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RESEARCH REPORT

Charcoal burning suicides in Hong Kong and urban Taiwan: an illustration of the impact of a novel suicide method on overall regional rates

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Objectives: Following the first case in Hong Kong in 1998, the method of committing suicide by charcoal burning has spread to other communities. This aim of this study was to examine the impact of charcoal burning suicides on both overall suicide rates and older-method suicide rates in Hong Kong and urban Taiwan.

Design: Trend analysis of the overall and method-specific suicide rates between 1997 and 2002. Comparison of age and gender profiles of those who committed suicide by charcoal burning and other methods of suicide.

Setting: Hong Kong and Urban Taiwan.

Main results: Suicides by charcoal burning increased rapidly within five years in both Hong Kong and urban Taiwan. This increase was not paralleled by decreases in suicides by older methods and led to an increase of more than 20% in the overall suicide rates. Those in the 24–39 age range were more likely to choose charcoal burning than other methods.

Conclusions: The lack of parallel decreases in the suicides rates of older methods with the rise of charcoal burning suicides suggests limited substitution between the methods. The preponderance of the rise in suicide deaths associated with charcoal burning suggests that its invention, followed by wide media dissemination, may have specifically contributed to the increase in suicides in both regions. As a similar increase was found in urban Taiwan as in Hong Kong, charcoal burning suicide should not be viewed as merely a local health problem and has the potential to become a major public health threat in other countries.

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The World Health Organization (WHO) estimated that suicide claimed about one million lives in 2001, which exceeded the number of deaths by homicide and war combined.¹ To prevent such tragic deaths, restriction of lethal means and responsible media reporting have been proposed to be two important measures.² The well-known findings of decreased suicide rates after the detoxification of domestic gas in the UK³ and the reduction of subway suicides and suicide attempts after the change in media reporting in Vienna⁴ have demonstrated the effectiveness of these two prevention strategies.

Although existing studies^{3 5 6–10} on method availability and suicide provide valuable information on prevention strategies, they have primarily focused on the effect on suicide rates when a specific method was restricted. It is also crucial, however, to examine the effect on suicide rates when a new method appears, if the emergence of its use can be clearly demarcated. Existing studies have not defined a clear distinction between the potential effects on suicide rates when a method is restricted (potentially leading to reduced rates or seeking alternative methods for suicide) and when an apparently new method is used by individuals to attempt suicide. The conceptual difference between these two scenarios is potentially significant: means restrictions can limit the range of choices but it should have no apparent impact on the size of the population actively seeking to undertake lethal suicidal acts. The emergence of a new method, however, may increase the size of that population at risk through the high availability and desirability¹¹ inherent in this new method.

The potential negative impact of medial portrayals of suicide on subsequent suicide rates has been well documented and extensively reviewed.^{12–15} Similar findings also have been reported in Japan.^{16 17} Marzuk *et al*¹⁸ report an increase in the

number of suicides by asphyxiation in New York City, a method recommended by *Final exit*, a book published in 1991 advocating voluntary euthanasia. However, there has been little discussion on the role of the everyday mass media in disseminating knowledge about methods of suicide. In the case of a new method of suicide, the effect of mass media reporting may be especially considerable, as many people can gain information about the new method's availability and desirability through such reporting. The mass media could also have "spread" the method beyond the country in which it was invented. From a public health perspective, it is important to monitor the impact of a new method on overall suicide rates in the country of origin as well as in other areas.

In October 1998, a 38 year old woman in Hong Kong committed suicide by burning barbecue charcoal in a small, sealed bedroom to create a carbon monoxide chamber. This method for killing oneself was vividly portrayed by the media as a painless, non-violent way to end one's life. The media portrayal of charcoal burning suicides has been shown to not adhere to WHO's guidelines on presenting suicide news, and the way the decedents committed suicide was described in great detail.¹⁹ Prior studies suggest the way the method was portrayed in the mass media played a key role in its rapid gain of popularity.^{20–23} Those who committed suicide by charcoal burning in Hong Kong were found more likely to be middle-aged, economically active, and without pre-existing mental illness.²¹ Subsequently, suicides by charcoal burning have been reported in predominantly Chinese communities in Taiwan and Macau,²⁴ and there have also been cases reported in Southern

Abbreviation: ICD-9, International Classification of Diseases-Ninth Revision.

