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# The association between motives, perceived problems and current thoughts of self-harm following an episode of self-harm. A network analysis

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## HIGHLIGHTS

- Of all motives and problems. the motive a wish to die was most directly related to current thoughts of self-harm
- The wish to die did not play a central role in the network, and thus was not strongly related to other motives and problems.
- External motives such as show how much I loved someone, were more central in the network but had no direct relation to current thoughts of self-harm

## ABSTRACT

**Background:** A history of self-harm is a major risk factor for suicide. Some patients are more likely than others to repeat suicidal behaviour after an episode of self-harm. Insight in the relation between current thoughts of self-harm, motives for the self-harm episode and perceived problems may improve prevention strategies. Network analysis allows to investigate the co-occurrence of these factors and their association with each other.

**Methods:** Ising model based networks are estimated on data collected between 2007–2015 within the Multicentre Study of Self-harm in Flanders. Patients were interviewed within 24 hours after hospitalization by a trained professional on their motives for the episode of self-harm and their perceived problems. Additionally, they were asked whether they had current thoughts of self-harm. Network analyses are used to determine which motives and problems are uniquely related to current thoughts of self-harm, and which are most central in the network.

**Results:** Data were used of 6068 patients (2279 males and 3789 females). Four internal motives (*wish to die*, *lost control*, *escape from situation*, *situation was*

*unbearable*), one external motive (*show somebody how hopeless I was*) and four perceived problems (*psychiatric, loneliness, trauma, rejection*) are directly related to current thoughts of self-harm. Of all motives and problems, the motive *a wish to die* is most strongly related to current thoughts of self-harm. However, external motives are more central in the network when compared to internal motives and perceived problems.

Limitations: Data most probably refer to a selected group of self-harm patients as many individuals who self-harm do not come to the attention of hospital services. Patients might be reluctant to tell professionals they had current thoughts of self-harm.

Conclusions: Many internal motives and problems are directly related to current thoughts of self-harm, but external motives are more central in the network. The clinically most important motive (wish to die) does not play a central role in the network.

## 1. BACKGROUND'

Suicidal behaviour is an important global health problem, with an estimated 800.000 suicides per year (World Health Organisation, 2014). The majority of individuals who die by suicide have a history of self-harm (Cooper et al., 2005, Owens et al., 2002, Hawton and van Heeringen, 2009, O'Connor and Nock, 2014). Patients who are referred to emergency departments following self-harm are therefore at a high risk of repeat suicidal behaviour, and require psychiatric evaluation and follow up interventions. In this paper, we use the definition of self-harm derived from the WHO/Euro Multicentre Study on Suicidal Behaviour: 'an act with nonfatal outcome, in which an individual initiates a deliberate, well-considered, and unusual behaviour, that without intervention of another will lead to self-harm or destruction, or when an individual deliberately takes a substance in a higher quantity than subscribed or generally suitable doses, with intention by means of actual or expected physical consequences to initiate desired changes' (Bille-Brahe et al., 1994).

The NICE clinical guideline on self-harm advises that all people who have self-harmed should be offered an assessment of insight in motives, problems and current suicide intent such as current thoughts of self-harm (National collaborating centre for mental health, 2004). Many studies found current suicide intent after an episode of self-harm or a suicide attempt to be an important predictor for future suicidal behaviour (e.g. Suokas et al., 2001, Suominen et al., 2004, O'Connor et al., 2008, O'Connor et al., 2013).

It has been argued that insight in the motives and perceived problems of patients that self-harmed may help to better understand suicidal behaviour and improve prevention strategies (Jacobson et al., 2013, Rajapakse et al., 2015, Townsend et al., 2016). Motives may range from internal motives such as escape from an unbearable situation and a wish to die to more external motives such as an attempt to influence others (Jacobson et al., 2013). Individuals with a history of self-harm also report that they are facing multiple problems in life, in particular relationship problems (with family, partners and others) (Bagge et al., 2013, Choi et al., 2013) followed by employment problems and financial difficulties (Haw and Hawton, 2008, Milnes

et al., 2002). The period when a relationship may be deteriorating is also a time of increased risk for suicidal ideation and plans/attempts (Batterham et al., 2014).

### 1.1. Network analysis

Previous studies either looked at (single) motives or (single) perceived problems but not at the complex interaction between them or their relationship with current thoughts of self-harm (e.g. *Jacobson et al., 2013, Rajapakse et al., 2015, Townsend et al., 2016*). It seems plausible that motives, problems and current thoughts of self-harm influence each other: for example, a problem with a partner might be associated with a wish to escape one's situation, and a wish to die, which in turn can be related to thoughts of self-harm. Understanding this interaction between motives, problems and current thoughts of self-harm might offer insights for tailored postvention. A relatively new and promising conceptualization of systems of complex problems, such as suicidal behavior, is the network perspective.

The network perspective introduced an innovative way to conceptualize psychopathology (*Borsboom and Cramer, 2013, Fried et al., 2017*). In the more traditional view, a medical disease model was applied to psychopathology. Such a model, in which an underlying disorder (e.g., lung tumour) causes symptoms (e.g., coughing) is argued to be inappropriate for mental disorders. According to the network perspective, taking depression as an example, symptoms such as anhedonia or loss of interest are not just caused by an underlying disease called depression. They are viewed as separate problems that relate to each other without having to be caused by an unobservable common cause.

