Clustering of suicides in children and adolescents: a review

Keith Hawton^{1, 5} FMedSci, Nicole T.M Hill² MBMSc, Madelyn Gould³ PhD, Ann John⁴ MD,
Karen Lascelles^{1, 5} MSc, and Jo Robinson² PhD

- 1 Centre for Suicide Research, Department of Psychiatry, University of Oxford, Warneford Hospital, Oxford, OX3 7JX, UK
- 2 Orygen, The National Centre of Excellence for Youth Mental Health, University of Melbourne, 35 Poplar Road, Parkville, VIC 3052, Australia
- 3 Division of Child & Adolescent Psychiatry and Department of Epidemiology, Columbia University Medical Center and The New York State Psychiatric Institute, 1051 Riverside Drive, Unit 72, New York 10032, USA
- 4 Swansea University Medical School, Data Science Building, Population Psychiatry, Suicide and Informatics, Sketty, Swansea SA2 8PP, UK
- 5 Oxford Health NHS Foundation Trust, Warneford Hospital, Oxford, OX3 7JX, UK

Corresponding Author:

Professor Keith Hawton

Address: Centre for Suicide Research, Department of Psychiatry, University of Oxford, Warneford Hospital, Oxford, OX3 3JX, UK

Email: keith.hawton@psych.ox.ac.uk

Phone: +44 (0)1865 902469

Abstract

Suicide is one of the major causes of death in young people, in whom it can occur in clusters. In this review we have investigated definitions and epidemiology of such clusters, the factors associated with them, mechanisms by which they occur, and means of intervening and preventing them. Clustering of suicidal behaviour is more common in young people than adults. Suicide clusters can occur as a greater number of episodes than expected at a specific location, including in institutions (e.g. schools, universities, psychiatric units, youth offender units). They may also involve linked episodes, spread out geographically. Locations exposed to clusters can be at risk for future clusters. Mechanisms involved in clusters include social transmission, particularly via person-to-person transmission and the media, perception that suicidal behaviour is widespread, vulnerable young people being more likely to socialise with others at risk of suicidal behaviour, and social cohesion contributing to the diffusion of ideas and attitudes. The internet and social media may play particularly important roles in spreading suicidal behaviour. The impact of suicide clusters on communities and institutions is usually profound. Experience of intervening in clusters has resulted in best practice guidance. This includes preparation for occurrence of clusters in both community and institutional settings. Identification of clusters in the community requires real-time monitoring of suicidal behaviour. Effective intervention is more likely if a cluster response group is established. The response should include bereavement support, provision of help for vulnerable individuals, proactive engagement with media interest, and population approaches to support and prevention. Social media can provide a powerful means for disseminating information and reaching young people at risk.

Introduction

Suicide is a leading cause of death in young people aged 25 years and under.¹

According to the Global Burden of Disease Study, in 2013 suicide accounted for 8.4% of deaths in 15-19 year-olds worldwide. While suicide occurs more frequently in young males than females it was the most common cause of death in females aged 15-19 years and the third most common cause in males in the same age group.² The incidence of suicide increases sharply during adolescence.³

Adolescents have been shown to be particularly susceptible to the phenomenon through which knowledge of the suicide of another may increase risk of further suicides and, according to a 1990 report, are two to four times more likely than adults to be involved in a suicide cluster.⁴ Suicide clusters have been documented in individuals as young as 10 years.⁵ Although relatively uncommon, suicide clusters generate considerable concern in the communities where they occur. This is especially so when a cluster occurs in a single school or university. The trauma associated with the suicide of a young person and increasing awareness of suicide clusters can lead to widespread fear and anxiety, as well as prolonged grief.⁶⁻⁸ Self-harm, defined as intentional non-fatal self-injury or self-poisoning irrespective of degree of suicidal intent or other type of motive,⁹ can also occur in clusters, these being relatively common in young people, as found in an early national study of attempted suicide in New Zealand,¹⁰ and in subsequent investigations.¹¹ Such clusters occur particularly in institutional settings such as schools and psychiatric units.⁵ Self-harm is a key factor associated with suicide in young people.¹² Unsurprisingly therefore clusters can include both suicide and self-harm;¹¹ indeed, linked episodes of self-harm may be a precursor to a suicide cluster.¹³

We have reviewed the research and clinical literature on suicide clusters in young people. Evidence regarding the prevalence of clusters of suicidal behaviour is presented, followed by what is known about the risk factors associated with susceptibility of youngsters to being involved in them and also possible underlying mechanisms. Finally, we consider interventions for the management and prevention of suicide clusters in young people. In this review the term 'young people' refers to children, adolescents and young people between ages 10 and 24 years. This broader view of 'adolescence' has important implications for cluster prevention, particularly in environments such as universities and custodial settings, whose populations of young people aged 18-24 years are otherwise excluded from a narrower conceptualisation of adolescence.¹⁴ Furthermore, studies of clustering phenomena often include young adults with children and adolescents.

Search strategy and selection criteria

We searched the following databases from inception to December 2017:

PsycINFO, Web of Knowledge, Medline, ASSIA, Sociological Abstracts, IBSS, and Social Services Abstracts, using the following search terms:

“suicid*”, “self-harm”, “self-injur*”, “self-mutilat*” AND “cluster*”, “space-time”, “echo”, “spatial”, “geospatial”, “mass”, “media”

OR “imitat*”, “epidemic”, “copycat”, “modelling”, “werther effect”, “priming”, “assort*”, “learning”, “prestige bias”, “homophil*”, “similarity bias”, “imitat*”, “identification psychology”, “learning”, “priming”, “suggestion”.

There were no language restrictions. We screened abstracts for key papers that identified clustering of suicide or self-harm behaviour in children and adolescents aged 24 years and younger. These publications were supplemented with our knowledge of the area, as well as a scan of the reference lists of landmark papers and reviews in the cluster literature.