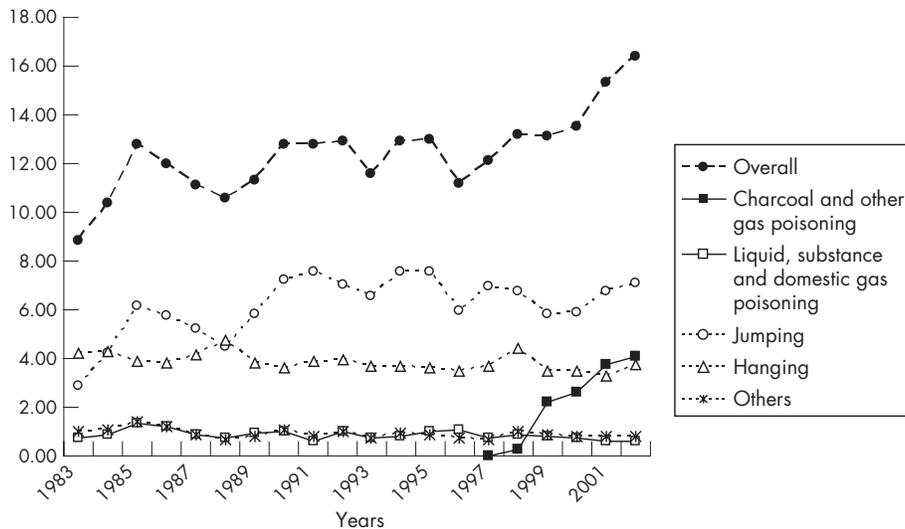


Figure 1 Overall and method-specific suicide rates, Hong Kong, 1983–2002.

China, Canada, the USA and Japan. Little is known, however, about the impact of charcoal burning suicides on overall and other method-specific suicide rates in Hong Kong and other affected populations. This study examined the impact of the emergence of charcoal burning on overall suicide rates of Hong Kong and urban Taiwan between 1997 and 2002. These two populations were chosen because they share many similarities and have frequent information exchange. We specifically focussed on the urban population of Taiwan because rural areas tend to differ from their urban counterparts in the pattern of suicide as well as methods used (for example, pesticide), and are therefore not directly comparable to the all-urban Hong Kong population. Our research questions were as follows:

- When a novel method of suicide emerges, does it become an option that draws individuals who would have used other methods and therefore lead to little changes in the overall suicide rates, or does the new method appeal to individuals who might not have used the other available methods, and therefore lead to an increase in overall suicide rates?
- Can the availability of the new method lead to substantial increases in suicide rates across geographical boundaries?

To address these questions, we examined the trends of overall suicide rates and method-specific suicide rates in Hong Kong

and urban Taiwan between 1997 and 2002. The demographic characteristics of those who committed suicide by charcoal burning and other methods in 2002 were compared.

METHODS

Suicide statistics for Hong Kong and Taiwan were made available from the Hong Kong Coroner's Court and the Department of Health of the Executive Yuan of Taiwan for 1983–2002. We adopted Tzeng and Wu's urban-rural classification²⁵ and assigned 55 Taiwan municipalities with an urbanisation level of 4 or above as urban areas. Under this classification, 52.6% of the suicide deaths over the period were regarded as taking place in an urban area.