Typically, a network consists of nodes and edges. Nodes can present all kinds of variables, such as psychiatric symptoms or, in our case, motives and problems (*Borsboom and Cramer, 2013, Fried et al., 2017*). The edges between the nodes represent their mutual associations. Such a network allows analysis of various characteristics of the network, with centrality being a key concept. Taking depression as an example, if symptom anhedonia has many and/or strong associations to other depressive symptoms, it has a higher centrality in the depression network. It is hypothesized that symptoms with a high centrality play an important role in the system; they could have more predictive power for the course or onset of psychopathology than the other symptoms (*Fried et al., 2017, Borsboom and Cramer, 2013, Boschloo et al., 2016*). As central variables are likely to activate other variables, targeting the most central nodes in a suicidal behaviour network might be an effective way to prevent a new crisis.

Recently, it has been suggested that network analysis can help to better understand the suicidal process, as suicidal behavior is understood as the end result of many different psychological, social and biological factors (*O'Connor and Kirtley, 2018, de Beurs, 2017, De Beurs et al., 2018*). A network analysis of the 19 suicidal symptoms as assessed with the Beck Scale for suicide ideation indicated that the desire for suicidal behavior was the most central symptom (*de Beurs, van Borkulo & O'Connor, 2017*).

For the current study, we will apply similar analysis to better understand the co-occurrence of motives and problems after an episode of self-harm. We are especially interested to determine which motives and problems are uniquely related to current thoughts of self-harm, as an indication of the clinically most relevant riskfactors. Then, in line with the literature on centrality, we expect these riskfactors to also be central in the network, giving rise to new possibilities for prevention.

## 2. METHODS

We used data from the monitoring study of self-harm in Flanders on individuals who presented with self-harm to the emergency departments of general hospitals ( $n = 36$ ) between 1st January 2007 and 31st December 2015. Data collection began in 2007 in 5 hospitals. The number of participating hospitals gradually increased over the years, and from 2012 on, there were 36 participating hospitals. A semi-structured interview is being used in the 36 hospitals by clinicians and nurses as part of the psychosocial assessment in order to collect data on episodes of self-harm presenting to the emergency departments. The semi-structured interview contains two parts. The first part is administered right after admission at the emergency department for a self-harm episode by a nurse or psychologist. During this interview, demographic data, characteristics of the self-harm act, history of self-harm, *social support*, hopelessness and suicide ideation were collected. The second part is administered one day after the self-harm episode, by a psychologist or psychiatrists. Only patients who needed to stay in the hospital were interviewed, as other patients already left home after the initial treatment. The second interview addresses motives, perceived problems and current thoughts of self-harm. In the present study, we only used data from the second part. More information on the Flanders study is available via *Vancayseele et al., 2016*.

## 3. INSTRUMENTS

### 3.1. Motives for self-harm

Motives for self-harm were assessed with fifteen items, which were identified in earlier research as related to suicide (*Holden et al., 1998., Perquier et al., 2017*). Factor analysis divided the initial 14 items into 7 items on internal motives and 7 external/manipulative motivations (*Holden et al., 1998, see also Table 1*). As the *wish to die* has been found to be strongly associated with an episode of self-harm, it was added as an internal motive (*Perquier et al., 2017*). Patients could indicate whether a motive was present for this recent self-harm episode or not.

[TABLE 1]

### 3.2. Problems

The second part of the interview targets perceived problems, which are assessed using a number of items from the ‘Problem Checklist’ (Table 2). These include problems with partners, parents, children, and/ or friends, and problems related to finances, work, physical and mental health, housing, and justice (*Milnes et al., 2002*). A number of major life events or triggering factors associated with suicidal behaviour were added to this list, including such feelings of loneliness (*Schinka et al., 2012*), rejection of a love, school problems, sexual orientation (*King et al., 2008*), death of a significant other, suicide or attempted suicide of a significant other (*Qin et al., 2002*), or trauma (*Brodsky et al., 2001, Daray et al., 2016*). Patients needed to indicate whether they perceived a problem as being present or not.

### 3.3. Current thoughts of self-harm

In addition, patients were asked whether they were still thinking about hurting or harming themselves. Answer options were no, mildly or moderate strong. We dichotomized this variable into *no current thoughts of self-harm* if “no” was

answered and into *current thoughts of self-harm* if the response “mildly” or “moderate strong” was endorsed.

#### 4. CONCEPTUAL SUMMARY OF THE ANALYSIS

We estimate one overall network containing all motives, perceived problems and current thoughts of self-harm. Centrality measures are obtained and plotted. We report which motives and problems in the network have a unique association with current thoughts of self-harm. Then we formally test which of these motive/problem adds the statistically most significant contribution to current thoughts of self-harm. To test how results may be different within different samples, we compare the network for males and females and between patients that reported a *wish to die*, and patients that did not. We expect no differences in networks between the subsamples.

#### 5. GENERAL DESCRIPTIVES

#### 6. FREQUENCY OF MOTIVES AND PROBLEMS

Statistical analysis includes the frequency distribution of motives and perceived problems for the total sample. The Nagelkerke pseudo R square is used to approximate how much of the variance of current thoughts of self-harm is explained by all separate motives and perceived problems together.