Definition of a cluster

The term “suicide cluster” describes a situation in which more suicides than expected occur in terms of time, place, or both. Varying definitions of clusters have been proposed,⁵ reflecting the absence of a specific agreed definition of the phenomenon. A suicide cluster usually includes three or more deaths; however, two suicides occurring in young people in a specific community or setting (e.g. a school, university or inpatient psychiatric unit), in a short time period, should also be taken very

seriously in terms of possible links and impacts (even if the deaths are apparently unconnected), especially if these occur in the context of an increase in self-harm. It is important to establish at a very early stage if there are connections between the individuals who died by suicide. However, it is also important to recognise that there do not have to be clear connections for multiple deaths to constitute a suicide cluster.¹⁵ Multiple unconnected deaths in a community can have similar consequences to a cluster in which links between deaths are apparent, including media response to the suicide deaths, heightened local concerns and speculation, and influence on methods used for suicide.¹⁶ There may also be unrecognised connections between deaths.

Different types of suicide clusters are illustrated in Figure 1. Attention is usually focussed on point clusters (spatiotemporal clusters). One example was the much-publicised cluster of suicides that occurred in young people the Bridgend area of Wales in 2007/8.¹⁷ However, with information about suicidal behaviour increasingly spreading via the internet, and social media,^{8, 18} the incidence of geographically-spread mass (temporal) clusters may be increasing. These clusters can be difficult to recognise, as the social connections between individuals are not always apparent due to the nature of the online environment. Additionally, there can also be clustering in terms of methods of suicide (e.g. specific types of overdose or injury). This might occur within a point cluster or a mass cluster. Point clusters can also include a series of suicides that occur at a particular site, such as a bridge, cliff or building. Echo clusters occur in the same location as a previous cluster, but sometime later.

(Figure 1 about here)

Epidemiology of suicide clusters

It is difficult to ascertain how many suicides are attributable to clusters and the extent to which clusters contribute to overall suicide rates.⁵ Early evidence from population-based studies in the USA indicated that approximately 1-13% of youth suicides occurred as part of suicide cluster.⁴ In Australia it was estimated that between the years 2010 and 2012, suicide clusters accounted for 5-6% of suicides in young people aged under 25 years - compared to approximately 2-3% of suicide in adults aged 25 years and over.¹⁹

The proportion of youth suicides that occur as part of mass clusters is not known, because these clusters occur across a large population and are geographically spread. Several studies have highlighted the contribution of media influence on such clusters. In an early population-based study of the effects of televised news reports of suicide on subsequent suicide rates in California, Phillips and Carstensen found suicide rates increased by 22.8% in young people aged 10-19 years (compared to 6.9% in those age 20-29 years).²⁰ Other more recent studies have also demonstrated substantial effects of media phenomena on youth suicides, including news reports²¹ and a TV drama.²² The influence of media on suicide clusters is further considered below.

Studies investigating echo clusters are scarce. A nationwide study of suicide clusters in New Zealand detected ten echo clusters in nine locations, separated by approximately seven years.²³ However, the authors did not describe the age or demographic characteristics of those involved in the clusters. A recent population-based study of suicide and self-harm in New South Wales, Australia, using Poisson scan statistics, found evidence of ten echo clusters in young people aged 15-24 years.²⁴ The authors found initial clusters predicted 36 percent of the spatial distribution of subsequent clusters.

Who is at risk of being involved in a cluster?

Young people have repeatedly been identified as being at elevated risk for suicide clusters compared to adults.^{4, 11, 16, 19, 25} However, with the exception of age and exposure to a suicide death, the risk factors associated with individuals being involved in suicide clusters do not differ greatly from non-cluster suicides,^{5, 16} although some distinctions exist. For example, males are more frequently involved in suicide clusters, while females are more commonly involved in clustering of self-harm or suicide attempts,^{26, 27} although these findings have not been replicated in some large-scale, population-based studies.^{11, 19, 28}

Suicide clusters can occur in young people in small community settings where news of a suicide can spread rapidly between people who are known to each other or share close geographic proximity.^{15, 29} Indigenous status has long been associated with risk for cluster involvement across the age range, including among young people. This is the case in several countries, including Canada, Australia and the United States.^{11, 19, 29-31} Similarly, geographical remoteness and economic deprivation have been identified as contexts associated with clusters.^{11, 19, 32, 33} This indicates that context, as well as individual risk factors, is important. Furthermore, suicide clusters more commonly occur in certain institutional settings, including schools^{26, 34} and universities.^{35, 36} Other common settings include mental health services, particularly inpatient units,^{37, 38} with approximately ten percent of suicides by people with mental illness thought to be the result of clustering or imitative effects,³⁷ and custodial settings,³⁹ with around six per cent of prison suicides thought to occur as part of a cluster.³⁹

Mechanisms that may explain the occurrence of suicide clusters

Several factors and mechanisms have been suggested to explain the occurrence of point clusters (see Table 1). These are not mutually exclusive mechanisms and may act in concert, to varying degrees, for different point clusters. However, there are still few empirical studies focusing on point clusters that explicitly contribute to our understanding of these mechanisms.¹⁶

(Table 1 about here)

Social transmission

This mechanism postulates that there is a causal effect of exposure, either via indirect exposure through the media or direct exposure through person-to-person transmission.⁴⁰

Indirect exposure through the media

There is growing empirical support that media portrayal of suicide plays a role in the emergence of some suicide clusters in young people. In a study comparing 48 youth suicide cluster communities in the USA with a matched control group of 95 control communities where non-cluster suicides occurred, newspaper coverage of suicide was associated with the initiation of the suicide clusters.²¹ This association was strongest for news stories about the young people who died. Overall, newspaper stories following the index (first) cluster suicide were more prominent, as indicated by front-page placement and presence of a picture; more explicit, with headlines containing the word “suicide” and specifying the method used; more detailed, publicising names, method procedures, and the presence of a suicide note; and more likely to report on completed rather than attempted suicide. The finding that only stories about suicidal individuals, as opposed to other types of newspaper stories about suicide, were associated with the occurrence of a subsequent suicide, supports the theory that the media effect operates through the mechanism of

identification with a model.⁴¹ That stories about the teen suicides in the study had the strongest effect on subsequent teen suicides is consistent with the theory of differential identification, in which the highest impact models are those who are either similar to the reader (i.e. another teenager) or revered by him or her (e.g. a celebrity).^{42, 43} The findings from this study constitute the first available information on the circumstances differentiating a suicide which initiates a suicide cluster from one which does not.

