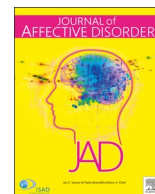




Contents lists available at ScienceDirect

## Journal of Affective Disorders

journal homepage: [www.elsevier.com/locate/jad](http://www.elsevier.com/locate/jad)

## Research paper

## Examining the mechanisms by which adverse life events affect having a history of self-harm, and the protective effect of social support

Su-Gwan Tham<sup>a,b</sup>, Saied Ibrahim<sup>a,b</sup>, Isabelle M. Hunt<sup>a,b</sup>, Nav Kapur<sup>a,b,c,d,e</sup>, Patricia Gooding<sup>b,c,\*</sup><sup>a</sup> The National Confidential Inquiry into Suicide and Safety in Mental Health, Centre for Mental Health and Safety, University of Manchester, UK<sup>b</sup> Division of Psychology and Mental Health, School of Health Sciences, University of Manchester, UK<sup>c</sup> Manchester Academic Health Sciences Centre (MAHSC), University of Manchester, UK<sup>d</sup> Greater Manchester Mental Health NHS Foundation Trust, UK<sup>e</sup> NIHR Greater Manchester Patient Safety Translational Research Centre, UK

## ARTICLE INFO

## Keywords:

Suicide  
Life events  
Hopelessness  
Self-harm  
Social support  
Mediation

## ABSTRACT

**Background:** Psychological models of suicide emphasize perceptions of negative stressors, hopelessness and self-harm as key antecedents to suicidal thoughts/acts. Such models also emphasize the potential protective role of social support in these pathways. However, such pathways have not been tested using population level data. Hence, this study aimed to redress this gap.

**Methods:** Questionnaire data regarding 24,444 patient suicide deaths were analysed. All individuals died between 1996 and 2015 and were seen by secondary mental health services in England within 12 months before their death. Mediation analyses, using fitted logistic regression models, investigated direct and indirect pathways between negative stressors, hopelessness and a proxy measure of suicide, namely, self-harm history. In addition, the buffering effects of social support were examined in these pathways.

**Results:** There was a direct effect of negative life events on suicidal behaviors. Supporting contemporary psychological models of suicide, a mediated effect via hopelessness and a protective effect of social support were identified. Social support buffered the pathway between stressful life events and hopelessness, with hopelessness decreasing as social support increased.

**Limitations:** Causal inferences are inappropriate as the design was cross-sectional. A proxy measure of suicidality was utilized (history of self-harm) as all individuals had died by suicide.

**Conclusions:** This is the first time that population data has been used to test psychological pathways to suicidal acts involving negative stressors, hopelessness and social support. Psychological interventions should focus on increasing social support following negative life events together with ameliorating perceptions of hopelessness.

## 1. Introduction

Suicidal thoughts, acts and deaths are serious mental health issues (Tarrier et al., 2008) and suicide fatalities are a leading cause of death globally. The suicide rate per 100,000 population has been reported as 10.6 globally, 15.4 in Europe, 15.3 in the United States and 8.9 in the United Kingdom (World Health Organization, 2018). Suicidal behaviors, such as self-harm (Hawton et al., 2015; Olfson et al., 2017) and suicide attempts (Bostwick et al., 2016) are strong predictors of suicide fatalities. The prevalence rates for suicidal behaviors are higher than those for suicide deaths. For example, based on data from Emergency Departments in three cities in England, the rate of episodes of self-harm per year (2010–2012) was 500.86 per 100,000 (Clements et al., 2016). Hence, it is important to further our understanding of the mechanisms

underlying both suicide deaths and suicide behaviors, including self-harm, to develop and refine the most effective suicide prevention methods.

A large body of research has identified numerous epidemiological risk factors for suicide deaths and suicidal behaviors. These include having a psychiatric disorder (Crump et al., 2014), having a physical illness (Webb et al., 2012), the time of year (Cavanagh et al., 2016) and being male (Nock et al., 2008). Although such work has been important in highlighting groups that are at higher suicide risk, epidemiological risk factors do not explain why and how a person comes to the decision to end their life. Epidemiological risk factors can also result in a high number of false-positive predictions made in suicide risk assessments (Fowler, 2012). Suicide as a cause of death, is clearly influenced by an array of psychological factors since it is the individual who decides to

\* Corresponding author at: Coupland Building 1, University of Manchester, Oxford Road, Manchester, M13 9PL, UK

E-mail address: [Patricia.A.Gooding@manchester.ac.uk](mailto:Patricia.A.Gooding@manchester.ac.uk) (P. Gooding).

<https://doi.org/10.1016/j.jad.2019.11.037>

Received 7 August 2019; Received in revised form 5 November 2019; Accepted 9 November 2019

Available online 11 November 2019

0165-0327/ © 2019 Published by Elsevier B.V.

intentionally end their own life (O'Connor and Nock, 2014).