Both regions adopted the International Classification of Diseases, Ninth Revision (ICD-9) for death registration in the study period. Under the ICD-9, there is no specific code for charcoal burning. Rather, it is incorporated in the three-digit ICD-9 code E952 that includes suicides by motor vehicle exhaust gas, other carbon monoxide, other specified gases and vapours, and unspecified gases and vapours (but excludes suicide by domestic gas poisoning, which is classified under the code E951). We reviewed the coronial documents for all suicide deaths in Hong Kong in 1998–2002 and found that 95.6% of the E952 cases were charcoal burning cases. In both urban Taiwan and Hong Kong, the E952 cases contributed to less than 2% of the annual number of suicides before the first case of charcoal

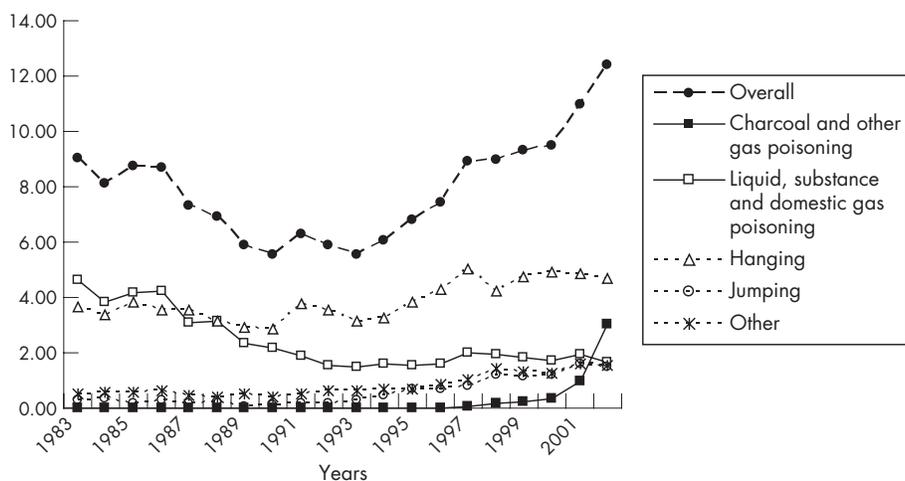


Figure 2 Overall and method-specific suicide rates, Urban Taiwan, 1983–2002.

Table 1 Estimated slope coefficients for time series of suicide rates by method used (1997–2002) in Hong Kong and urban Taiwan from log-linear regression model

	Hong Kong		Urban Taiwan	
	Estimate	p Value	Estimate	p Value
Charcoal burning and other gas poisoning	0.4582	<0.0001	0.875	<0.0001
Liquid, substance and domestic gas poisoning	-0.0607	0.0816	-0.0364	0.014
Jumping	-0.0023	0.8414	0.1022	<0.0001
Hanging	-0.0284	0.0643	-0.006	0.5182
Others	-0.0041	0.8982	0.0578	0.0008

burning suicide in 1998, suggesting a majority of the E952 cases in Taiwan were deaths most likely from charcoal burning. Unfortunately, we were unable to ascertain the proportion of charcoal burning cases among the E952 cases in Taiwan without access to the coroner's court files.

We grouped suicide methods into jumping (E957); hanging (E953); liquid, substance and domestic gas poisoning (E950 and E951); charcoal and other gas poisoning (E952); and others (E954–E956, E958 and E959). To examine whether the increase of charcoal burning suicides was associated with decreases in other method-specific rates and increases in the overall suicide rates in both locations, correlation statistics were computed among overall suicide rates, suicide rates by charcoal burning and other gas poisoning, and other method-specific rates between 1997 and 2002. Additionally, a Poisson regression model was used to test the significance of the trends for the method-specific rates within the same period. Descriptive statistics of the age and gender profiles of those who committed

suicide by charcoal burning/other gas poisoning and other methods in both regions in 2002 were provided.

RESULTS

Figures 1 and 2 show the overall suicide rates and method-specific rates from 1983 through 2002 in Hong Kong and urban Taiwan respectively. The overall suicide rates in both Hong Kong and urban Taiwan increased by more than 20% between 1998 and 2002: from 13.3 per 100 000 to 16.4 per 100 000 (23%) in Hong Kong and 8.9 per 100 000 to 12.4 per 100 000 (39%) in urban Taiwan. Among the different methods, suicides by charcoal burning and other gas poisoning showed the most substantial increase in the same period. In Hong Kong, it became the second most common suicide method within the five years following the first reported case, rising from 16 cases out of 784 suicide cases (3%) in 1998 to 276 cases out of 1109 cases (24%) in 2002. A similar rapid increase was found in urban Taiwan, with an increase from 21 cases out of 1252 cases (2%) in 1998 to 444 cases out of 1802 cases (25%) in 2002. The most substantial increase occurred between 2001 and 2002.¹