While not focusing on suicide clusters specifically, the effects of a peer's suicide on adolescents' mental health and suicide risk has been the focus of myriad studies,^{29, 44-46} suggesting a possible role in the initiation of suicide clusters. The majority of cross-sectional analyses examining adolescents' exposure to a peer's suicidal behaviour have found a significant association with adolescent suicidal ideation and attempts.^{29, 44-46} Consistent findings have emerged from several longitudinal studies using data from the USA National Longitudinal Survey of Adolescent Health (ADD Health).^{44, 46, 47} Similarly, a longitudinal study employing the Canadian National Longitudinal Survey of Children and Youth⁴⁸ showed that exposure to a schoolmate's attempted or completed suicide predicted suicidal ideation and attempts among youth, two years after exposure. Effects of suicide exposure on suicidality outcomes were not modified by previous social support, depression, anxiety, or previous ideation or attempts.

Experiencing negative stressful life events appears to influence the effect of exposure to a peer's suicide. The Canadian longitudinal study showed that exposure to a schoolmate's suicide was predictive of suicidal ideation and behaviour only for those students with previous stressful life events, but not for exposed youth with no previous stressful life events.⁴⁸ Similarly, a recent study comparing students in

schools where a schoolmate had died by suicide to students who attended “non-exposed” schools showed that exposure exacerbated the impact of negative life events.⁴⁹ Students with recent negative life events who attended schools where a schoolmate had recently died by suicide had significantly greater odds of serious suicidal ideation/behaviour than students with recent negative life events in non-exposed schools.

The social transmission hypothesis, for which the potentially misleading term ‘contagion’ was previously used,⁵⁰ does not propose that the effect of exposure is uniform in a population; rather, characteristics of the individual, as well as environmental factors, influence the impact of exposure on health outcomes.^{16, 51} Moreover, it has been suggested that “a ‘social multiplier’ may amplify the effects” (p.233)⁵² of other suicidogenic factors. The extent that a suicide model - indirectly via the media or directly in the community - contributes to a suicide death is related to many other suicide risk factors.³

Descriptive norms

Descriptive norms – an individual’s perception or beliefs about how widespread a particular behaviour is among other people – have been found to be related to an individual’s behaviour.^{53, 54} Specifically, the more prevalent an individual perceives a behaviour to be, the more likely the individual is to believe that engaging in the behaviour is normative, and the more likely he or she is to engage in the behaviour him- or herself.⁵⁴ A recent cross-sectional study of over 2,000 high school students in the U.S. found that adolescents who believed suicidal ideation and attempts to be more widespread among peers (i.e. elevated ideation and attempt descriptive norms) were more likely to endorse suicidal ideation and attempts themselves.⁵⁵

Adolescents exposed to familial or peer suicides were more likely than non-exposed

adolescents to believe that a higher number of adolescents experienced serious suicidal ideation or attempted suicide. These findings are consistent with earlier research of O'Connor and colleagues who found that the belief that peers engaged in self-harm was associated with increased odds of both self-harm thoughts and behaviour among students.⁵⁶ It could be hypothesised that direct exposure to the suicidal behaviour of others may contribute to the elevation of adolescents' descriptive norms regarding suicide. Descriptive norms may thus be one previously unexplored mechanism by which adolescent suicide is increased.

Assortative relating

Assortative relating postulates that individuals at high risk of suicidal behaviour are more likely to be friends with other high-risk individuals, and this shared risk explains the effect of exposure.⁵⁷ Assortative relating would predict that individuals closest to the suicide decedents would be most suicidal after the death of a peer. Recent studies have found this not to be the case. In the comparative study described previously,⁴⁹ friendship with the decedent increased the odds of depression; however, the decedent's close friends were not at increased odds of serious suicidal ideation or behaviour. It was friends who were least close that were at highest risk. Recent research employing the ADD Health longitudinal surveys also highlighted that assortative relating was not sufficient to explain the increased risk after exposure to peer suicidal behaviour.⁴⁶ Exposure to a peer's suicidal behaviour still increased the risk of suicidal behaviour even after controlling for a wide range of variables potentially "involved in assortative selection of peers" (p. 220).⁴⁶ A study using computer simulation modelling to explore assortative relating as a possible mechanism behind suicide clustering found that assortative relating was less likely

than social learning to generate point clusters and unlikely to generate purely temporal clustering of suicides.⁵⁸

Social integration and regulation

Social integration, sometimes referred to as social cohesion, is a construct describing the structure of social relationships surrounding individuals that can regulate their emotional and physical health.^{59, 60} While the protective nature of social integration has long been emphasised,⁵⁹ increasing evidence has emerged that high levels of social integration may also have a negative impact on individuals and may promote the occurrence of point clusters.⁶⁰ A qualitative case study of 110 individuals living in a community that experienced 19 suicide deaths within 15 years, some of which clustered in four distinct suicide clusters, showed how small, tight-knit communities can be “volatile environments” for vulnerable teenagers. External and internal pressures to meet cultural expectations are amplified by the speed with which “word travels” in close-knit community networks. Also, while emotional distress increased in the local youth, there was low willingness to seek help because both the young people themselves and their parents were concerned about public disclosure of mental health problems.

Social cohesion is also important for the diffusion of ideas and attitudes, sometimes referred to as “cultural scripts”,⁶¹ which in turn may influence suicidal behaviour.