Based on a robust literature, contemporary theoretical models which seek to understand the psychological pathways underpinning suicidal thoughts/behaviors highlight the importance of perceptions of negative stressors (e.g., negative life events, such as relationship break-ups) (e.g., Kőlves et al., 2006; Owen et al., 2015; Van Orden et al., 2010; Williams, 1997), and hopelessness (e.g., Klonsky et al., 2012; Klonsky and May 2015) as key psychological antecedents of suicide fatalities and suicidal behaviors. Less research has sought to examine if there is a mediational pathway between negative life events, hopelessness and suicide/suicidal behaviors. However, recent work has identified a direct effect of negative life event on suicide attempts, in addition to an indirect effect through hopelessness and depression (Liu and Zhang, 2018).

Although the literature investigating the mechanisms underlying suicide fatalities and suicidal behaviors is growing (Liu et al., 2019; Schomerus et al., 2015; Sinclair et al., 2007), studies typically employ small samples and fall-short of being fully powered population level studies which can test psychological mechanisms robustly. An exception to this includes a prospective cohort study of 19,479 individuals who presented to one of three hospital Emergency Departments in Manchester, UK, following an episode of self-harm (Steege et al., 2016). Hopelessness was found to amplify the effect of numerous risk factors for suicide deaths and self-harm, including living alone and being unemployed.

One theory, the Schematic Appraisal Model of Suicide (Johnson et al., 2008) explicitly emphasizes both the psychological amplifiers of suicidal behaviors and protective factors. Specifically, there is evidence that social support can act as a buffer by weakening relationships between psychological precursors of suicidal behaviors in people with severe mental health problems. For example, social support has been shown to moderate the effect of hopelessness on suicidal ideation in people with schizophrenia-spectrum disorders (Gooding et al., 2013; Johnson et al., 2010b). There has been limited research examining the extent to which social support can weaken the links between negative life events, hopelessness and suicide deaths and suicidal behaviors in a mediational pathway, especially at a population level of analysis.

Hence, the over-arching goal of the current study was to examine, using population level data, a pathway to suicidal behaviors involving negative life events, and hopelessness, in which social support acted as a moderator of these relationships. It was predicted that (i) negative life events would be associated with suicidal behaviors directly, and indirectly via the mediator of hopelessness, and (ii) social support would weaken the pathways between negative life events and suicidal behaviors, negative life events and hopelessness, and between hopelessness and suicidal behaviors (see Fig. 1).

## 2. Method

### 2.1. Design

This was a retrospective analysis of cross-sectional questionnaire data on a national consecutive case-series of suicide fatalities (NCISH, 2019). As all individuals included in the study had died by suicide, their history of self-harm was used as a proxy indicator of suicidality prior to death. Therefore, history of self-harm was the outcome variable. Research has consistently shown that self-harm is one of the strongest risk factors for future suicide fatalities (Carroll et al., 2014; Hawton et al., 2015; Owens et al., 2002).

The predictor (if the patient had experienced stressful life events in the three months prior), mediator (if the patient exhibited clear evidence of hopelessness at their last contact with mental health services) and outcome (if the patient had self-harmed at any time) variables were all dichotomous (present / absent). These variables were all derived from responses to the National Confidential Inquiry into Suicide and Safety in Mental Health questionnaire (NCISH, 2015). A history of self-harm was categorised as present if the clinician's questionnaire response stated that the patient had self-harmed at any time prior to their death. The control variable (date of last contact with secondary mental health services) was also dichotomous (seen within 3 months before death / seen more than 3 months before death). The moderator variable (social support) was categorical. A social support score was generated for each individual and derived from participants' living circumstance (0 = living alone, 1 = residing with at least one other person) and marital status (0 = single, widowed or divorced, 1 = married or cohabiting). The social support score was the sum of participant's living circumstance and relationship scores (range: 0–2) with a score of 0 representing a low level of social support, 1 a moderate level and 2 a high level of social support.

### 2.2. Case ascertainment

Data were acquired as part of the National Confidential Inquiry into Suicide and Safety in Mental Health (NCISH, 2019). A detailed description of the methodology is available elsewhere (Windfuhr et al., 2008). In brief, first, identifiable data were obtained from the Office for National Statistics on individuals who died in England and received either a death by suicide or open verdict at a coroner's inquest. It is conventional practice for UK based suicide research to include open verdicts (Carr et al., 2017; Kapur et al., 2016). Based on the balance of probability, most open verdicts are deaths by suicide and thus, their exclusion can result in a significant under-estimation of the number of suicide deaths (Linsley et al., 2001). Second, National Health Service