As shown in figures 1 and 2, other method-specific rates in 1998–2002 did not appear to have decreased in parallel to the increase in suicide rate by charcoal burning and other gas poisoning. Correlation analysis confirmed that the increases in charcoal burning and other gas poisoning between 1997 and 2002 in both regions were not significantly correlated with the trends in other method-specific rates ($p>0.05$). Moreover, the increase in the overall suicide rates were only correlated with the increase in the suicide rates by charcoal burning and other

¹In rural Taiwan, the number of suicide cases by charcoal burning also increased between 1998 and 2002, from 4 cases out of 921 cases (0%) in 1998 to 183 cases out of 1245 cases (15%) in 2002. The overall suicide rural suicide rate increased from 11.8 per 100 000 to 16.0 per 100 000 between 1998 and 2002.

Table 2 Number, percentage and adjusted residuals of charcoal burning and other gas poisoning and other method of suicide, by gender and age group in Hong Kong and Urban Taiwan, 2002

			Other methods			Charcoal burning and other gas poisoning		
			Observed count	% Within gender	Adjusted residual	Observed count	% Within gender	Adjusted residual
Hong Kong	Male	<15	2	0.4	0.3	1	0.5	-0.3
		15–24	57	10.4	1.3	14	7.3	-1.3
		25–39	126	23.0	-5.5	84	43.8	5.5
		40–59	200	36.5	-2.0	86	44.8	2.0
		60+	163	29.7	7.4	7	3.6	-7.4
		Subtotal	548	100	-	192	100	-
	Female	<15	3	1.1	-0.9	2	2.4	0.9
		15–24	33	11.6	0.2	9	10.7	-0.2
		25–39	58	20.4	-5.4	42	50.0	5.4
		40–59	91	32.0	-0.2	28	33.3	0.2
60+		99	34.9	5.6	3	3.6	-5.6	
	Subtotal	284	100	-	84	100	-	
	Total	832*	-	-	276	-	-	
Urban Taiwan	Male	<15	3	0.3	1.0	0	0.0	-1.0
		15–24	58	6.4	0.5	24	7.3	-0.5
		25–39	205	22.7	-8.4	156	47.3	8.4
		40–59	341	37.8	-0.9	134	40.6	0.9
		60+	295	32.7	10.0	16	4.8	-10.0
		Subtotal	902	100	-	330	100	-
	Female	<15	1	0.2	0.5	0	0.0	-0.5
		15–24	33	7.2	-0.6	10	8.8	0.6
		25–39	105	23.0	-5.0	53	46.5	5.0
		40–59	155	34.0	-1.3	46	40.4	1.3
		60+	162	35.5	6.5	5	4.4	-6.5
		Subtotal	456	100	-	114	100	-
		Total	1358	-	-	444	-	-

*Total number of suicides was 833 with one case with missing information on age. Bold text denotes adjusted residual ≥ 2 .

gases and vapours in both Hong Kong ($r = 0.96$, $p < 0.01$) and urban Taiwan ($r = 0.91$, $p < 0.01$), but not with the other suicide methods ($p > 0.05$). A Poisson regression model was fitted to detect changes in the method-specific rates over the same period. Table 1 gives the results of the estimated slope parameters. In Hong Kong, no method-specific rates changed significantly except charcoal burning and other gas poisoning, which rose precipitously ($p < 0.00$). In urban Taiwan, charcoal burning and other gas poisoning also had a very significant positive slope ($p < 0.00$). Jumping had a significant but modest increase, while liquid, substance and domestic gas poisoning showed a slight decrease.