#### 7. NETWORK ESTIMATION

To estimate the network structure of binary data, the current state-of-the-art are graphical models. A graphical model can be displayed as a network in which the edges between the nodes express conditional dependencies between the variables. This means that, when an edge is present between two variables, they are associated (dependent) after controlling for all other variables. Conversely, when no edge is present between two variables, this means that they are conditionally independent; after controlling for all other variables, the focal variables are not associated. Estimation of a graphical model for binary data, is typically based on the Ising model (*Ising, 1925, Kindermann and Snell, 1980*). The parameters of the Ising model are estimated with nodewise logistic regressions, which are regularized to minimize the estimation of spurious edges (*Friedman et al., 2008*). This L1-regularization involves a so-called tuning parameter  $\lambda$ , which controls the level of sparsity of the network. Because the level of sparsity of the true network is unknown, the value of  $\lambda$  is selected with a goodness-of-fit measure: the extended *Bayesian Information Criterion* (EBIC; *Chen & Chen, 2008*). This procedure has been implemented in R package *IsingFit* (*van Borkulo & Epskamp, 2016*) and was validated under various circumstances that are common in psychology and psychiatry research and shown to perform well in retrieving the true network structure. An elaborate explanation of this procedure is available elsewhere (see supplementary information of *van Borkulo et al., 2014*).

The *qgraph* package is used to visualize the estimated network (*Epskamp et al., 2012*). The placing of the nodes is determined using the Frucherman-Reingold algorithm in which more central nodes are placed in the centre of the network, and less central nodes at the periphery (*Frucherman and Reingold, 1991*). As we are interested in which variables are related to one specific node (current thoughts of



self-harm), we used a novel graphical function in qgraph called *flow* that places the node of interest to the left, then in vertical levels the nodes connected with 1, 2 or three edges.

We use the R package *relaimpo* to calculate the relative importance of the motives and problems that have a unique relation with suicide ideation (*Fried and Nesse, 2014, Grömping, 2006*). The LMG metric is used to average the explained variance of each single variable over all possible points of entry in the regression model. The bootstrapping option of the package gives the confidence intervals of the explained variance. This allows to quantify and order the effect that separate motives and problems have on current thoughts of self-harm.

## 8. CENTRALITY

Centrality in network analysis refers to the relative importance of a node in the network, and it is calculated using three estimates: strength, closeness and betweenness (*Opsahl et al., 2010*). By summing the strength of each of the edges of a node, the strength of a node within a network is obtained. Closeness is inversely proportional to the mean of the shortest distance from one node to all other nodes in the network. The betweenness estimate reflects the number of times a node lies on the shortest path between other nodes. High values indicate a high level of centrality. The estimates are standardized to allow for easy comparison.

## 9. DIFFERENCES BETWEEN SAMPLES

The network is re-estimated with the sample split for males and females, and with sample split for patients with and without a reported *wish to die*. When plotting the networks, nodes will be placed in a circle to be able to visually compare the networks more easily. To formally test the difference in network structure between males and females, the network comparison test as implemented in the *NetworkComparisonTest* package is used (*van Borkulo et al., 2016*). The test assesses whether the overall connectivity (global strength) within the two networks are identical or not. Default settings of the package are used (gamma for binary data = 0.25, iterations = 100).

## 10. RESULTS

### 10.1. Descriptives

Data were used on the 6068 patients (2279 males and 3789 females) who were referred to a participating general hospital and who answered all questions on motives, problems and current thoughts of self-harm. The mean age was 40 (sd = 15.8). Among the males, 791 (34%) reported current thoughts of self-harm, while 1364 females (36%) had current thoughts of self-harm. Of the males, 1090 (48%) had a history of suicidal behaviour, for the females this was 2103 (56%). Logistic regression analysis showed that all motives and problems combined explain 19% of the variance of current thoughts of self-harm. *Table 1* shows how often different motives and problems were endorsed.

On average, 3 motives (sd = 1.6) were endorsed. This was the same for males and females. The motives a *wish to die* and *the situation was so unbearable I had to do something* were most often endorsed. Of the 3959 patients who reported a wish to die as a motive for the recent self-harm episode, 50% (1831) reported also a current

thoughts of self-harm. On average, 2 (SD = 1.4) problems were endorsed. Psychiatric problems were most often reported by both males and females. Some problems are rarely endorsed such as *problems with sexual orientation* or *problems with justice*. Network 1: motives, perceived problems and current thoughts of self-harm  
*Fig. 1* shows the network of the complete sample. The network has 150 edges, of which 127 are positive and 23 negative.

**[FIGURE 1]**

Fig. 1. network of motives, perceived problems and current thoughts of self-harm. Red node is current thoughts of self-harm, green nodes indicate motives, blue nodes indicate perceived problems. Coloring of the nodes was done by hand, so does not represent statistical clustering. Green lines indicate positive association, red lines indicate negative association. The thicker the line, the stronger the association. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

*Fig. 2* shows that four internal motives (*wish to die, lost control, escape from situation, situation was unbearable*), one external motive (*show somebody how hopeless I was*) and four perceived problems (*psychiatric, loneliness, trauma, rejection*) are directly related to current thoughts of self-harm. The motive *I lost control* is negatively related with a current thoughts of self-harm, indicating that they do not co-occur often.

**[FIGURE 2]**

Fig. 2. Flow diagram of current thoughts of self-harm and motives and problems. CSH: current thoughts of self-harm, MOTIVES: thou: escape from thoughts, efs: escape from situation, ubs: unbearable situation, con: lost control, punish: I want to punish myself, loser: I feel like a loser, cry: I wanted to find help for my nerves and my problems: hop: I wanted to show people how hopeless I am, ssil: I wanted to show somebody I loved him, sism: I wanted to see if somebody loved me, infl: I wanted to influence someone, regret: I wanted to make people regret, scare: I wanted to scare somebody, mad: I was mad at somebody. Die: I wanted to die. PROBLEMS: part: partner, par: parent, child: children, lone: loneliness, soc: problems with relationships/friendships, rej: rejection, hea: health, psy: psychiatric symptoms, work: work, jus: justice: scho: school, sex: sexual orientation, dos: death of significant other, soo: suicide of significant other, trau: trauma.