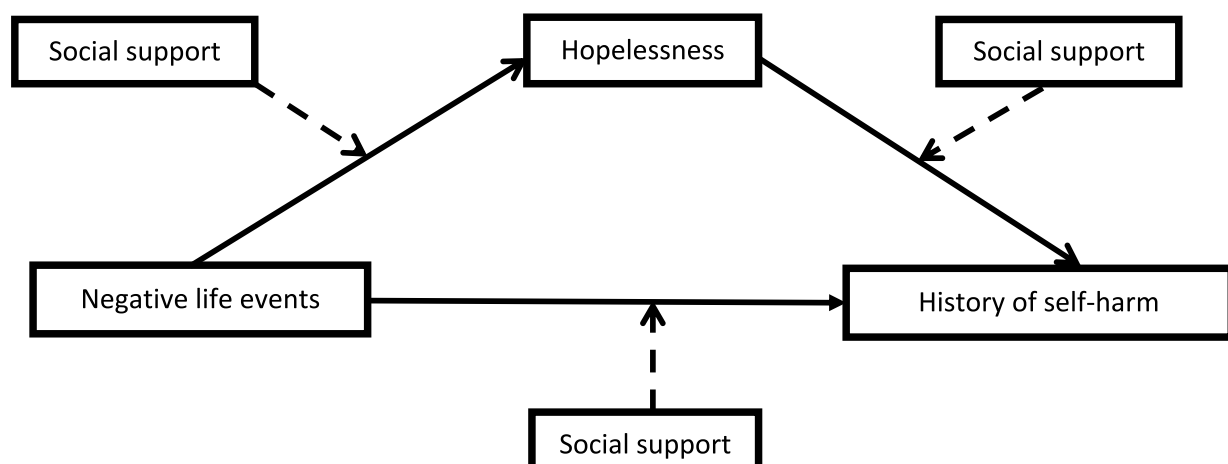


Fig. 1. Moderated (dotted line) – mediation (block line) pathways between negative life events, hopelessness, history of self-harm and social support.

mental health trusts and independent mental health hospitals in the deceased's district of residence were contacted. This ascertained whether the deceased individuals had been seen by secondary mental health services in the 12 months prior to their death. In such instances, the National Confidential Inquiry into Suicide and Safety in Mental Health (NCISH, 2015) questionnaire was sent to the consultant psychiatrist who had cared for the patient. From this questionnaire, demographic, psychosocial and clinical data were obtained.

### 2.3. Research ethics

The National Confidential Inquiry into Suicide and Safety in Mental Health has North West - Greater Manchester South Research Ethics Committee approval (reference: ERP/96/136) and Section 251 approval under the NHS Act 2006 (Reference: PIAG 4-08(d)/2003). The latter permits collection of patient identifiable data for medical research without the need for patient consent.

### 2.4. Statistical analysis

Tetrachoric correlation analysis was performed with the predictor, mediator, outcome and control variables as these were all binary. Associations between negative life events, hopelessness and history of self-harm were examined using Pearson's  $\chi^2$  tests with a two-tailed  $p$  value of less than 0.05 deemed as statistically significant. 'Not known' responses to questions coded as missing data were addressed using pairwise deletion.

To ascertain whether stressful life events had a direct association with suicidal behaviors, i.e., history of self-harm, and/or an indirect association through hopelessness, mediation analyses were conducted. We estimated the indirect effect of hopelessness and assessed the statistical significance of the mediation effect using the Baron and Kenny method with a dichotomous outcome (Baron and Kenny, 1986). This was computed using the binary\_mediation command in Stata (StataCorp, 2017). Due to having a binary mediator, 10,000 bootstrap replications were performed to ensure the confidence intervals were as accurate as possible (Rochon et al., 2014; Xavier et al., 2016). To understand the impact of social support on the mediation effect of hopelessness, additional mediation models were run stratified by low, moderate and high levels of social support.

A series of logistic regression analyses were performed to ascertain whether social support weakened the pathways i. between negative life events and hopelessness, ii. between hopelessness and self-harm history and iii. between negative life events and self-harm history. The Likelihood ratio  $\chi^2$  test was used to assess the statistical significance of any moderation effects for the logistic regression models. All statistical analyses were conducted using Stata version 15 (StataCorp, 2017).

## 3. Results

### 3.1. Sample characteristics

We were notified of 69,456 deaths by suicide which occurred between 1st January 1996 and 31st December 2015 (inclusive). We received questionnaire data on 24,444 out of 25,321 (97%) individuals who had been in contact with secondary mental health services in the 12 months before their death. Table 1 displays the key demographic, behavioral and clinical characteristics of the patients. Fifteen percent of patients exhibited clear evidence of hopelessness at their last contact with secondary mental health services. Almost half (45%) had a low level of social support. As shown in Table 2, the most common type of negative life event experienced was the end of a marriage or relationship.

