	–	48.9%
All conditions	–	–	–	–	89.7%

NOTE: all models control for the influence of a subsequent added risk factor domain. Each row shows the PARP of new onset suicidal attempt a number of times while adding more controls each time. In the first column, only sociodemographic variables and parental psychopathology were controlled for, in the next column, childhood adversities are controlled for on top of the previous controls. The last column includes all controls. For parental psychopathology, childhood adversities, trauma, chronic physical conditions, and mental disorders, only these disorders that were significantly related to suicidal attempt were controlled for. Negative population attributable risk results are considered non-interpretable.

of cases of STB that could be eliminated if we were able to eliminate the risk factors studied, assuming a causal relation between risk factors and outcomes. We found that, on average, 71% of the STB in the Belgian general population could be prevented if each of the risk domains studied could be eliminated. Mental disorders (as proximal factors) are the most important risk factor domain, but also chronic physical conditions and or traumatic experiences (as distal risk factors) account for a considerable proportion of new onset STB.

Results presented in this study should be interpreted in the light of the following limitations. First, respondents who did not speak the main language(s) of the country sufficiently, those institutionalized, and those without fixed address were not included in the present study. It cannot be ruled out that these groups of persons differed in the association between childhood adversities and suicidal behaviors. Second, we estimated the PARPs of different risk factor domains and not of individual risk factors; in fact, we pooled different risk factors into one risk factor group. This means that we were unable to calculate PARPs for individual traumatic events or individual mental disorders. In addition, a number of burdensome mental disorders, such as dementia and psychosis, were not included in the study. Nonetheless, the inclusion of a broader set of mental disorders (like psychosis, bipolar disorder, or drug abuse/dependence) would have yield more reliable PARPs for mental disorders than those we obtained now. This means that the PARPs for mental disorders we provide now are to be interpreted as underestimates. Further study should focus more profoundly on possibly high impact risk factors that were not included in the present study. Third, recall bias may affect the accuracy of the adversity recall. For instance, rates of forgetting to report abusive experiences have been estimated in the 20–33% range (Wilsnack et al., 2002) but without consistent evidence for false positive reports (Hardt and Rutter, 2004). Fourth, although the range of risk factor domains assessed here is larger than in

most previous studies, it is far from exhaustive and did not assess the severity, duration, or sequencing of any of these domains. In addition, we did not include other common reported risk factor domains for suicidality such as genetic factors or personality features. A fifth limitation pertains to the fact that we were not able to include stressors to the multivariate models in order to investigate a stress–diathesis approach for STB more profoundly. As this is the first study that investigates the role of different risk domains in the onset of STB, our approach is hypothesis-generating and explorative rather than hypothesis-testing and conclusive. Further study may therefore focus on statistical interactions between different risk domains across the lifespan, in order to confirm or refute our findings, and to apply post-hoc adjustments to address experiment-wise errors in testing interactions between risk domains and specific vulnerabilities associated with the onset of STB. A last limitation is that the method of collecting information on parental mental disorders is susceptible to recall error: respondents with mental disorders are more likely to report mental disorders in their family compared to those without (Milne et al., 2009). Combined with the fact that we only assessed parental mental disorders during childhood, this suggests that the PARPs for parental psychopathology and STB are rather conservative.

In the population as a whole, mental disorders accounted for 38–49% of the new onset of STB. In line with previous findings (Nock et al., 2012; Goldney et al., 2000), they highlight the prominent role of mental disorders in STB for both the individual and the society. From a public-health viewpoint, when it comes to identifying specific risk factor domains that could be the subject of prevention, it is important to evaluate not just the prevalence of a specific risk factor domain, but also its impact on the individual and the societal level. Against this, mental disorders are the most important disorders to consider; they are highly prevalent, their high risk on STB for the individual with a mental disorder, and

**Table 3**  
Population attributable risk proportions of risk factor domains on onset of suicide attempts among ideators in Belgium.