**10.2. Centrality**

*Fig. 3* shows that external motives such as *See if someone loved me*, were more central when compared to internal motives or perceived problems.

**[FIGURE 3]**

Fig. 3. Percentage of relative importance of motives and problems on current thoughts of self-harm, including bootstrapped confidence intervals. Each value represents the unique shared variance between a motive or problem and the variable current thoughts of self-harm. Die: *wish to die*, psy: psychiatric problems, con: lost control, trau: trauma, lone: loneliness, efs: escape from situation, ubs: unbearable situation, hop: show someone how hopeless I am, rej: rejection.

*Fig. 4.*

**[FIGURE 4]**

Fig. 4. centrality plot for motives, problems and current thoughts of self-harm. Coefficients are standardized and ordered by the centrality metric *strength*. SI: persistent desire to self-harm, MOTIVES: thou: escape from thoughts, efs: escape from situation, ubs: unbearable situation, con: lost control, punish: I want to punish myself, loser: I feel like a loser, cry: I wanted to find help for my nerves and my problems: hop: I wanted to show people how hopeless I am, ssil: I wanted to show somebody I loved him, sism: I wanted to see if somebody loved me, infl: I wanted to influence someone, regret: I wanted to make people regret, scare: I wanted to scare somebody, mad: I was mad at somebody. Die: I wanted to die. PROBLEMS: part: partner, par: parent, child: children, lone: loneliness, soc: problems with relationships/friendships, rej: rejection, hea: health, psy: psychiatric symptoms, work: work, jus: justice: scho: school, sex: sexual orientation, dos: death of significant other, soo: suicide of significant other, trau: trauma.

## 11. RELATIVE IMPORTANCE

The motive wish to die was significantly most strongly related to current thoughts of self-harm (odds 3.2, 95% 2.8–3.6). Perceived psychiatric problems was the perceived problem with the strongest relation to current thoughts of self-harm (odds ratio 1.7 (1.5–1.9)).

### 11.1. Comparing networks within subgroups

Fig. 5a and 5b show the networks of males and females for all motives and problems (network 1). No significant difference in network density global strength is found ( $p = 0.33$ ). There is also no significant difference in network density global strength between patients that reported a wish to die as a motive ( $n = 3595$ ), and those that did not ( $n = 2472$ ). This indicates that our estimated network holds across subsamples.

**[FIGURE 5]**

Fig. 5. network of current thoughts of self-harm, problems and motives. for males (a) and females (b). Red node is persistent desire to self-harm, green nodes indicate motives, blue nodes indicate perceived problems. Green lines indicate positive association, red lines indicate negative association. The thicker the line, the stronger the association. CSH: current thoughts of self-harm, MOTIVES: thou: escape from thoughts, efs: escape way from situation, ubs: unbearable situation, con: lost control, punish: I want to punish myself, loser: I feel like a loser, cry: I wanted to find help for my nerves and my problems: hop: I wanted to show people how hopeless I am., ssil: I wanted to show somebody I loved him, sism: I wanted to see if somebody loved me, infl: I wanted to influence someone, regret: I wanted to make people regret, scare: I wanted to scare somebody, mad: I was mad at somebody. Die: I wanted to die. PROBLEMS: part: partner, par: parent, child: children, lone: loneliness, soc: problems with relationships/friendships, rej: rejection, hea: health, psy: psychiatric symptoms, work: work, jus: justice: scho: school, sex: sexual orientation, dos: death of significant other, soo: suicide of significant other, trau: trauma. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)



## 12. DISCUSSION

In this study, network analysis was used to unravelling the association between motives and perceived problems following an episode of self-harm. The main finding is the clinically most important motive (wish to die) did not play a central role in the network, and thus was not strongly related to other motives and problems. Four perceived problems were directly related to a current thoughts of self-harm, with psychiatric problems being most strongly connected.

Preceding a discussion of implications of these findings for suicide prevention and for further study a number of methodological issues need to be addressed. We were able to use data on a large sample of self-harm patients, which were collected by means of a consistent monitoring system in Flemish hospitals for nine years.

However, the data most probably refer to a selected group of self-harm patients as many individuals who self-harm do not come to the attention of hospital services (McMahon *et al.*, 2014). As the self-harm episodes of these patients did not require hospitalization, one could argue that the motives or problems were different from our group. For example, they might less often report a *wish to die*. However, as we found no difference in network structure between patients that reported a wish to die and patients that did not, we expect our findings with regard to the overall network structure to be comparable with other patients who self-harm. We also have no information about patients who undergo an intensive or surgical procedure due to a severe self-harm act, as they were not seen by a psychologist/psychiatrist directly after the act. Patients were asked about their motives, problems and whether they had current thoughts of self-harm one day after hospitalization. It might be that the perceptions of their motives and problems changed within that time frame, or that they have a different recollection of events when compared whether they would have been asked the day before. They might also not want to admit any current thoughts of self-harm to professionals in fear of the consequences. As all interviews were done by qualified psychologists or psychiatrists one day after hospitalization, we expect that they were able to build a good rapport with the patients, which would increase the likelihood of an honest answer of the patient. Also, the wording of the wish to die as a motive for self-harm episode and current thoughts of self-harm might have been too similar, resulting in circular findings (i.e. a wish to die is similar to current thoughts of self-harm). As about 50% of the patients that reported a wish to die as a motive did not report current thoughts of self-harm, this makes it likely that patients were able to understand the difference between the two. Finally, within network analysis, we study only pairwise associations. The estimation of an interaction between three variables is not yet possible and therefore more layered interactions between variables may be missed. However, as network analysis returns a solution under strict penalization, we can be quite certain that any direct link found between two variables is indeed real.