Forty-six percent experienced at least one negative life event in the three months prior to death. Patients who experienced at least one negative life event were significantly more likely to have displayed

**Table 1**

Demographic, behavioral and clinical characteristics of psychiatric patients who died by suicide.

|   | <i>n</i>    | Total  | %    |
|---|-------------|--------|------|
| <b>Demographic features</b>                                       |             |        |      |
| Age: median (range)   | 44 (10–100) |        |      |
| Male  | 16,155      | 24,444 | 66.1 |
| Black or minority ethnic group                                    | 1785        | 23,899 | 7.5  |
| Living alone  | 10,725      | 23,510 | 45.6 |
| Married or co-habiting  | 6971        | 23,820 | 29.3 |
| Unemployed  | 9978        | 23,411 | 42.6 |
| <b>Behavioural features</b>                                       |             |        |      |
| History of self-harm  | 16,039      | 23,869 | 67.2 |
| History of alcohol misuse   | 10,447      | 23,780 | 43.9 |
| History of drug misuse  | 7492        | 23,665 | 31.7 |
| History of violence   | 5016        | 23,527 | 21.3 |
| <b>Clinical features</b>  |             |        |      |
| Primary diagnosis   |             |        |      |
| Schizophrenia (and other delusional disorders)                    | 4375        | 23,633 | 18.5 |
| Affective disorder  | 10,875      | 23,633 | 46.0 |
| Alcohol dependence or misuse                                      | 1987        | 23,633 | 8.4  |
| Drug dependence or misuse   | 1027        | 23,633 | 4.4  |
| Personality disorder  | 2229        | 23,633 | 9.4  |
| Other primary diagnosis   | 3140        | 23,633 | 13.3 |
| Any secondary psychiatric diagnosis                               | 12,464      | 23,635 | 52.7 |
| Duration of psychiatric condition less than 12 months             | 4908        | 23,683 | 20.7 |
| Duration of psychiatric condition more than 5 years               | 12,138      | 23,683 | 51.3 |
| Psychiatric inpatient at the time of death                        | 2763        | 24,425 | 11.3 |
| Seen within 3 months of death                                     | 20,535      | 24,115 | 85.2 |
| Adverse life event within 3 months of death                       | 9869        | 21,546 | 45.8 |
| Hopelessness at last contact with mental health services          | 3498        | 23,030 | 15.2 |
| <b>Social support level</b>                                       |             |        |      |
| Low – living alone and single, widowed or divorced                | 10,347      | 23,254 | 44.5 |
| Moderate – living alone and married                               | 225         | 23,254 | 1.0  |
| Moderate – not living alone and were single, widowed or divorced  | 6002        | 23,254 | 25.8 |
| High – not living alone and married or co-habiting with a partner | 6680        | 23,254 | 28.7 |

**Table 2**

Type of adverse life event experienced within three months prior to suicide.

| Type of adverse life event                                 | <i>n</i> | Total  | %    |
|--|----------|--------|------|
| Marriage or relationship break up or divorce               | 2178     | 21,546 | 10.1 |
| Financial problems   | 1296     | 21,559 | 6.0  |
| Problems or arguments with family                          | 1245     | 21,546 | 5.8  |
| Problems or arguments with partner or ex-partner           | 1219     | 21,546 | 5.7  |
| Employment or student related problems                     | 1203     | 21,546 | 5.6  |
| Accommodation problems or moving house                     | 1202     | 21,547 | 5.6  |
| Physical health problems in patient                        | 1125     | 21,546 | 5.2  |
| Bereavement or anniversary of bereavement                  | 961      | 21,546 | 4.5  |
| Other problems   | 878      | 21,546 | 4.1  |
| Legal problems, court case, being arrested                 | 635      | 21,546 | 3.0  |
| Physical health problems in someone else                   | 498      | 21,546 | 2.3  |
| Actual or suspected perpetrator of violent or sexual crime | 352      | 21,546 | 1.6  |
| Problems or argument with peers                            | 237      | 21,546 | 1.1  |
| Actual or suspected victim of a violent or sexual crime    | 202      | 21,546 | 0.9  |
| Experienced adverse life event but no details given        | 423      | 21,548 | 2.0  |

hopelessness at their last contact with secondary mental health services compared to those who had no events ( $n = 11,677$ , 54%),  $\chi^2$  (1,  $n = 20,624$ ) = 88.93,  $p < .001$ . Patients who had at least two life events ( $n = 2903$ , 13%) were also significantly more likely to have exhibited hopelessness when compared to those with one life event,  $\chi^2$  (1,  $n = 9401$ ) = 9.47,  $p = .002$ . As shown in Table 3, there were significant, positive correlations between the predictor (recent stressful life events), mediator (hopelessness), outcome (history of self-harm)

**Table 3**  
Tetrachoric correlations between study variables.

| Variables  | Hopelessness at last contact with mental health services |          |                | History of self-harm |          |                | Seen within 3 months of death |          |                |
|--|--|----------|----------------|----------------------|----------|----------------|-------------------------------|----------|----------------|
|  | <i>r</i>   | <i>n</i> | Standard error | <i>r</i>             | <i>n</i> | Standard error | <i>r</i>                      | <i>n</i> | Standard error |
| Adverse life event within 3 months of death              | .1234 **   | 20,624   | .0130          | .0761 **             | 21,236   | .0112          | .1343 **                      | 21,357   | .0152          |
| Hopelessness at last contact with mental health services |  |          |                | .0726 **             | 22,591   | .0132          | .2172 **                      | 22,906   | .0162          |
| History of self-harm                                     |  |          |                |                      |          |                | .0838 **                      | 23,573   | .0129          |

Note.