Conditions cured	Parental psychopathology	Childhood adversities	Trauma	Chronic physical conditions	Mental disorders
Parental psychopathology	–9.4%	–11.3%	–8.2%	–6.8%	3.5%
Childhood adversities	–	5.4%	6.9%	7.2%	12.4%
Trauma	–	–	18.1%	13.7%	16.9%
Chronic physical conditions	–	–	–	10.3%	5.9%
Mental disorders	–	–	–	–	–28.4%
All conditions	–	–	–	–	36.6%

NOTE: all models control for the influence of a subsequent added risk factor domain. Each row shows the PARP of new onset suicidal attempt among suicide ideators a number of times while adding more controls each time. In the first column, only sociodemographic variables and parental psychopathology were controlled for, in the next column, childhood adversities are controlled for on top of the previous controls. The last column includes all controls. For parental psychopathology, childhood adversities, trauma, chronic physical conditions, and mental disorders, only these disorders that were significantly related to suicidal attempt among ideators were controlled for. Negative population attributable risk results are considered non-interpretable.

their high attributable risk in a society-level approach. However, and this is probably the most important finding, the same is true for the more proximal risk factors we included. Taken together, their PARP (roughly 33–41%) is only slightly lower to that of mental disorders (38–49%). Thus, these results suggest that also distal risk factors – as a specific vulnerability – may play a significant role in preventing STB, probably in interaction with specific contextual stressors (Van Heeringen, 2012).

The latter is even more pronounced when we exclusively focus on suicide attempts. The PARP for mental disorders is considerably higher than usually reported (Chan et al., 2009), but none of the earlier studies disaggregated new onset attempts in the general population from new attempts among those with ideation. After doing so, two interesting findings appear. First, in the condition that all risk domains could be eliminated, our data show that only 37% of the new onset cases (among those with suicide ideation) could be prevented. This is considerably higher than the 7% in the worldwide approach from the World Mental Health surveys (Nock et al., 2012), but still lower than the other PARPs we calculated. From these data it is clear that most risk factors for a suicide attempt among ideators are still unknown. More research is needed here that will elucidate which risk factor domains are at play here. Second, if we look at those domains that play a role in the 37% of the attempts that could be prevented, our data suggest that new onset cases of attempts among ideators were *not* attributed to mental disorders. Instead, childhood adversities and traumatic experiences together explained 29% of the new onset attempts among persons who already endorsed with suicidal ideation. This suggests that the extent to which onset of suicide attempts is attributed to distal risk domains may be higher than usually assumed (Roy, 2003). Against this, our findings do not support the common knowledge that interventions aimed at treating the mental disorder *per se* in those with suicide ideation may prevent the onset of an attempt.

The results obtained in this study may have some important implications when it comes to prioritizing public health needs in Belgium, the country with the highest suicide rate in Europe (Eurostat, 2015), and a strong emphasis on suicide prevention (Vlaams Agentschap Zorg en Gezondheid, 2009). In this sense is our study a first step in building and guiding a conceptual model of STB built on national-representative country data.

Our data underscore the importance of including other risk factor domains in suicide prevention strategies than just mental disorders because these disorders attribute only for maximum half of the new cases of STB. Moreover, the different risk factor domains together contribute to the onset and further development of STB, as we found that the PARPs in each domain dropped when an additional domain was added to the statistical model. Earlier studies pointed to the importance of mental disorders – and especially depression – as important risk factors, but our data also suggest that we may apply a broader focus when it comes to prevention of STB. How exactly the impact of the different risk factor domains may be integrated in a country's attempts to reduce new onset suicide attempts remains an important albeit unanswered question. So far, suicide prevention interventions in Belgium have largely focused on psycho-education of the general population or preventing re-attempts after an initial attempt (Pil et al., 2013). In any case, our data support to the idea that suicide prevention should at best be focused on both proximal *and* distal risk factors, and thus not just focused on those who are at elevated risk. Of course, it is evident that interventions are more easily implemented in groups who are already at high risk, but we should also take into consideration that their impact on the population level is quite limited (Li et al., 2011).

Public health approaches to suicide prevention is of paramount importance, including universal or selective prevention

interventions (Knox, 2014). However, they appear rather difficult because this requires changes on different societal levels. For example, population strategies including interventions to reduce the effects of parental psychopathology or childhood adversities have been designed but are difficult to implement (e.g. Reynolds et al. (2010)). This does not mean, however, that population-based initiatives should *de facto* be precluded. After all, combined prevention strategies including legislative, individual-level, and society-level interventions (Rose, 2008) have been proven to be successful in sustainably reducing clinical outcomes with complex etiologies such as cardiovascular disease (Taylor et al., 2006) and even STB in the US Air Force (Knox, 2014).

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