Table 2 provides the age and gender breakdown of the methods of suicide (charcoal and other gas poisoning *v* other methods) in 2002 in Hong Kong and urban Taiwan. It shows that the excess of charcoal burning cases were found among men and women in the 24–39 years age range in both regions (that is, adjusted residual ≥ 2). There also was an excess of charcoal and other gas poisoning among men aged between 40 and 59 years in Hong Kong.

DISCUSSION

This study examined the method-specific trends of the affected populations after a new method of suicide was introduced. The data reveal that the increase in overall suicide rates of 23 and 39%, in Hong Kong and urban Taiwan respectively, after 1997 were largely attributable to the increase in charcoal burning and other gas poisoning suicides. The finding that urban Taiwan also had a substantial increase in suicides by charcoal burning and other gas poisoning confirms the view that the problem is not limited to Hong Kong.²⁴ Our results show that middle-aged people were more likely to use charcoal burning and other gas poisoning than other methods to commit suicide in both regions. Such findings give new insights into the role of environmental factors on suicide, as well as having important implications for suicide prevention strategies.

Novel method of suicide and overall suicide rates

Compared with the number of population studies^{3–7} conducted on the impact on overall suicide rates when a specific method is restricted, little research has been conducted on the impact on suicide rates when a novel suicide method becomes available. It is possibly due to the fact that such changes tend to be insidious (for example, the gradual spread of handgun ownership in the US over 150 years), and are thus neither recognised at first nor readily visible for tracking. The rapid emergence of burning charcoal indoors as a source of toxic carbon monoxide for carrying out suicide provides a unique opportunity to study the impact of method availability on overall suicide rates. While Leung *et al*²³ failed to find an increase in the overall suicide rates associated with charcoal burning suicides in Hong Kong due to their short observation period (one year after the first case of charcoal burning suicide), our study showed that the increase in suicides by charcoal burning and other gas poisoning was not paralleled by decreases in the suicide rates of older methods. The same pattern was found in urban Taiwan in the same period. Such pattern can be seen as an unfortunate “mirror image” of the British domestic gas story: Kreitman³ shows that the overall suicide rates in the UK decreased by more than 30% between 1960 and 1971, corresponding in time to the fall in the carbon monoxide content in domestic gas. While the restriction of existing means of suicide is likely to have deterred those who are at high risk of suicide, the availability of this new suicide method appears to have appealed to those who might not have committed suicide by other methods and increases the size of the population at risk.

Imitative suicides across geographical boundaries

Although prior studies^{12–17} of mass media reporting and subsequent suicide rates have demonstrated a positive relationship between the two, the magnitude of the effect is modest; as noted by Phillips,²⁶ the number of suicide in the US increased by only 3% on average after the suicide stories were publicised in his research. While these previous studies focus on story characteristics such as celebrity status of the deceased or whether the stories were based on real or fictional suicides,¹⁵ the imitation of suicide method has seldom been studied. But Schmidtke and Hafner’s²⁷ finding suggests that the potential imitative suicides tend to use the same method in the story. Still little is known about the role of the mass media in transferring knowledge about methods of suicide and therefore their potential to “export” them. Clarke and Lester,⁹ however, have already pointed out that the increase in car exhaust suicides in Britain since the beginning of the 1970s cannot be explained simply by increased opportunities, and suggest that increased knowledge about the method may have been important. Moreover, the reduction in the number of railway suicides and suicide attempts after the implementation of a media guideline in Vienna⁴ suggests the media could have a role in encouraging a specific means of suicide. In the era of the Internet and globalisation, there is ample reason to anticipate an especially rapid spread if a new method appears comparatively more acceptable to vulnerable individuals than existing methods. Compared with the modest increases of suicides after publicised suicide stories, the over 20% increase in suicide rates in both Hong Kong and urban Taiwan attributable to the reporting of charcoal burning suicides is highly substantial.