\*\*  $p < .001$ .

**Table 4**  
The direct, indirect and total effect of adverse life events on history of self-harm as mediated by hopelessness.

|   | <i>n</i>                   | Social support level |                  |                | Total sample  |
|---|----------------------------|----------------------|------------------|----------------|---------------|
|   |                            | Low<br>8822          | Moderate<br>5328 | High<br>5684   |               |
| Direct effect                                       | $\beta$                    | 0.05                 | 0.06             | 0.03           | 0.05          |
|   | Bootstrap SE               | 0.01                 | 0.02             | 0.02           | 0.01          |
|   | BC CI (95%)                | 0.03 – 0.08          | 0.02 – 0.09      | – 0.001 – 0.06 | 0.03 – 0.06   |
|   | <i>p</i>                   | < 0.001              | < 0.001          | = 0.07         | < 0.001       |
| Indirect effect                                     | $\beta$                    | 0.004                | 0.01             | 0.002          | 0.003         |
|   | Bootstrap SE               | 0.002                | 0.002            | 0.001          | 0.001         |
|   | BC CI (95%)                | 0.001 – 0.01         | 0.002 – 0.01     | 0.002 – 0.004  | 0.002 – 0.01  |
|   | <i>p</i>                   | = 0.02               | = 0.01           | = 0.12         | < 0.001       |
| Total effect  | $\beta$                    | 0.06                 | 0.06             | 0.03           | 0.05          |
|   | Bootstrap SE               | 0.01                 | 0.02             | 0.02           | 0.01          |
|   | BC CI (95%)                | 0.03 – 0.08          | 0.03 – 0.09      | 0.0002 – 0.06  | 0.03 – 0.07   |
|   | <i>p</i>                   | < 0.001              | < 0.001          | = 0.05         | < 0.001       |
| Proportion of total effect mediated by hopelessness | Proportion of total effect | 6.62%                | 8.50%            | 5.38%          | 6.53%         |
|   | BC CI (95%)                | 2.53% – 8.85%        | 6.49% – 11.09%   | < 0 – 7.22%    | 5.06% – 7.73% |

Note. SE = standard error; BC CI = bias corrected confidence intervals.

and the control (seen within 3 months before death by secondary mental health services) variables.

### 3.2. Associations between negative life events and history of self-harm mediated by hopelessness

Table 4 shows the results of the mediation analyses. Based on the total sample, there was a direct effect of adverse life events on suicidal behaviors (0.05, 95% BC CI: 0.03 – 0.06). The direct effect was statistically significant in individuals with a low and moderate level of social support, but not in those who had a high level of social support. Overall, the indirect effect was 0.003 (95% BC CI: 0.002–0.01) indicating a significant partial mediation effect of the relationship between adverse life events and suicidal behaviors via hopelessness. This pattern was also found for individuals with a low and moderate level of social support although the mediation effect with a high level of social support was not statistically significant. Based on the total sample, 6.53% of the total effect of stressful life events on suicidal behaviors was mediated by hopelessness.

### 3.3. Associations between negative life events, hopelessness and history of self-harm moderated by social support

Fig. 2 shows the moderating effect when social support was present on each of the hypothesised pathways. Social support was a significant moderator of the relationship between negative life events and hopelessness ( $p = .005$ ). Negative life events predicted hopelessness but this relationship was increasingly likely in those with low (OR = 1.55, 95% BC CI: 1.38, 1.74) or moderate social support (OR = 1.51, 95% BC CI: 1.30, 1.75) compared to those with high social support (OR = 1.17, 95% BC CI: 1.02, 1.34). Social support did not moderate the relationship between hopelessness and history of self-harm ( $p = .75$ ) or between adverse life events and history of self-harm ( $p = .28$ ).

## 4. Discussion

The aim of this study was to determine the direct and indirect pathways between negative life events, hopelessness and suicidal behaviors, namely history of self-harm, and the extent to which social support moderated, that is, weakened, any of these pathways using epidemiological data. To our knowledge, this was the first time that a mediational pathway between negative life events, hopelessness and having a history of self-harm was tested using epidemiological, national level data. There were two key findings. Consistent with our first prediction, negative life events had both a direct effect on suicidal behaviors and an indirect effect which acted via hopelessness. The second prediction was partially supported. A measure of social support, derived from an individual's living circumstances and marital status, was found to weaken the relationship between negative adverse events and hopelessness, as predicted, but not those between hopelessness and suicidal behaviors, nor directly between negative adverse life events and suicidal behaviors.