This may partially explain why point clusters have often been described as occurring in bounded social environments, such as psychiatric inpatient units, high schools, prisons, and indigenous peoples’ reservations.⁴⁰

Internet, social media and other new media influences in suicide clusters

Concern regarding the influence of the internet, social media and other new media on self-harm and suicidal behaviours has grown in recent years alongside their

increased use, particularly in young people. Systematic reviews have identified significant potential for harm from online activity in relation to suicidal behaviours (normalisation, triggering, competition, cyberbullying), but also the potential for benefits (crisis support, reduction of social isolation, delivery of therapy, outreach to isolated groups), with young people increasingly using social media to communicate distress, particularly to peers.^{18, 62} The focus of this concern and much of the expanding evidence base in this area has involved the active searching for suicide related information online (e.g. suicide methods), internet forums, and online interventions, rather than the role of the internet, social media, and other new media influences in the spread of suicidal behaviour, and the development and maintenance of suicide clusters. Less than 4% of research publications on suicide and the internet between 1997 and 2015 relate to online spread of suicidal behaviour or suicide pacts of those who meet online.⁶³

The use of social networking and other new media influences may facilitate increases in suicide, extending the boundaries of social and psychological proximity beyond traditional geographical proximity. One recent example of media influence concerns the Netflix series '13 Reason's Why' which, over thirteen episodes, depicts a series of events that leads the main character, a 17 year-old female, to take their own life. A recent ecological analysis of nationwide mortality data in the USA indicate that the release of '13 Reasons Why' corresponded with a 13% increase in suicides in youth aged 10-19 years. The increase in suicide deaths was concordant with the one-month period in which social media discussions of the series were greatest, it was most marked in females aged 10-19 years, and it was not found in older age groups.²² A further study of suicides in 10 -17 year-olds showed a similar increase in suicides, but also a greater number of suicides than expected in the following two

months.⁶⁴ Following challenges from mental health and suicide prevention organisations, two years after the release of the series Netflix deleted the scene in which the suicide was depicted in a graphic and sensationalized way.

Other studies have focused on text messaging and social media. For example, an investigation focused on the role of social media and text messaging in the aftermath of a high school suicide cluster in the USA, showed that young people used social media to memorialise the deceased, reminisce about shared experiences and as a place for receiving and providing support.¹⁰ However, some students reported feeling that social networking impeded their recovery following the suicide, with unexpected reminders of the deceased or negative comments interfering with the grieving process. The public nature of social networking also appeared to highlight social pressures and uncertainty about who was entitled to grieve. Young people who were close to the deceased reported feeling angry at other students for constantly posting on the deceased's Facebook page, and attributed these behaviours to attention seeking. Other young people described feeling obligated to be sad at school and were uncertain whether or not it was acceptable to laugh or when mourning about the death would end.

Similarly, in an investigation of eight suicides in young people from several different schools and communities within a city in New Zealand, it was found that some individuals were connected by social networking sites, including memorial pages, and instant text messaging. Of note, one of the deceased had lived in a geographically distant location but was linked to members of the suicide cluster via social media.⁸ In this instance, electronic communications enabled the rapid spread of information and rumors about the cluster, which generated heightened anxiety in the community.

The example above highlights how information can now spread further and faster than more traditional forms of communication, thus increasing the influence of an individual's death by suicide beyond well-defined geographical boundaries. Young people in a community, such as a school or university setting, may become aware of a suicide before professionals, teachers or parents. This may have an impact on community efforts to identify those who are affected by the suicide, plan an appropriate response and intervene appropriately. Consequently, the internet, social media and other new media influences make the timely detection of a suicide cluster, identification of the links between those who have died and those at risk and the management of suicide clusters, more challenging. Notwithstanding concerns about harms, the internet and social media can be used protectively in the context of suicide clusters as discussed in the intervention section below.

Further research focusing on the internet, social media and other new media influences as a medium for the spread of suicide. Given the popularity of these technologies among young people and the reach of visual (still and video) online media such as Instagram, YouTube, and streaming platforms such as Netflix, research focusing on the spread of suicides and the potential opportunities for suicide prevention that these platforms present, should be considered a priority.

(Table 2 about here)

Identifying and responding to a suicide cluster

Suicide can devastate families, friends, work colleagues, teachers and others. Any suicide usually affects a large number of people and the aftermath of suicides of young people can be particularly profound.⁶⁵ Because people bereaved by suicide themselves have an increased risk of suicide⁶⁵ this might add to the possible extension of a suicide cluster. Awareness of a suicide cluster in a community or

institution can cause panic and sometimes uncoordinated efforts to introduce interventions and preventive measures may have deleterious effects. To try and mitigate against reactive responses advance planning for the eventuality of a suicide cluster can be important.

Research into interventions in this area is evolving and thus current approaches to responding to suicide clusters are largely based on good practice derived from experience.⁶⁶ Such experience indicates that, ideally, plans should be developed prospectively rather than in the event of an actual cluster, to contain anxiety and instill confidence in the response. A summary of the components of such a response is shown in Table 3.

Community-based real-time suicide surveillance can provide information on local suicidal behaviour to enable early identification of signs of a potential suicide cluster. In settings such as schools, colleges and universities there is usually early awareness of probable suicides and concerns about the possible spread of suicidal behaviour in such settings might arise after a single suicide.

Concerns about a possible cluster should be reviewed by a small 'cluster response' group of individuals with responsibility for local suicide prevention to establish facts. Keeping this group small helps to avoid rumors and reduce the chance of premature or inaccurate judgements of evidence of a suicide cluster. Most young people will have connections to communities such as schools, colleges, universities or youth offender institutions. Cluster response group representation from the relevant organisation is important as increases in self-harming behaviour may be observed within institutions that might not otherwise be captured by community surveillance arrangements. Moreover, individuals within the organisation will be better able to gauge the extent of the impact of a suicide (and response interventions) than an

external group alone. In England, local authority public health-led multidisciplinary suicide prevention groups have responsibility for leading responses to suicide clusters. Close collaboration between public health and specific organisations where suicides have occurred can facilitate the response.⁶⁶

(Table 3 about here)

The remit of a cluster response group will necessarily involve sharing of sensitive and confidential information. Attention to information-sharing protocols is important to ensure appropriate levels of disclosure and should ideally be in place as part of prior local suicide prevention arrangements. Media interest is more likely following suicides of young people⁶⁷ and communication teams should be involved in the cluster response group to assist in the preparation of a media response. Guidance for media reporting of suicides is readily available⁶⁸ and can inform responses to media interest. A core responsibility of a cluster response group is the identification of individuals and groups who are bereaved and affected and those who may be themselves vulnerable as a result of a suicide. Whilst identifying those immediately bereaved, such as family members who lived with the deceased is relatively straightforward, it is more difficult to distinguish who in the deceased's social, educational and professional groups might be affected or vulnerable, and still harder to establish less obviously connected individuals who may identify with the deceased individual or suicidal act and be at potential risk themselves.