The impact of these limitations however appears to be limited as study findings, first, are consistent with those from previous studies, as far as available. As in other studies, we found that internal motives such as *escape from situation* are more often mentioned than more externally directed motives such as *I wanted to influence someone* (Hjelmeland *et al.*, 2002, Rasmussen *et al.*, 2016, Scoliers *et al.*, 2009). The explained variance and related *odds ratios* in our study are in line with a recent *meta-analysis* of risk factors of suicide behaviour (Franklin *et al.*, 2017). The notion that the motive of a wish to die is strongly related to current thoughts of self-harm is also

consistent with findings from a previous study that found a positive association between suicidal ideation in the month preceding the self-harm act and the wish to die (*Perquier et al., 2017*). It relates with modern theories of suicidal behaviour that suicide attempts and self-harm episodes emerge from a desire for suicide (*Van Orden et al, 2010; O'Connor, 2011, O'Connor and Kirtley, 2018*). Psychiatric problems such as depression and anxiety have been found to be related to suicide ideation in previous studies (*Franklin et al., 2017*).

### **12.1. Implications for suicide prevention**

By applying network analysis to a large dataset on patients after a self-harm episode, we hope to contribute to more in depth knowledge of risk factors for suicidal behavior and prevention after an episode of self-harm. Our analysis indicate that among the many potential motives, the wish to die is most directly related to current thoughts of self-harm. The wish to die however does not play a central role in the network, i.e. it is not strongly related to other motives and problems. Psychiatric problems were the most related perceived problem to current thoughts of self-harm. Next to a history of self-harm in the past years, assessing motives and problems of a patient yields valuable information for effective follow-up. Psychiatric problems were also not central in the network. So, although it is argued that future interventions should focus on the most central symptoms or riskfactors (*Fried et al., 2017, Borsboom and Cramer, 2013, Boschloo et al., 2016*), this does not hold for the variables in our data. Indeed, a recent study showed that the relation between central nodes and future prevention strategie is unlikely to be straightforward (*Rodebaugh et al., 2018*).

Our findings indicate that regardless of other problems and motives, a wish to die as a motive for their suicidal behaviour and the presence of psychiatric problems should be carefully assessed in both males and females that presented an episode of self-harm. The presence of this motive and these perceived problems are uniquely associated with current thoughts of self-harm, and thus should lead to close follow up. Also, most motives with a direct relation to current thoughts of self-harm (*wish to die, control, escape from situation, situation was unbearable*) were internal motives. This resonates with the recent insight that feelings of internal entrapment, rather than feelings of external entrapment play a key role when assessing and treating suicidal behaviour (*Owen et al., 2017, Rasmussen et al., 2010*).

### **12.2. Implications for further study**

We found that internal motives were more directly related to current thoughts of self-harm when compared to external motives. However, some authors stress that it is naïve to think that individuals who self-harm for interpersonal motives may have a lesser risk for suicidal behavior, and therefore would be less in need of mental health services (*Knowles et al., 2013*). Further research should aim to better understand how patients with different motives for self-harm are best treated. Although the explained variance and odd ratios are comparable to other studies, this does not mean that this gives the clinician enough information about risk for future suicidal behaviour. When assessing various motives and problems, we were able to identify 19% of the (pseudo) variance of current thoughts of self-harm. This means that the rest must be explained by other factors that were not assessed. Indeed a recent meta-analyses showed that over 50 years, the identification of risk factors has not improved, indicating the need to identify better predictive risk factors (*Franklin et al, 2017*).

When collecting data, one should aim to assess a wider range of psychiatric and psychological riskfactors, such as entrapment, *ruminatio*n and defeat. *Social support* and other *protective factors* are also largely understudied. Such data has recently been collected among a community sample and network analysis of this data offered novel insights in the dynamics of a wide range of risk factors (O'Connor et al., 2018, De Beurs et al., 2018). Suicide prevention research would greatly benefit if comparable data was collected among patients after an episode of self-harm. Finally, the collection of follow up data can further help to validate our cross sectional results. Network analysis can then be used to see whether baseline network structure can help use better understand actual future suicidal behavior as has been done earlier within the field of depression (van Borkulo et al, 2015).

#### AUTHOR STATEMENT

##### Contributors

The idea for the article was conceived by all others. KvH, GP and NC collected the data and prepared the data for the current analysis. DdB did the analysis. DdB and NvC wrote the initial draft. All authors contributed to the writing of the manuscript and all authors agree with the final version.

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##### Competing interests

The authors have no competing interests to declare.

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## FIGURES AND TABLES

Table 1. endorsement of motives and problem for self-harm. The first eight motives are internal motives, the last 7 external.