Previous work has identified adverse life events as a risk factor for suicide deaths (e.g., Chen et al., 2006) and suicide attempts (Liu et al., 2019; Park et al., 2015; Zhang et al., 2015). Earlier research by Liu and Zhang (2018) has also found in a case-control study in 13 rural Chinese counties, a direct effect of negative life events on suicide attempts, and an indirect effect through hopelessness and depression. The current study expands on this earlier research by elucidating one mediational pathway involving hopelessness through which adverse life events may exert an effect on having a history of self-harm in mental health patients who have died by suicide. Furthermore, the current study examined a protective factor, in the form of an objective indicator of social support, which is in accord with an increasing focus on factors which confer resilience to suicidal, thoughts, behaviors and deaths. We found that interpersonal social problems reported by patients, in particular the end of a relationship, and problems with a partner, ex-partner or family member, were amongst the top four most common stressful adverse life



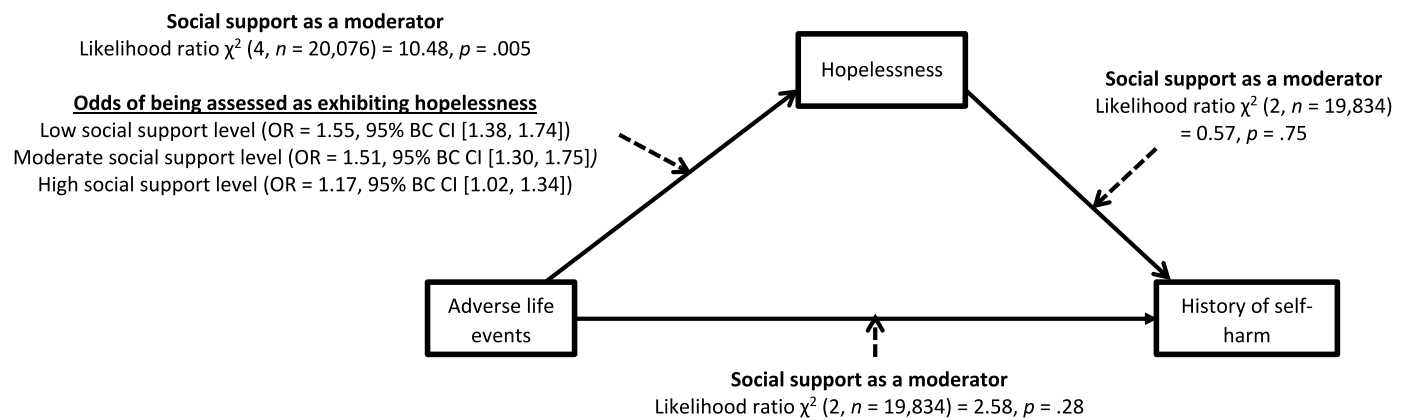


Fig. 2. Moderated-mediation pathways between adverse life events, hopelessness, history of self-harm and social support.

Note. The odds of being assessed as exhibiting hopelessness when social support was a moderator in the pathway between adverse life events and hopelessness are also presented. OR = odds ratio; BC CI = bias corrected confidence intervals.

events experienced prior to death by suicide. These results appear to indicate that despite the high proportion of individuals who had interpersonal problems, the presence of social support was still protective in buffering against the positive relationship between these types of negative life events and hopelessness. We found that there was an increase in the proportion of patients who were assessed as experiencing hopelessness, the greater the number of recent challenging life events. Similarly, it has been found in a cohort of people who had presented to hospital after self-harm, that the proportion of people assessed as exhibiting hopelessness increased as the number of reported negative life problems increased (Steeg et al., 2016). It has also been shown that the likelihood of attempting suicide is greater in people who have experienced more negative life events (Liu and Zhang, 2018).

That social support weakened the pathways between adverse life events and hopelessness is important because it has identified a potential source of resilience acting early-on in the pathways to suicidal thoughts and behaviors (Johnson et al., 2010a, 2010b; Panagiotti et al., 2014). Our results resonate with studies which have shown that objective indicators of social support are part of a potential buffering, resilience mechanism (Bryan and Hernandez, 2013). However, it must be remembered that evidence is accumulating that it is perceptions of social support which comprise a key resilience factor in the pathways to suicidal thoughts and acts (Bayat et al., 2008; Zdravec Šedivy et al., 2017). That said, our findings imply that both objective and subjective social support may be important in acting as a buffer in the pathways to suicidal thoughts and behaviors.

