Effectiveness of barriers at suicide jumping sites: a case study

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Objectives: Suicide safety barriers were removed from a central city bridge in an Australasian metropolitan area in 1996 after having been in place for 60 years. The bridge is a known suicide site and is located adjacent to the region's largest hospital, which includes an acute inpatient psychiatric unit. This paper examines the impact of the removal of these barriers on suicide rates.

Method: Data for suicide deaths by jumping from the bridge in question, from 1992 to 2000, were obtained from the regional City Police Inquest Office. Data for suicide deaths by jumping from other sites in the metropolitan area in question, from 1992 to 1998, were obtained from the national health statistics database. Case history data about each suicide death by jumping in the metropolitan area in question, from 1994 to 1998, were abstracted from coronial files held by a national database.

Results: Removal of safety barriers led to an immediate and substantial increase in both the numbers and rate of suicide by jumping from the bridge in question. In the 4 years following the removal of the barriers (compared with the previous 4 years) the number of suicides increased substantially, from three to 15 ($\chi^2 = 8$, df = 1, $p < 0.01$); the rate of such deaths increased also ($\chi^2 = 6.6$, df = 1, $p < 0.01$). The majority of those who died by jumping from the bridge following the removal of the safety barriers were young male psychiatric patients, with psychotic illnesses. Following the removal of the barriers from the bridge the rate of suicide by jumping in the metropolitan area in question did not change but the pattern of suicides by jumping in the city changed significantly with more suicides from the bridge in question and fewer at other sites.

Conclusions: Removal of safety barriers from a known suicide site led to a substantial increase in the numbers of suicide deaths by jumping from that site. These findings appear to strengthen the case for installation of safety barriers at suicide sites in efforts to prevent suicide deaths, and also suggest the need for extreme caution about the removal of barriers from known jumping sites.

Key words: jumping, suicide prevention, suicide.

Australian and New Zealand Journal of Psychiatry 2001; 35:557–562

Suicide by jumping is a relatively uncommon method of suicide in most countries [1]. However, some cities and 'city states' characterized by high-density housing provide notable exceptions. In these places suicides by jumping constitute a significant proportion of all suicide deaths [2–8]. In both Australia and New Zealand suicide by jumping is rare. In 1998 (the year for which most recent data are available) suicide by jumping accounted for only 2.8% of all suicide deaths in New Zealand [9] and 5.8% of Australian suicide deaths [10].

Despite the rarity of suicide by jumping, there is a limited literature on the topic. Review of this research suggests the following points:

1. Suicide by jumping tends to become a focus of interest when an increased number of deaths are noted at a particular site. Often, specific sites or structures tend to acquire local and international reputations, symbolic

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Received 22 March 2001; revised 8 June 2001; accepted 14 June 2001.

significance and iconic status as places for suicide attempts [11–19].

2. The majority of those who attempt suicide by jumping from a height have severe mental illness, with the most common disorders being schizophrenia and severe depression [11,13,15,19–26].

3. The majority of those who survive suicide attempts by jumping do not subsequently die by suicide, suggesting that preventive measures to restrict access to suicide sites may be useful [1,21]. Indeed, survivors of suicide attempts by jumping have themselves recommended the construction of barriers at suicide sites [27].

4. Studies of suicide attempts or deaths by jumping at specific sites consistently comment on either the reductions in suicide deaths which followed the introduction of safety barriers restricting access to these sites, or recommend the installation of such barriers to try to reduce the number of suicides by jumping from a particular site [1,11,13,16,18,21,24,26,28–30].

More generally, best-practice guidelines for preventing suicide recommend that, wherever possible, safety barriers be added to existing structures where risk of jumping is high and incorporated into designs of new buildings where risk of jumping is likely to be high (see, for example, [11,31–34]).

There appear to be no reports in the suicide literature of the impact of the removal of barriers from a known suicide site. Indeed, the epidemiological testing of the effectiveness of bridge barriers has been described as requiring: 'a controlled study, whereby after a 5- to 7-year period of time, we would remove the barriers from the bridge for a comparable period of time, measure the number and rate of completed suicides associated with jumping from the bridge, and then determine whether any differences that were observed were directly related to the presence of the barriers.' [16, p.98]. The authors went on to state: 'Needless to say, this controlled study can never be done, in part because it would be intolerable to wait for a 5- to 7-year period of time to elapse if it was observed early on that there was even a slight increase in the number (let alone rate) of suicides occurring on the bridge once the barriers came down'.