Durkheim rejected imitation as having any influence on suicide rates because he believed that imitative effects have limited geographical radiance²⁸; his 19th century observations, however, may have little relevance for our “global community” of the 21st century. One ethnographic investigation in Hong Kong showed that people chose charcoal burning because they were prompted to use the method by newspaper reports²¹: the first charcoal burning suicide victim in Taiwan explicitly stated that he learned of the method from a Hong Kong newspaper website. Alarming, the method has recently spread to non-Chinese societies: during late 2004, there was a charcoal burning suicide pact involving seven teenagers in Japan. This sparked six more charcoal burning suicide pacts resulting in 22 deaths in two months.²⁹ Hence, charcoal burning suicides should not be viewed solely as a Chinese or local health problem. We speculate that the reason Asian countries seem to be the first to be affected by charcoal burning suicides was because of the local media’s tendency to report regional news. Nonetheless, if cases of charcoal burning suicides start to take place in other regions and are widely publicised, or when one case receives wide international media attention, charcoal burning suicide may have a great impact on the suicide rates in non-Asian populations. We are concerned that the recent wave of international reports of Japanese suicide pacts using charcoal burning may already have publicised the method in other countries. There is no reason to expect that the features associated with suicide by charcoal burning—for example, easy accessibility, no body disfigurement and high lethality, should be perceived as attractive only by the Asian populations. In addition, even though we have this journalistic impression that charcoal burning suicides are still relatively rare in non-Asian populations, there is still no systematic research on the impact of charcoal burning suicides in other regions, and therefore we do not know the true extent of the problem. One difficulty lies in the absence of a specific code for suicide by charcoal burning in the latest version of the ICD. We

recommend the inclusion of suicide by charcoal burning in future revisions of the ICD to facilitate the monitoring of this potential global health problem.

At-risk groups

It is important to study the profiles of those who may be more susceptible to the new suicide method with its associated imitative potential. It has been shown that method substitution was more limited among older men than their younger counterparts when domestic gas was detoxified in the UK.³⁰ On the other hand, there is some evidence suggesting that suicide contagion tends to occur more often among young people.³¹ Yet little is known about whom, and under what circumstances, imitation is likely to influence outcome. To address this issue, it is important to study how individual characteristics interact with the ways that the suicides are portrayed. Similar to the findings of a previous study,²¹ our results show that people in the 24–39 age range were more susceptible to suicide by charcoal burning in Hong Kong. Moreover, people in this age group were also more likely to choose charcoal burning as their method of suicide in urban Taiwan. It has been suggested that charcoal burning may have “attracted” or appealed to individuals who would not have considered killing themselves were they faced with using a method that they perceived as painful or traumatic, rather than the apparently “painless” alternative of carbon monoxide poisoning from charcoal burning.²¹ Further research is needed to study why this method is particularly attractive to this population subgroup.

Implications for suicide prevention strategies

Communities, policy makers and media professionals should be made aware of the tragic experiences in Hong Kong and urban Taiwan, and try to minimise the risk of charcoal burning in increasing suicide rates. As Daigle⁸ points out, the traditional clinical and individual approach to interventions has led to an underappreciation of the importance of environmental approaches such as restriction of lethal means. The major scepticism about preventing suicide by means restriction is that when one method becomes unavailable, suicidal individuals may simply choose another. As mentioned above, there is strong and consistent evidence from international studies that restricting access to specific methods can prevent suicides.^{3 5–7 32} There are also good theoretical reasons which suggest means substitution may not be as simple as it seems. As Clarke and Lester¹¹ point out, different methods of suicide have different levels of desirability and accessibility. Given the substantial perceived differences between methods, in many cases one method may not easily replace another. In addition, a person's time of maximum suicidal potential may be of short duration: 89–93% of suicide attempters do not go on to die by suicide.^{33 34} It is reasonable to expect that the unavailability of certain methods may reduce the number of people attempting suicide, or provide a window of time to intervene as the person seeks a less convenient method.

This study shows that charcoal burning has the potential to increase suicide risk not only in Hong Kong, but also in other populations. To limit the number of potential suicides by this method should be one of the priorities of our global suicide prevention effort. Once the method became popularised in Hong Kong, it has been difficult to eradicate. A community-based approach to controlling such an apparent “epidemic” of charcoal burning is required, as means control cannot be successfully undertaken at an individual level. This approach, conceptually similar to limiting the spread of a pathogen by the vector, may well be a feasible solution to prevent charcoal

burning from establishing itself as an endemic suicide method in a community.