The 'Circles of Vulnerability' model adapted by Zenare (2009) is an approach that can help guide this task (see Figure 2).⁶⁹ This model identifies three factors that can act in isolation or in combination to increase the potential for future risk following exposure to a suicide death (or other unexpected death). These include: 1) Geographical proximity to the death i.e. the physical distance individuals are from the

suicide, including those who may have witnessed or discovered the death; 2) Social proximity, which refers to the relationships individuals have with the deceased, e.g. family members, friends, peers, or others who are part of the same social circle, including online social networks; and 3) Psychological proximity, which refers to the extent to which an individual can relate to the deceased. Whilst each factor may contribute to elevated risk, individuals most at risk are likely to be those who fall into the overlapping portions of the model, and who already display some underlying vulnerabilities or risk factors for suicide, such as past suicide-related behaviour, bereavement or mental health difficulties.

(Figure 2 about here)

Where vulnerable individuals and groups can be identified it is possible to target supportive interventions accordingly. However, those connected less directly to the deceased are more likely to be reached by whole population approaches to support and prevention. Here, social media can be used positively to promote a sense of social connection and mutual support, which may be protective. The ability to reach a large number of people this way, including vulnerable or isolated individuals,^{18, 70} may be an advantage. While it is important to remain alert to harmful internet and social media coverage, for example by monitoring online news articles and memorial sites and reporting offensive content, internet and social media can be effectively used to disseminate information about the grieving process and its complexity, as well as advice on how to intervene or who to contact if people are aware of, or concerned about, messages they see online in the aftermath of a suicide. Research has shown that school psychoeducational prevention programs that teach appropriate responses to suicidal posts may mitigate some of the negative influences of the Internet.¹⁸ It may be that young people themselves can safely

participate in developing suicide prevention messages for their peers and help disseminate them on social media.^{70, 71}

In the same way that it can be difficult to know when to instigate a cluster response plan it might be difficult to be sure about when to end one. Some whole population approaches, such as suicide awareness training or more widely publicised signposting to support agencies, might become part of standard community suicide prevention policy. Specific organisations such as schools or universities are likely to experience residual impact of the loss of a student for months or years, with particular times of increased vulnerability (e.g. anniversaries, exams or graduations). Monitoring and review of cluster response plans can help to inform ongoing wider suicide prevention initiatives in young people and be used to share experiences with other areas that experience similar concerns.

(Box 1 about here)

An example of interventions following detection of a suicide cluster in Casey, Cardinia, in Australia is shown in Box 1. Response to the Casey Cardinia suicide cluster has been the subject of a coronial inquest⁷² and has been formally evaluated by headspace.⁷³ As shown in Box 1, identification of the suicide cluster was delayed due to the absence of formal procedures for monitoring suicidal behaviour in the community. Consequently, an inquiry into the potential spread of suicide in the community was conducted after 12 suicide deaths had occurred within a twelve-month period. The coronial inquiry into the deaths of those involved in the Casey-Cardinia suicide cluster recognised the rapid crisis response led by local agencies in the community, which, as a result of the suicide cluster, has since developed a crisis response strategy that has become part of standard community suicide prevention policy.

Conclusions

There is increasing recognition that suicide can cluster in young people in community and institutional settings. The mechanisms involved may include direct exposure to the behaviour, media reporting, belief that the behaviour is commonplace, vulnerable individuals sharing social groups, and influence of social media and the internet.

Once occurrence of a cluster is suspected there should be a carefully coordinated and preferably pre-planned response, ideally by an identified cluster response group.

The response should include bereavement support, provision of help for vulnerable individuals, proactive responding to media interest, and community approaches to support and prevention. Social media can provide a powerful means for dissemination of information and help.

Contributors

KH and JR planned the review. All authors contributed substantially to the interpretation of the included studies and to the writing of the manuscript. The literature search was mainly performed by NC, who also prepared the figures.

Declaration of interests

The authors declared no conflict of interest.

Funding

There was no specific funding for this review.

Figure 1. Types of suicide clusters

Table 1. Mechanisms involved in suicide clusters

Mechanism	Description	Key Points to consider
Social transmission	Occurs when exposure to suicide or self-harm facilitates suicidal behaviour in another	Exposure can be <i>indirect</i> through certain types of media reports or fictional portrayals of suicide Exposure can be <i>direct</i> through personal acquaintance or with someone who has died by suicide.
Descriptive norms	Occurs when individuals perceive suicidal behaviour to be more common than it really is in the community	The normalization of suicidal behaviour increases the likelihood that a person will reinforce perceptions of suicidal behaviour as an acceptable coping strategy.
Assortative relating	Occurs when there are close social ties between individuals with pre-existing vulnerabilities that increase overall risk of suicidal behaviour within peer circles	Susceptibility may be mediated by the presence or absence of pre-existing risk factors shared among peers.
Social integration and regulation	Occurs in closed communities with high rates of social isolation and social cohesion that leads to diffusion of ideas and behaviours	Tight-knit communities may be particularly susceptible to the rapid dissemination of information and formation of cultural scripts associated with negative events such as suicide.