The study described by O'Carroll and Silverman [16] above has been recently conducted, albeit perhaps unwittingly. This paper examines the impact on suicide numbers and rates of the removal of safety barriers from an overpass bridge, a known suicide site, in an Australasian metropolitan area. The overpass in question is referred to hereafter as 'Bridge A' and the metropolitan area is referred to as 'City Z.' The reasons for presenting the results in anonymous form are twofold. First, Bridge A currently has no safety barriers and there is a risk that media publicity about the lack of safety barriers could encourage the use of Bridge A as a jumping site. Second, the results of this study may be seen as controversial and reflecting poorly on the process followed, and the institutions involved, in the decision to remove the barriers.

Bridge A is a 97.5 m-long concrete arch structure in central City Z. The bridge links two major central city roads and rises approximately 80 m above a metropolitan motorway. There are pedestrian pathways on both sides of the bridge. The bridge was completed in 1910, and is now regarded as a 'heritage' structure both nationally and by the City Z Council, which is responsible for the maintenance of the bridge. At the recommendation of the then Coroner, following suicide deaths from Bridge A, mesh safety barriers were erected on the bridge in 1937 in an effort to prevent suicide attempts from the bridge. In the late 1980s the original mesh barriers were replaced by metal screens installed above the concrete parapets. The bridge is adjacent to the region's largest general hospital, which includes both an emergency department (where individuals who make suicide attempts are treated), and the region's largest acute inpatient psychiatric unit. In 1995 the City Z Council made a decision to remove the safety barriers from Bridge A.

This decision was prompted by concerns raised by community members who believed that the safety barriers were an unsightly addition, which marred the beauty of the bridge and served to vandalize an historic structure. Further, it was claimed that the barriers impeded efforts to rescue people attempting to jump from the bridge. Acting on these concerns, the City Z Council obtained the views of several local bodies and relevant service providers (including the fire, police, ambulance and mental health services). Taking account of the opinions and views expressed by these individuals and institutions, the City Z Council concluded that the existing barriers: (i) did not prevent people from attempting suicide; (ii) in fact, impeded rescue attempts; and (iii) were visually unattractive and detracted from the heritage status of the bridge. The City Z Council decided to remove the safety barriers, and to cap the parapets of the bridge with an inward sloping edge to stop people walking along the handrail. This work was carried out in March and April of 1996.

Following the removal of safety barriers from Bridge A concerns about the effects of the removal of the barriers on numbers of suicides were expressed by several community members, including City Z mental health consumer advocates. However, no quantitative research has been conducted to ascertain whether or not the removal of barriers from Bridge A has led to a detectable increase in numbers of suicides from this structure.

This paper reports upon a study of suicide by jumping from Bridge A before and after the removal of safety

barriers from the bridge. Specifically, the study seeks to address the following questions:

1. Was the removal of safety barriers from Bridge A associated with a detectable increase in numbers and rates of suicide by jumping from the bridge?
2. Were any changes in rates of suicide by jumping from Bridge A paralleled by changes in rates of suicide by jumping at other sites in City Z?
3. What were the characteristics of those individuals who died by jumping from Bridge A following the removal of the safety barriers?

Method

Data on suicides by jumping in the City Z region were obtained from the following sources:

1. It was possible to obtain data from the City Z Police Inquest Officer for dates of death for suicides by jumping from Bridge A for the years 1992–2000 inclusive.
2. Owing to privacy restrictions relating to the Coroner's Act and limitations on police time it was not possible to obtain parallel data on all suicides by jumping in the City Z region during the period 1992–2000. However, limited data were available for the period 1994–1998 from the national health statistics database.
3. From date of death data provided by the Inquest Officer and the national database of health statistics it was possible to gain access to nationally held coronial files for all suicides by jumping in City Z for the period 1994–1998. From these files a number of details about each suicide were abstracted. These data included age, gender, psychiatric status (inpatient/outpatient) and psychiatric diagnoses at the time of suicide (as noted in the Coroner's report).

Results

Suicides from Bridge A before and after the removal of safety barriers

Table 1 compares the number of deaths by suicide by jumping from Bridge A in the 4-year period (1992–1995) prior to the removal of the safety barriers with the number of deaths in the 4-year period (1997–2000) following the removal of the barriers. (Since the safety barriers were removed during 1996 data for 1996 are excluded from all analyses.) The table also provides estimates of the rate of suicide by jumping per 100 000 of the population at risk for each 4-year period. For both comparisons the population at risk was set at the estimated mid-point value of the time periods (i.e. the last quarters of 1993, 1998).