It is important that psychological models of pathways to suicidal thoughts, acts, and deaths (Johnson et al., 2008; O'Connor and Kirtley, 2018; Van Orden et al., 2010; Williams, 1997) are tested. This process should use convergent approaches (Kral et al., 2011) including qualitative methods, mixed method (e.g., Li et al., 2017), diary methods and self-report questionnaire methods developed to capture the precise constructs of interest comprising the putative mechanisms. A crucial addition to such a convergent approach is the use of epidemiological data in which precursors to suicidal thoughts, behaviors and deaths are measured at a more general, population level and with much larger sample sizes. Most of the work testing recent psychological models has not been based on epidemiological data but there have been exceptions (Steeg et al., 2016; Wetherall et al., 2018). The findings reported here of a direct and an indirect mediational pathway from negative adverse events to suicidal behaviors supports key contemporary models testing the pathways to suicidal thoughts and behaviors which place hopelessness as a central component, most particularly, the Cry of Pain Model (Williams, 1997), the Schematic Appraisals of Model of Suicide [SAMS] (Johnson et al., 2008) and the Three-Step Theory (Klonsky and May 2015). Furthermore, the findings are important in suggesting testable

modifications to such psychological models. For example, the SAMS (Johnson et al., 2008) purports that perceptions of poor social support are an initial step in the pathways to suicidal thoughts and behaviors. Our results indicate that social support resources may act as a moderator, albeit in the early stages of pathways to suicidal thoughts and acts which supports the SAMS, at least in part.

An interesting debate has arisen in the suicide literature as to whether there are overlapping or distinct factors which underlie suicide attempts and deaths, as compared to the experience of suicidal thoughts (May and Klonsky, 2016; Pérez et al., 2016; Smith et al., 2010). Recent evidence suggests that factors which lead to suicidal thoughts contribute to a small variance in factors which appear to underlie suicide fatalities and suicide attempts (Batterham and Christensen, 2012; Huang et al., 2018). Our findings provide important evidence pertaining to this debate as population level data can capture frequencies of suicide deaths and acts which allow statistical analyses powered to requisite levels. We found evidence for hopelessness as a mediator in pathways to history of self-harm which reflects the role of hopelessness in leading to suicidal thoughts. As suggested by early work, hopelessness is an important common factor to consider with respect to suicidal thoughts, acts and deaths (Beck, 1986; Beck et al., 1993, 1985). Equally as important, our findings have demonstrated that social support is not just key to preventing or ameliorating suicidal thoughts but is also key to preventing self-harm because it weakens the relationship between negative stressors and hopelessness.

There are two key clinical implications arising from the findings of this study. Psychological autopsy studies have shown that between 46% (Almasi et al., 2009) to 81% (Heikkinen et al., 1995) of individuals experienced at least one negative life event within three months before their suicide. The first clinically important finding was that in the current study, 46% of individuals experienced at least one challenging life event within three months before their death by suicide. As hopelessness may be modifiable (Steeg et al., 2016), these findings suggest that it could be beneficial for clinicians to assess for evidence of hopelessness in patients following the experience of negative life events. Focused interventions to reduce hopelessness to mitigate the increased risk of self-harm appears warranted (Tarrier et al., 2008). Furthermore, there have been interventions which have been shown to reduce hopelessness and consequently decrease suicidal ideation (Celano et al., 2017).

Second, the current study found that social support acted as a buffer between challenging life events and hopelessness and that this protective effect increased as the amount of social support increased. Assessing the degree of protective factors, such as social support, could, therefore, help identify those at higher or lower suicide risk following challenging life events. Social support is a modifiable risk factor for suicide (Kleiman and

Liu, 2013). Therefore, resilience could be fostered through use of suitable coping strategies such as modifying any negative appraisals of the availability of social support (Johnson et al., 2008) and seeking to enhance existing support networks..

#### 4.1. Limitations

Five limitations warrant discussion. First, the design was cross-sectional and so causal inferences cannot be made. However statistically, mediation analysis can be (Hayes, 2018) and has previously been conducted using cross-sectional data (Littlewood et al., 2016; Park et al., 2015; Tal-Or et al., 2010). Although the examined mechanisms were based on a theoretically supported psychological model of suicide (Johnson et al., 2008), longitudinal studies are necessary to identify the temporal relationships between the postulated mechanistic antecedents and suicidal behaviors. A longitudinal study was not possible here as the NCISH does not follow up or observe mental health patients prior to their death. Second, the key variables included in this analysis were dichotomous. It is often not possible to use measures which collect continuous data in large population based epidemiological studies. Although mediation analysis can be conducted using dichotomous variables (Samawi et al., 2018; Serang and Jacobucci, 2019), examining moderation and mediation effects as a function of percentiles may provide a more nuanced understanding of the moderated-mediation pathway. Future studies should utilize more detailed, in-depth measures of the key variables under study. Of reassurance is that broadly, there was convergence from the current findings with studies not based on epidemiological data. Third, participants were allocated a score by the researchers to indicate whether they had been in receipt of a low, moderate or high level of social support. The NCISH questionnaire was not designed specifically for this study and so did not collect data on the patient's complex levels of available, or perceived, social support. There are different types of social support, including emotional, informational and tangible forms such as provision of resources. The availability of different types of support was not captured within our study. Therefore, further studies should use more nuanced measures to identify the availability of different types of social support, as well as the participants' own perception of the support available to them. However, some work has indicated that the rate of suicide deaths was lower in people who were married, compared to those who were unmarried, divorced, separated or widowed (Masocco et al., 2008) and that there was an increased suicide risk in those living alone (Agerbo et al., 2007), supporting the use of our proxy indicator of social support. Clinically, this highlights both risk factors for suicidal fatalities and behaviors and protective factors. Fourth, history of self-harm was used as a proxy measure of suicidality, but it was not a direct measure as all participants in this study had died by suicide. However, self-harm is a strong predictor of death by suicide (Hawton et al., 2003; Olfson et al., 2018). Fifth, data for this study were gathered from clinicians completing the NCISH questionnaire from the patient's clinical notes and their knowledge of the patient. Therefore, the clinician rated clinical factors, such as, hopelessness. Nonetheless, most of the questionnaires were completed by frontline clinicians who had seen or treated the patients prior to suicide. Furthermore, using clinician ratings underscores their role in assessing risk as a mental health professional and identifying factors which may buffer against suicidal thoughts, attempts and deaths (Sinclair and Leach, 2017).