	Total sample (n = 6068)		Total sample (n = 6068)
Motives	Yes	Perceived problems	Yes (%)
To get away from my thoughts	1424(24%)	Partner	3232(53)
Escape from an unbearable situation	2383(40%)	Parents	1806(30)
Situation was so unbearable that I had to do something	2969(49%)	Child	1470(24)
I lost control over myself	1154(19%)	Loneliness	2223(36)
I wanted to punish myself	196(3%)	Social relations	1161(19)
I am a loser	865(14%)	Rejection	1515(25)
I wanted to die	2822(47%)	Health	1279(21)
I wanted help for my nerves and difficulties	349(6%)	Psychiatric problems	3448(57)
I wanted to show others how desperate I was	1116(18%)	Work	168,028)
I wanted to show someone how much I loved he	430(7%)	Justice	316(5)
I wanted to know whether someone loved me ore not	308(5%)	Housing	678(11)

	Total sample (n= 6068)		Total sample (n= 6068)
Motives	Yes	Perceived problems	Yes (%)
I tried to influence somebody's opinion	386(6%)	Finance	1391(23)
To make someone regret	563(9%)	School	361(5)
I wanted to scare somebody	103(2%)	Sexual orientation	115(2)
I was mad at somebody* and wanted to get back ad him/her	325(5%)	Death of loved one	1260(21)
		Suicide of sig other	673(11)
		Trauma	1318(22)

Fig. 1. network of motives, perceived problems and current thoughts of self-harm. Red node is current thoughts of self-harm, green nodes indicate motives, blue nodes indicate perceived problems. Coloring of the nodes was done by hand, so does not represent statistical clustering. Green lines indicate positive association, red lines indicate negative association. The thicker the line, the stronger the association. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

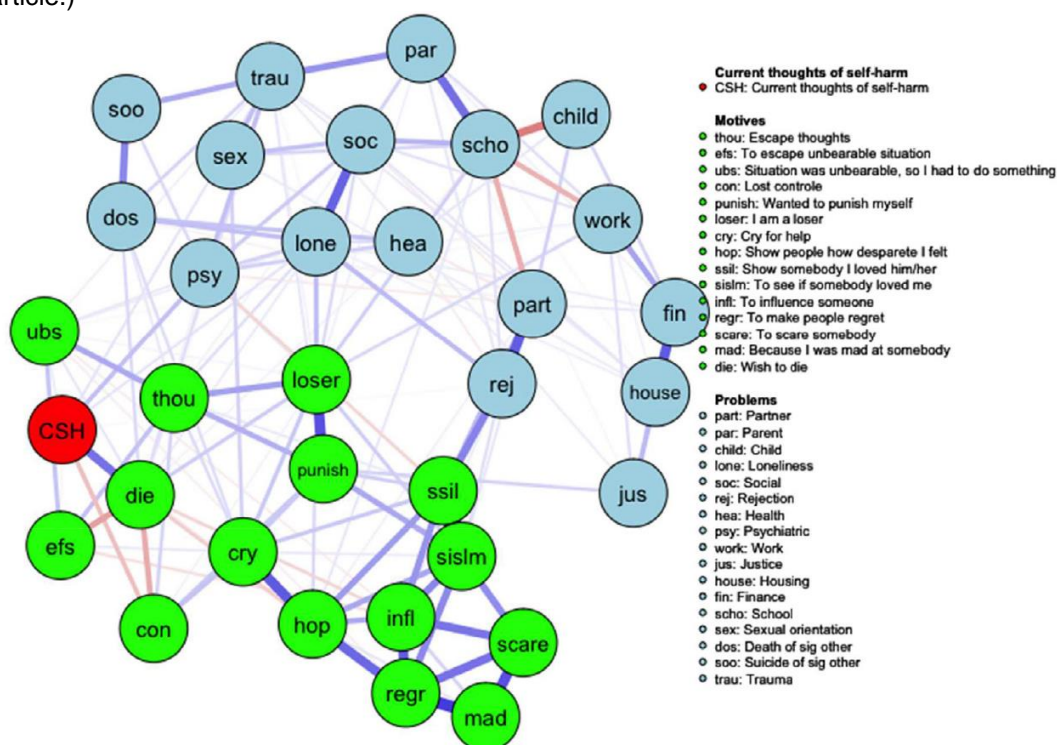


Fig. 2. Flow diagram of current thoughts of self-harm and motives and problems. CSH: current thoughts of self-harm, MOTIVES: thou: escape from thoughts, efs: escape from situation, ubs: unbearable situation, con: lost control, punish: I want to punish myself, loser: I feel like a loser, cry: I wanted to find help for my nerves and my problems: hop: I wanted to show people how hopeless I am, ssil: I wanted to show somebody I loved him, sism: I wanted to see if somebody loved me, infl: I wanted to influence someone, regret: I wanted to make people regret, scare: I wanted to scare somebody, mad: I was mad at somebody. Die: I wanted to die. PROBLEMS: part: partner, par: parent, child: children, lone: loneliness, soc: problems with relationships/ friendships, rej: rejection, hea: health, psy: psychiatric symptoms, work: work, jus: justice: scho: school, sex: sexual orientation, dos: death of significant other, soo: suicide of significant other, trau: trauma.