There was a substantial increase in both the number and rate of suicides by jumping from Bridge A following the removal of the safety barriers from the bridge. Prior to the removal of barriers only three suicides occurred during the preceding 4 years, compared with 15 deaths in the 4 years following the removal of barriers. Chi-squared, one-sample tests showed these differences to be highly significant (numbers, 3 *vs* 15: $\chi^2 = 8$, df = 1, $p < 0.01$; rates, 0.29 *vs* 1.29 per 100 000: $\chi^2 = 6.6$, df = 1, $p < 0.01$).

Suicides from other sites in City Z following the removal of safety barriers from Bridge A

However, the increase in suicides by jumping from Bridge A following the removal of the barriers (reported in Table 1) may not reflect a tendency for suicides by jumping to rise following the removal of the safety barriers. Rather, it could be a specific manifestation of a more general tendency for rates of suicide by jumping to increase in the City Z region. This issue is examined in Table 2 which compares the number and rate of suicides by jumping from other sites in the City Z region during the 2 years prior to, and following, the removal of barriers from Bridge A. (As explained in Method above, these comparisons are limited to a 2-year period as data on suicides in the City Z region for 1999 and 2000 are currently not available.)

Table 2 shows that, in contrast to the data for Bridge A, the number and rate of suicides by jumping from other sites tended to decline (rather than increase) after 1996. In the 2 years prior to the removal of barriers from Bridge A (1994–1995) there were 12 suicides by jumping at other sites in City Z. In the 2 years following the removal of barriers from Bridge A (1997–1998) there were seven suicides at other sites. Rates showed a similar decrease. However, these differences failed to reach significance (χ^2, one sample-tests: numbers, 12 *vs* 7: $\chi^2 = 1.4$, df = 1, $p > 0.10$; rates, 1.15 *vs* 0.61 per 100 000: $\chi^2 = 1.8$, df = 1, $p > 0.10$).

All suicides by jumping in City Z before and after the removal of safety barriers from Bridge A

Table 3 shows the pattern of suicide by jumping in City Z in the 2 years before (1994–1995) and the 2 years after (1997–1998) the removal of barriers from Bridge A. The table shows a complicated set of relationships: Overall numbers of suicides by jumping remained unchanged (14), prior to, and following, the removal of barriers from Bridge A. However, the distribution of deaths by jumping varied markedly: prior to the removal of barriers from Bridge A the majority (12/14) of suicides by jumping in City Z occurred at sites other than Bridge A; following the removal of the barriers half (7/14) of all suicides by jumping in City Z occurred at Bridge A. A χ^2 test showed a significant association between time period and site ($\chi^2 = 4.12$, df = 1, $p < 0.05$).

Table 1. Suicide by jumping from Bridge A before and after removal of safety barriers

Suicide deaths	Safety barriers *in situ* 1992–1995	Safety barriers removed 1997–2000
Number	3	15
Rate per 100 000 of population at risk	0.29	1.29

Charactersitics of those who died by suicide by jumping

To provide some contextual details on the data in Table 3 case history information was gathered from coronial records for the 28 subjects in Table 3. Salient features of this information are summarized in Table 4 which compares the characteristics of those who died by jumping from Bridge A with those who died by jumping from other sites in City Z. The table shows points of similarity and difference. The two groups appear to be generally similar in terms of age and gender. However, there are clear differences in terms of psychiatric history and status. In particular, the majority (7/9) of those who jumped from Bridge A were psychiatric inpatients (4) or in psychiatric residential care (3) at the time of their death. In addition seven out of nine had diagnoses of schizophrenia or probable schizophrenia. In contrast, of those who jumped from other sites in City Z, only a minority (3/19) were psychiatric inpatients or in psychiatric residential care and only a minority (4/19) had been diagnosed as having schizophrenic illnesses at the time of suicide. These results convey the clear impression that those dying by suicide by jumping from Bridge A were predominantly mental health patients with a diagnosis of schizophrenia. In contrast, only a minority of those jumping from other sites showed these features.

Discussion

This study has capitalized on what may be a unique natural experiment in which safety barriers were removed from a known suicide site. Although a number of studies [18,19,24,29,31] have examined the consequences of erecting barriers at popular suicide sites there appear to have been no studies which have examined the effects of the removal of such barriers. The results show some interesting (if disturbing) outcomes of this natural experiment. First and foremost, there was strong evidence to suggest that the removal of barriers from Bridge A led to a substantial increase in both numbers and rates of suicides by jumping from this bridge. There seems to be little doubt that following the removal of barriers from Bridge A there was a substantial increase in the preference for this site for suicide.