Table 2. Internet and social media influences on suicide clusters

Positive examples	Negative examples
<ul style="list-style-type: none"> • The internet and social media platforms provide a useful way for young people to memorialise the deceased, and stay connected with others who knew the deceased • They provide young people with the chance to communicate with others and share their personal experiences • They can be a useful source of help-seeking and support for young people, particularly those in marginalized or remote communities that don't have access to face-to-face support • During a cluster, social media can be used positively to disseminate information and promote a sense of social connection and mutual support 	<ul style="list-style-type: none"> • The instant nature of social media and text messaging may increase the risk of potential spread of suicidal behaviour, and misinformation can spread rapidly beyond traditional geographic boundaries • These technologies transcend typical geographic boundaries, making it difficult to identify links between those who have died, and those who may be at risk of further suicidal behaviour. • Social media and text messaging have made the identification of links between those who have died or those at risk and the timely management of a possible cluster more challenging • These technologies allow young people to generate their own content, which may unintentionally reinforce stigma or contain information about the suicide deaths that may facilitate further suicides.

Table 3. Identification and responding to suicide clusters

Key elements of response	Components of response
Surveillance	<ul style="list-style-type: none"> Real-time monitoring of suicidal behaviour involving police, coroners, emergency departments Interpretation of patterns of behaviour
Information sharing	<ul style="list-style-type: none"> Identified network Sharing of sensitive and confidential information Consideration of what information should be shared with the public
Media	<ul style="list-style-type: none"> Encouraging responsible reporting Identifying person responsible for media liaison Vigilance for harmful internet and social media coverage
Bereavement support	<ul style="list-style-type: none"> Identification of those bereaved and affected by suicides Provision of supportive interventions
Prevention	<ul style="list-style-type: none"> Identification of vulnerable groups Targeted and whole population interventions
Monitoring and reviewing plan	<ul style="list-style-type: none"> Ongoing monitoring of suicidal behaviour and impact of interventions Revising plan if necessary Winding down cluster response (retaining interventions that should be sustained e.g. bereavement support, suicide awareness training)
Evaluation of response	<ul style="list-style-type: none"> Review by cluster response group Planning for possible future clusters Sharing experience of cluster response with other areas

Figure 2: Circles of Vulnerability (adapted from Zenare 2009)

The three overlapping groups of concentric circles shows varying vulnerability according to closeness to the deceased (red circle D) in terms of geographical, psychological and social proximity.

Box 1 Example of a youth cluster response in Case and Cardinia Shire, Australia

Background and cluster detection	<p>The City of Casey is located in south east Victoria, Australia and borders the Shire of Cardinia. During 2011-2012 the Casey Cardinia region experienced 12 suicide deaths among youth aged 13-24 years. A member of the public contacted the Victoria Coroners Prevention Unit (CPU) conveying concern about an increase in youth suicide in the area, and the impact this was having on young people in the region. The CPU initiated a review of the recent suicides and hospitalised self-harm in the region, utilising data from the Victoria Injury Surveillance Unit, hospital admissions, and coroner's records.⁷²</p>
Cluster response	<p>The local council convened an all agency emergency response meeting which revealed that many agencies had information about the suicides and coordinated a Suicide Steering committee to act a lead agency for coordinating communication and mobilising postvention interventions in the community.^{72, 73} The Victorian State Government developed a specialist program to work in the region and facilitate collaboration between: 1) organisations and programs in the community; 2) schools; and 3) parents. This included the upscaling of resources to local agencies.</p> <p>Cluster prevention activities included:</p> <ul style="list-style-type: none"> • Raising awareness among Government Departments, politicians, service providers, schools and community leaders about suicide prevention and the potential spread of suicide, and likely needs and availability of resources. • Professional development workshops were delivered to 2585 school and service agency employees targeting awareness of suicide risk, language for discussing risk and safety planning, and referral. • 1213 primary and secondary school students and 94 parents in the region completed workshops targeting emotional resilience. • Debriefing opportunities were provided to school staff via headspace Project Workers who were funded by the Victorian Government to assist with cluster response activities in the region.
Risk factors identified	<p>The Casey Cardinia region experienced a rapid period of urban growth, particularly among young people. However, this growth was accompanied by a lack of corresponding service infrastructure. These issues are currently being prioritised by local members of the advisory and steering committees, as part of ongoing cluster prevention efforts.⁷²</p>

References

1. World Health Organization. Preventing suicide: A global imperative. Geneva: World Health Organization; 2014
2. Mokdad AH, Forouzanfar MH, Daoud F, Mokdad AA, El Bcheraoui C, Moradi-Lakeh M, et al. Global burden of diseases, injuries, and risk factors for young people's health during 1990-2013: A systematic analysis for the global burden of disease study 2013. *Lancet*. 2016;387(10036):2383-401.
3. Hawton K, Saunders KE, O'Connor RC. Self-harm and suicide in adolescents. *Lancet*. 2012;379(9834):2373-82.
4. Gould MS, Wallenstein S, Kleinman MH, O'Carroll P, Mercy J. Suicide clusters: An examination of age-specific effects. *Am J Public Health*. 1990;80(2):211-2.
5. Niedzwiedz C, Haw C, Hawton K, Platt S. The definition and epidemiology of clusters of suicidal behavior: A systematic review. *Suicide Life Threat Behav*. 2014;44(5):569-81.
6. Centres for Disease Control. Cluster of suicides and suicide attempts. New Jersey; 1988.
7. Heffel CJ, Riggs SA, Ruiz JM, Ruggles M. The aftermath of a suicide cluster in the age of online social networking: A qualitative analysis of adolescent grief reactions. *Contemp Sch Psychol*. 2015;19(4):286-99.
8. Robertson L, Skegg K, Poore M, Williams S, Taylor B. An adolescent suicide cluster and the possible role of electronic communication technology. *Crisis*. 2012;33(4):239-45.
9. National Institute for Health and Clinical Excellence. Self-harm: Longer-term management. (clinical guideline cg133.) 2011.
10. Gould MS, Petrie K, Kleinman MH, Wallenstein S. Clustering of attempted suicide: New zealand national data. *Int J Epidemiol*. 1994;23(6):1185-9.
11. Too LS, Pirkis J, Milner A, Spittal MJ. Clusters of suicides and suicide attempts: Detection, proximity and correlates. *Epidemiol Psych Sci*. 2017;26(5):491-500.
12. Hawton K, Bergen H, Kapur N, Cooper J, Steeg S, Ness J, et al. Repetition of self-harm and suicide following self-harm in children and adolescents: Findings from the multicentre study of self-harm in england. *J Child Psychol Psychiatry*. 2012;53(12):1212-9.
13. Hacker K, Collins J, Gross-Young L, Almeida S, Burke N. Coping with youth suicide and overdose: One community's efforts to investigate, intervene, and prevent suicide contagion. *Crisis*. 2008;29(2):86-95.
14. Sawyer SM, Azzopardi PS, Wickremarathne D, Patton GC. The age of adolescence. *Lancet Child Adolesc Health*. 2018; 2(3): 223-28.
15. Callahan J. Negative effects of a school suicide postvention program--a case example. *Crisis*. 1996;17(3):108-15.
16. Haw C, Hawton K, Niedzwiedz C, Platt S. Suicide clusters: A review of risk factors and mechanisms. *Suicide Life Threat Behav*. 2013;43(1):97-108.
17. Jones P, Gunnell D, Platt S, Scourfield J, Lloyd K, Huxley P, et al. Identifying probable suicide clusters in wales using national mortality data. *PLoS ONE*. 2013;8(8):e71713.
18. Marchant A, Hawton K, Stewart A, Montgomery P, Singaravelu V, Lloyd K, et al. A systematic review of the relationship between internet use, self-harm and suicidal behaviour in young people: The good, the bad and the unknown. *PLoS ONE*. 2017;12(8):e0181722.