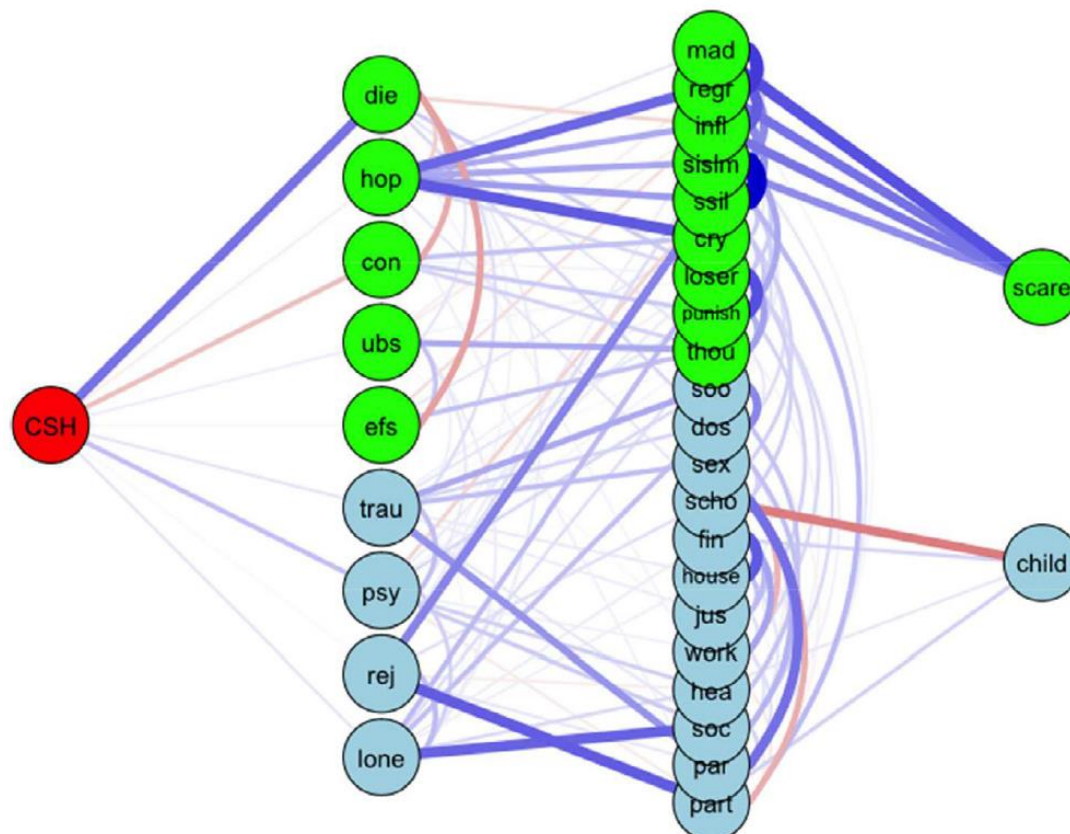


Fig. 3. Percentage of relative importance of motives and problems on current thoughts of self-harm, including bootstrapped confidence intervals. Each value represents the unique shared variance between a motive or problem and the variable current thoughts of self-harm. Die: wish to die, psy: psychiatric problems, con: lost control, trau: trauma, lone: loneliness, efs: escape from situation, ubs: unbearable situation, hop: show someone how hopeless I am, rej: rejection.

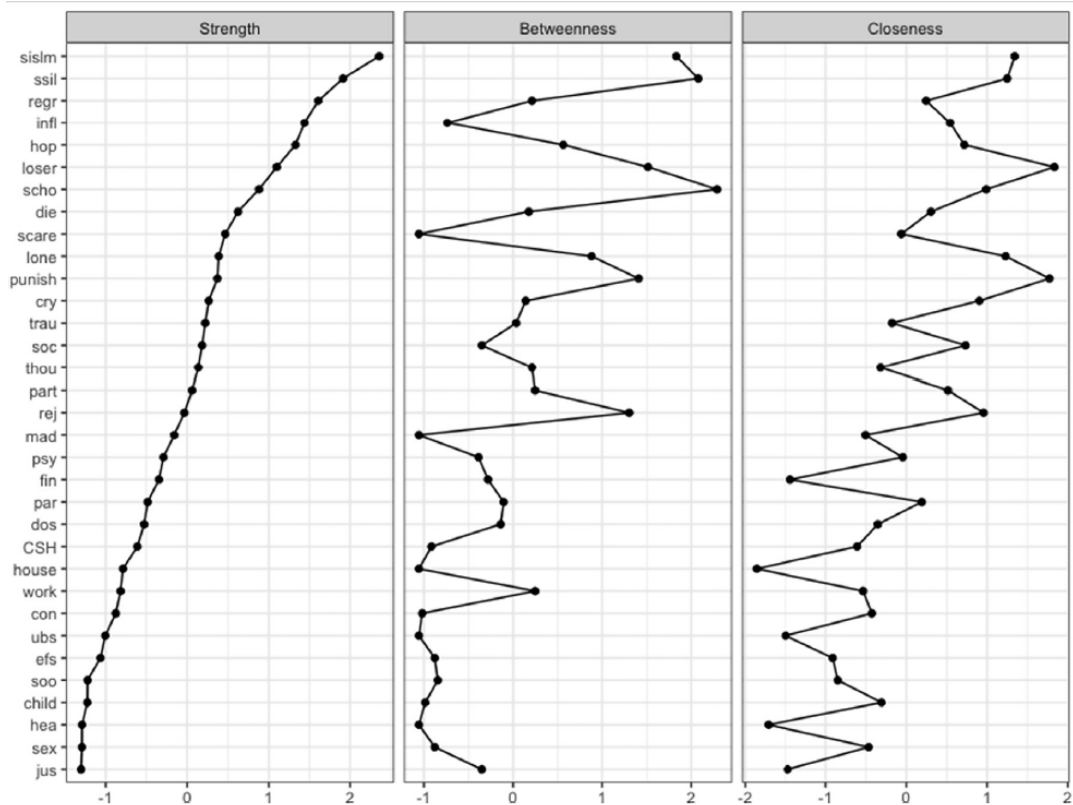
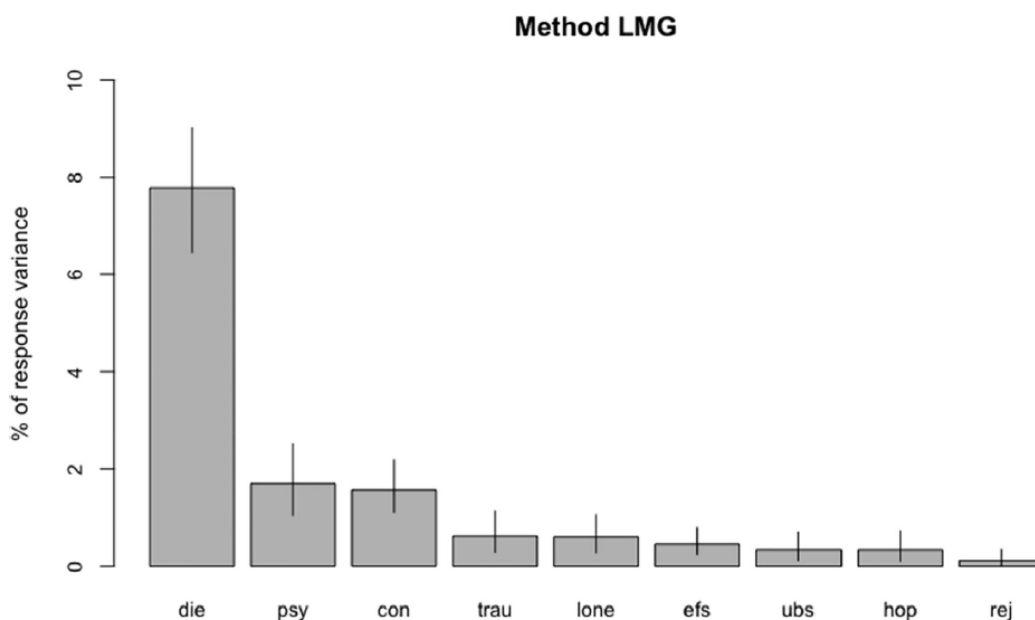