Table 2. Suicide by jumping from sites in City Z other than Bridge A, before and after removal of safety barriers from Bridge A

Suicide deaths	Safety barriers *in situ* 1994–1995	Safety barriers removed 1997–1998
Number	12	7
Rate per 100 000 of population at risk	1.15	0.61

Table 3. Suicides (n) by jumping in City Z, by site, before (1993–1995) and after (1997–1998) removal of safety barriers from Bridge A

	Site		
Time	Bridge A	All other City Z sites	Total
1994–1995	2	12	14
1997–1998	7	7	14

Table 4. Features of those who died by suicide by jumping, by site, in City Z 1994–1995, and 1997–1998

	Site	
Feature	Bridge A N = 9	Other City Z sites N = 19
Male (n)	8	14
Mean age (years)	26.3	33.9
Schizophrenia or probable schizophrenia (n)	7	4
Psychiatric inpatient/residential care at time of death (n)	7	3

Nevertheless, the increase in suicides by jumping from Bridge A does not necessarily imply that the rise was due to the removal of the barriers. It could be suggested that this rise reflected a more general increase in suicide by jumping in the City Z region. However, the available evidence clearly does not support this hypothesis. If anything, the data suggest that rates of suicide by jumping at other sites in City Z tended to decline following the removal of barriers from Bridge A. Further examination suggested a complicated state of affairs in which:

1. Overall numbers and rates of suicide by jumping in City Z remained constant prior to, and following, the removal of barriers from Bridge A;
2. Prior to the removal of barriers from Bridge A the majority of suicides by jumping in City Z occurred at sites other than Bridge A;
3. Following the removal of barriers from Bridge A the majority of suicides by jumping in City Z occurred at Bridge A.

There are two possible explanations for this pattern of suicides by jumping. The first is that the removal of barriers from Bridge A made a contribution to the overall rate of suicide by jumping in the City Z region and that had the barriers not been removed rates of suicide by jumping in City Z would have declined (as was the case for other sites). The alternative explanation is that the increase in suicides from Bridge A did not contribute to the overall rate of suicide by jumping in City Z but rather, reflected the fact that the removal of barriers had made Bridge A a more accessible and preferred site for suicide by jumping than was the case when barriers were in place.

From the available data it is not possible to distinguish between these alternative explanations. However, there are supplementary data, which suggest that the removal of barriers from Bridge A may have contributed to the overall rate of suicide by jumping in City Z. In particular, it was evident that those jumping from Bridge A were a somewhat different group from those who jumped from other sites in that the majority had a schizophrenic illness and more than half were psychiatric inpatients or patients in mental health residential care at the time of their suicide. In contrast, the majority of those who jumped from other sites did not have these features. These results tend to suggest that the removal of barriers from Bridge A may have led to an increased number of deaths by jumping among a highly vulnerable group of individuals including some who were housed immediately adjacent to the bridge.

Although it cannot be concluded unequivocally that the removal of barriers from Bridge A led to an overall increase in the rates of suicide by jumping in the City Z region, it is almost beyond dispute that this removal led to a substantial increase in the preference for Bridge A as a site for suicide by jumping, particularly amongst psychiatric patients and those with schizophrenia. These observations highlight the fact that, in retrospect, the removal of safety barriers from Bridge A was an ill-advised act. At a minimum, this removal substantially increased the accessibility of Bridge A as a site for suicide by jumping. It is also arguable that the removal of these barriers may have contributed to the overall rate of suicide by jumping in City Z by exposing a vulnerable, severely psychiatrically ill population to increased risk.

There are a number of caveats that must be imposed on this study. These relate to data availability. Because of legal issues associated with the Coroner's Act, and coronial and inquest workloads, it was not possible to obtain full coronial data for suicides by jumping in the City Z region after 1998, although data for suicides from Bridge A were available up to 2000. These restrictions on data availability reduce the statistical precision of the before and after comparisons reported in this paper. Furthermore all data are based upon official records and are subject to the liabilities and potential imprecisions of official record data. Notwithstanding these caveats, the dramatic rise in suicides by jumping from Bridge A following the removal of safety barriers is clearly evident in all of the data despite their potential limitations.

These findings are consistent with results of previous studies that have examined the effects of introducing safety barriers at known suicide jumping sites [17,18,23,28,30]. The weight of evidence from these studies clearly suggests reductions in rates of suicide by jumping from the sites following the introduction of barriers. However, the extent to which such changes lead to (i) an overall reduction in suicide or, (ii) increased preferences for other sites or methods of suicide, remains contentious [16,35]. The results of the present study showing that the removal of barriers has the opposite effect of the installation of barriers strengthens the case for barriers to be erected at known suicide sites and also suggests the need for extreme caution about the removal of barriers from such sites.

Acknowledgements

The assistance of David Fergusson and John Horwood is gratefully acknowledged.

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