19. Robinson J, Too LS, Pirkis J, Spittal MJ. Spatial suicide clusters in australia between 2010 and 2012: A comparison of cluster and non-cluster among young people and adults. *BMC Psychiatry*. 2016;16:417-26.
20. Phillips DP, Carstensen LL. Clustering of teenage suicides after television news stories about suicide. *N Engl J Med*. 1986;315(11):685-9.
21. Gould MS, Kleinman MH, Lake AM, Forman J, Midle JB. Newspaper coverage of suicide and initiation of suicide clusters in teenagers in the USA, 1988-96: A retrospective, population-based, case-control study. *Lancet Psychiatry*. 2014;1(1):34-43.
22. Niederkrotenthaler T, Stack S, Till B, Sinyor M, Pirkis J, Garcia D, et al. Association of increased youth suicides in the united states with the release of 13 reasons why. *JAMA Psychiatry*. 2019; 76(9):933–40.
23. Larkin G, Beautrais, A. *Geospatial mapping of suicide clusters*. Aukland: Te Pou o Te Whakaaro Nui.; 2012.
24. Too LS, Pirkis J, Milner A, Robinson J, Spittal MJ. Clusters of suicidal events among young people: Do clusters from one time period predict later clusters? *Suicide Life Threat Behav*. 2019;49(2):561-71.
25. Cox GR, Robinson J, Williamson M, Lockley A, Cheung YT, Pirkis J. Suicide clusters in young people: Evidence for the effectiveness of postvention strategies. *Crisis*. 2012;33(4):208-14.
26. Brent DA, Kerr MM, Goldstein C, Bozigar J, Wartella M, Allan MJ. An outbreak of suicide and suicidal behavior in a high school. *J Am Acad Child Adolesc Psychiatry*. 1989;28(6):918-24.
27. Fowler KA, Crosby AE, Parks SE, Ivey AZ, Silverman PR. Epidemiological investigation of a youth suicide cluster: Delaware 2012. *Del Med J*. 2013;85(1):15-9.
28. Williamson MK, Tung SJ, Pirkis J, Derek cheung YT, Spittal MJ. Predictors of suicides occurring within suicide clusters in australia, 2004-2008. *Soc Sci Med*. 2014;118:135-42.
29. Insel BJ, Gould MS. Impact of modeling on adolescent suicidal behavior. *Psychiatr Clin North Am*. 2008;31(2):293-316.
30. Wilkie C, Macdonald S, Hildahl K. Community case study: Suicide cluster in a small manitoba community. *Can J Psychiatry*. 1998;43(8):823-8.
31. Bechtold DW. Cluster suicide in american indian adolescents. *Am Indian Alsk Native Ment Health Res*. 1988;1(3):26-35.
32. Cheung YT, Spittal MJ, Pirkis J, Yip PS. Spatial analysis of suicide mortality in australia: Investigation of metropolitan-rural-remote differentials of suicide risk across states/territories. *Soc Sci Med*. 2012;75(8):1460-8.
33. Cheung YT, Spittal MJ, Williamson MK, Tung SJ, Pirkis J. Application of scan statistics to detect suicide clusters in australia. *PLoS ONE*. 2013;8(1):e54168.
34. Askland KD, Sonnenfeld N, Crosby A. A public health response to a cluster of suicidal behaviors: Clinical psychiatry, prevention, and community health. *J Psychiatr Pract*. 2003;9(3):219-27.
35. Haas AP, Hendin H, Mann JJ. Suicide in college students. *Am Behav Sci*. 2003;46(9):1224-40.
36. MacKenzie DW. Applying the anderson-darling test to suicide clusters evidence of contagion at u. S. Universities? *Crisis*. 2013;34(6):434-7.
37. McKenzie N, Landau S, Kapur N, Meehan J, Robinson J, Bickley H, et al. Clustering of suicides among people with mental illness. *Br J Psychiatry*. 2005;187:476-80.
38. Rosen PM, Walsh BW. Patterns of contagion in self-mutilation epidemics. *Am J Psychiatry*. 1989;146(5):656-8.
39. McKenzie N, Keane M. Contribution of imitative suicide to the suicide rate in prisons. *Suicide Life Threat Behav*. 2007;37(5):538-42.