The difficulty is that charcoal is generally perceived as a household leisure commodity used for home barbecue. Attempts to limit its availability in Hong Kong have met with public resistance. We believe that responsible media reporting, as recommended by most international guidelines^{2 35} on the prevention of suicide, have a key role in preventing such tragic deaths. Media professionals in Asian countries should not only be made aware of the potential negative impact of the reporting of charcoal burning suicides (or any other methods of suicide that would be considered as desirable by their audience), but also their potential role in suicide prevention through responsible reporting.²⁰ Furthermore, media professionals in other regions should learn from the experiences of Hong Kong and Taiwan and exercise due care when reporting suicides, especially when any new methods are involved.

Although proactive engagement with the media to ensure judicious and responsible reporting of charcoal burning as a suicide method may help reduce the imitation effect, it likely will not suffice. One might consider limiting the sale of charcoal in Hong Kong to locations near parks where it is used for cookouts, or placing bags behind store counters to modestly reduce its accessibility, which is consistent with the United Nations' guidelines for suicide prevention.³⁵ It is certain that such efforts will not entirely suffice to prevent all such suicides.¹⁰ Yet ample evidence reveals that making a suicide means more difficult or time-consuming to obtain will have a direct effect at least on the more impulsive acts that may result in suicide deaths.³⁶

Certainly, whether charcoal burning suicide will also lead to increased suicide rates in other regions depends on the relations among suicide rates, method availability, and method acceptability, which vary from county to county. Little is known about important dimensions, such as the role of culture and opportunities of the suicidal individuals, and these are serious challenges in suicide prevention.³⁷ The apparently enhanced risk posed by a novel method of suicide such as charcoal burning underscores the need to better understand the mechanisms that drive suicidal behaviour, at both individual and broader social levels, in order to formulate more effective suicide prevention strategies.

Limitations

As we did not have access to the coroner's records in Taiwan, we could only infer that the majority of the E952 cases are charcoal burning suicides on the basis that the E952 cases only contributed to 2% of suicides before 1998. Therefore, more caution is needed in interpreting the findings on Taiwan. Further research is needed to ascertain the proportion of charcoal burning suicides in Taiwan.

The ecological nature of this study places limitations on the types of conclusions that might be drawn. Even though there was little or no change in suicides by older methods, it remains possible that rates would have increased if charcoal burning had not emerged and grown so dramatically. In essence, it still might have been possible for rates in especially vulnerable groups to have increased over the study period, albeit using “traditional” methods. However this methodological problem is not limited to studies of new methods of suicide; all prior ecological studies on means restriction have been subject to the same limitation. No doubt there are numerous factors that also may have influenced the overall trends that we describe, and it is impossible to weigh the separate potential contributions of other factors even when there is a robust correlation between charcoal usage and overall increases in rates. For example, both Hong Kong and Taiwan were hit by the Asian financial crisis of

What is already known

- When a specific means of suicide is restricted, substitution of methods is limited and often associated with a decrease in the overall suicide rate.
- Publicised suicide stories in the mass media were associated with increases in subsequent suicide rates.

What this paper adds

- The availability of a new method of suicide that is regarded as acceptable and painless, followed by wide media dissemination, can lead to a large increase in suicide rates.
- The impact of a publicised new method of suicide may be much more substantial than publicised individual suicide cases.

Policy implications

- Responsible media reporting is needed to limit the potential increase of suicides associated with novel methods of suicide.
- Policy makers in countries where charcoal burning suicides have become common should consider limiting the sale of charcoal to locations near where it is used for cookouts, or placing it behind store counters.

1997, and it is likely that it placed a large number of people into situations potentially associated with an increased risk of suicide. Nonetheless, the fact that the preponderance of the increase in deaths was associated with one specific method leads us to suggest that its initial use, followed by wide media dissemination of the method, may have been specifically linked to an increase in suicides in both regions.

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