Fig. 4. centrality plot for motives, problems and current thoughts of self-harm. Coefficients are standardized and ordered by the centrality metric strength. SI: persistent desire to self-harm, MOTIVES: thou: escape from thoughts, efs: escape from situation, ubs: unbearable situation, con: lost control, punish: I want to punish myself, loser: I feel like a loser, cry: I wanted to find help for my nerves and my problems: hop: I wanted to show people how hopeless I am, ssil: I wanted to show somebody I loved him, sislm: I wanted to see if somebody loved me, infl: I wanted to influence someone, regret: I wanted to make people regret, scare: I wanted to scare somebody, mad: I was mad at somebody. Die: I wanted to die. PROBLEMS: part: partner, par: parent, child: children, lone: loneliness, soc: problems with relationships/friendships, rej: rejection, hea: health, psy: psychiatric symptoms, work: work, jus: justice: scho: school, sex: sexual orientation, dos: death of significant other, soo: suicide of significant other, trau: trauma.

### Relative importances for CSH with 95% bootstrap confidence intervals

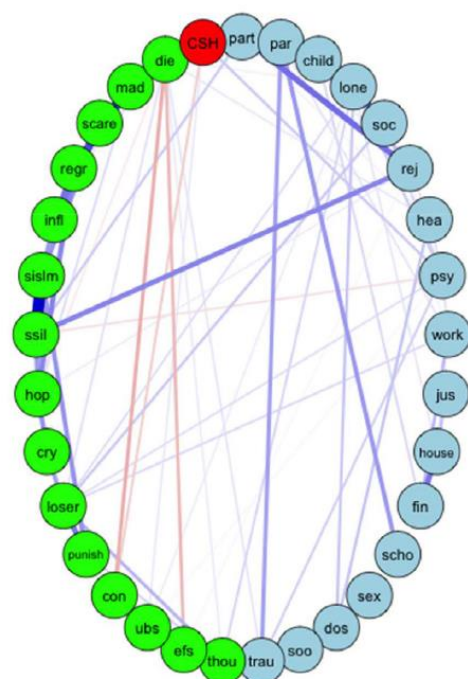


$R^2 = 13.51\%$ , metrics are not normalized.



Fig. 5. network of current thoughts of self-harm, problems and motives. for males (a) and females (b). Red node is persistent desire to self-harm, green nodes indicate motives, blue nodes indicate perceived problems. Green lines indicate positive association, red lines indicate negative association. The thicker the line, the stronger the association. CSH: current thoughts of self-harm, MOTIVES: thou: escape from thoughts, efs: escape way from situation, ubs: unbearable situation, con: lost control, punish: I want to punish myself, loser: I feel like a loser, cry: I wanted to find help for my nerves and my problems: hop: I wanted to show people how hopeless I am., ssil: I wanted to show somebody I loved him, sism: I wanted to see if somebody loved me, infl: I wanted to influence someone, regret: I wanted to make people regret, scare: I wanted to scare somebody, mad: I was mad at somebody. Die: I wanted to die. PROBLEMS: part: partner, par: parent, child: children, lone: loneliness, soc: problems with relationships/friendships, rej: rejection, hea: health, psy: psychiatric symptoms, work: work, jus: justice: scho: school, sex: sexual orientation, dos: death of significant other, soo: suicide of significant other, trau: trauma. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Males



Females