40. Gould M, Davidson L. Suicide contagion among adolescents. *Adv Adolesc Mental Health*. 1988;3:29-59.
41. Blood RW, Pirkis J. Suicide and the media: Part iii. Theoretical issues. *Crisis*. 2001;22(4):163.
42. Niederkrotenthaler T, Fu KW, Yip PS, Fong DY, Stack S, Cheng Q, et al. Changes in suicide rates following media reports on celebrity suicide: A meta-analysis. *J Epidemiol Community Health*. 2012;66(11):1037-42.
43. Stack S. Suicide in the media: A quantitative review of studies based on nonfictional stories. *Suicide Life Threat Behav*. 2005;35(2):121-33.
44. Feigelman W, Gorman BS. Assessing the effects of peer suicide on youth suicide. *Suicide Life Threat Behav*. 2008;38(2):181-94.
45. Ho TP, Leung PW, Hung SF, Lee CC, Tang CP. The mental health of the peers of suicide completers and attempters. *J Child Psychol Psychiatry*. 2000;41(3):301-8.
46. Randall JR, Nickel NC, Colman I. Contagion from peer suicidal behavior in a representative sample of american adolescents. *J Affect Disord*. 2015;186:219-25.
47. Abrutyn S, Mueller AS. Are suicidal behaviors contagious in adolescence?: Using longitudinal data to examine suicide suggestion. *Am Sociol Rev*. 2014;79(2):211-27.
48. Swanson SA, Colman I. Association between exposure to suicide and suicidality outcomes in youth. *CMAJ*. 2013;185(10):870-7.
49. Gould MS, Lake AM, Kleinman M, Galfalvy H, Chowdhury S, Madnick A. Exposure to suicide in high schools: Impact on serious suicidal ideation/behavior, depression, maladaptive coping strategies, and attitudes toward help-seeking. *Int J Environ Res*. 2018;15(3).
50. Hasking P, Boyes M. Cutting words: A commentary on language and stigma in the context of nonsuicidal self-injury. *J Nerv Ment Dis*. 2018;206(11):829-33.
51. Gould M. Suicide clusters and media exposure. In: Blumenthal SJ, Kupfer DJ, editors. *Suicide over the life cycle: Risk factors, assessment, and treatment of suicidal patients*. Washington, DC, USA: American Psychiatric Press; 1990. p. 517-32.
52. Cutler D, Glaeser, E., Norberg, K.,. Explaining the rise in youth suicide. In: Gruber J, editor. *Risky behavior among youths: An economic analysis*. Chicago, IL, USA: University of Chicago Press; 2001. p. 219–69.
53. Cialdini RB, Reno RR, Kallgren CA. A focus theory of normative conduct: Recycling the concept of norms to reduce littering in public places. *J Pers Soc Psychol*. 1990;58(6):1015-26.
54. Rimal RN, Real K. Understanding the influence of perceived norms on behaviors. *Communication Theory*. 2003;13(2):184-203.
55. Reyes-Portillo JA, Lake AM, Kleinman M, Gould MS. The relation between descriptive norms, suicide ideation, and suicide attempts among adolescents. *Suicide Life Threat Behav*. 2019;49(2):535-46.
56. O'Connor RC, Rasmussen S, Hawton K. Distinguishing adolescents who think about self-harm from those who engage in self-harm. *Br J Psychiatry*. 2012;200(4):330-5.
57. Joiner TE, Jr. Contagion of suicidal symptoms as a function of assortative relating and shared relationship stress in college roommates. *J Adolesc*. 2003;26(4):495-504.
58. Mesoudi A. The cultural dynamics of copycat suicide. *PLoS ONE*. 2009;4(9):e7252.
59. Durkheim E. *Suicide*. London, England: Routledge; 1951.
60. Mueller AS, Abrutyn S. Adolescents under pressure: A new durkheimian framework for understanding adolescent suicide in a cohesive community. *Am Sociol Rev*. 2016;81(5):877-99.

61. Abrutyn S, Mueller AS, Osborne M. Rekeying cultural scripts for youth suicide: How social networks facilitate suicide diffusion and suicide clusters following exposure to suicide. *Soc Ment Health*. 2019;2156869319834063.
62. John A, Glendenning AC, Marchant A, Montgomery P, Stewart A, Wood S, et al. Self-harm, suicidal behaviours, and cyberbullying in children and young people: Systematic review. *J Med Internet Res*. 2018;20(4):e129.
63. Kryszyska K, Westerlund M, Niederkrotenthaler T, Andriessen K, Carli V, Hadlaczky G, et al. A mapping study on the internet and suicide. *Crisis*. 2017;38(4):217-26.
64. Bridge JA, Greenhouse JB, Ruch D, Stevens J, Ackerman J, Sheftall AH, et al. Association between the release of netflix's 13 reasons why and suicide rates in the united states: An interrupted times series analysis [published online ahead of print April 28, 2019]. *J AM ACAD CHILD PSY*. 2019.
65. Pitman A, Osborn D, King M, Erlangsen A. Effects of suicide bereavement on mental health and suicide risk. *Lancet Psychiatry*. 2014;1(1):86-94.
66. Public Health England. Identifying and responding to suicide clusters and contagion: A practice resource. In: Health Do, editor. London, England: Department of Health; 2015.
67. Marzano L, Fraser L, Scally M, Farley S, Hawton K. News coverage of suicidal behavior in the united kingdom and the republic of ireland. *Crisis*. 2018;39(5):386-396.
68. Samaritans. Media guidelines for reporting suicide. London, UK: Samaritans; 2013.
69. Zenere FJ. Clusters and contagion. *Principal Leadership*. 2009;10:12-6.
70. Robinson J, Bailey E, Hetrick S, Paix S, O'Donnell M, Cox G, et al. Developing social media-based suicide prevention messages in partnership with young people: Exploratory study. *JMIR Ment Health*. 2017;4(4):e40.
71. Robinson J, Hill NTM, Thorn P, Battersby R, Teh Z, Reavley NJ, et al. The #chatsafe project. Developing guidelines to help young people communicate safely about suicide on social media: A delphi study. *PLoS ONE*. 2018;13(11):e0206584.
72. Coroners Court of Victoria. Coronial investigation report- casey and cardinia suicide cluster. Victoria Australia: Coroners Court of Victoria; 2015.
73. headspace National Youth Mental Health Foundation. Final evaluation report: Casey cardinia suicide postvention project. A headspace suicide recovery project. Australia: headspace; 2016.