There were three key strengths. First, this study has gone beyond main effect models by testing moderation and mediation effects. In doing so, this helps to further knowledge regarding the mechanisms involved in the pathways to suicidal deaths and acts as well as factors which confer resilience to suicide (Johnson et al., 2010a, 2011; Kleiman and Anestis, 2015). Second, the majority of psychological research into suicide to date has examined suicidal ideation and attempts instead of suicide deaths (O'Connor and Nock, 2014). In contrast, the

present study included individuals who had died by suicide. Findings were based on a unique, extensive corpus of data on over 24,000 individuals from almost a twenty year period (1996 to 2015). The high return rate of questionnaires was in part, due to the obligation of doctors to contribute to confidential inquiries such as NCISH. Third, suicide research to date has mainly investigated the detrimental effect of risk factors rather than the beneficial impact of protective factors. Thus, there is a need to ascertain factors which encourage resilience in individuals (Gooding et al., 2017; Kleiman and Anestis, 2015; O'Connor and Nock, 2014). The present study has helped to address this, finding that social support has a protective effect against hopelessness following negative life events.

To summarize, we found that there was a direct association between negative life events and suicidal behaviors, i.e., a history of self-harm in people who had died by suicide. Adverse life events also had an indirect effect on suicide/suicidal behaviors through hopelessness. An objective indicant of social support had a protective effect on the pathway between stressful life events and hopelessness such that as the level of social support increased, the odds of experiencing hopelessness decreased. Findings suggest that suicide prevention efforts may be advanced by bolstering available social support following challenging life events, such as, the provision of emotional support, supplying material resources and strengthening the individual's social support network, to reduce hopelessness and consequently decrease the likelihood of suicidal behavior.

#### Financial support

NCISH is commissioned by the Healthcare Quality Improvement Partnership (HQIP).

The Healthcare Quality Improvement Partnership (HQIP) is led by a consortium of the Academy of Medical Royal Colleges, the Royal College of Nursing and National Voices. HQIP's aim is to promote quality improvement, and it hosts the contract to manage and develop the Clinical Outcome Review Programs, one of which is the Mental Health Clinical Outcome Review Program, funded by NHS England, NHS Wales, the Health and Social Care division of the Scottish Government, the Northern Ireland Department of Health, and the States of Jersey and Guernsey. The programs, which encompass confidential enquiries, are designed to help assess the quality of healthcare, and stimulate improvement in safety and effectiveness by systematically enabling clinicians, managers and policy makers to learn from adverse events and other relevant data. More details can be found at: [www.hqip.org.uk/national-programs/a-z-of-clinical-outcome-review-programs](http://www.hqip.org.uk/national-programs/a-z-of-clinical-outcome-review-programs).

HQIP had no role in the design of the study. HQIP did not collect, analyse or interpret the data, write the report and was not involved in the decision to submit the article for publication.

#### CRedit authorship contribution statement

**Su-Gwan Tham:** Conceptualization, Formal analysis, Writing - original draft, Writing - review & editing. **Saied Ibrahim:** Conceptualization, Formal analysis, Writing - review & editing. **Isabelle M. Hunt:** Writing - review & editing. **Nav Kapur:** Supervision, Writing - review & editing. **Patricia Gooding:** Conceptualization, Supervision, Writing - review & editing.

#### Declaration of Competing Interest

N.K. is a member of the Department of Health's (England) National Suicide Prevention Advisory Group. N.K. chaired the NICE guideline development group for the longer-term management of self-harm and the NICE Topic Expert Group (which developed the quality standards for self-harm services). He is currently chair of the updated NICE guideline for depression. All other authors declare no conflict of interest. All other authors declare no competing interests.

## Acknowledgements

The study was carried out as part of the National Confidential Inquiry into Suicide and Safety in Mental Health. We thank the other members of the research team: Alison Baird, James Burns, Huma Daud, Myrsini Gianatsi, Jane Graney, Julie Hall, Rebecca Lowe, Cathryn Rodway, Phil Stones. We thank the consultant psychiatrists and mental health teams for completing our study questionnaire.

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