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Suicide and Life-Threatening BEHAVIOR

ORIGINAL ARTICLE

Short- and long-term effects of a community-based suicide prevention program: A Hong Kong experience

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Abstract

Background: A multidisciplinary, multilayer, community-based suicide prevention program (2008–2012) was implemented in the Eastern District, Hong Kong. This article documents the program and reports on short- and longer-term program evaluation.

Methods: Characteristics and rates of self-harm/suicidal behaviors and suicide deaths by age group and gender in the Eastern District before, during, and after the intervention were calculated and compared with the rest of Hong Kong, using Kruskal–Wallis and chi-squared tests, and Jonckheere–Terpstra and Cochran–Mantel–Haenszel tests for trend analyses.

Results: The program impacts varied by age and gender subgroups. Suicide rates in the Eastern District were lower compared to the rest of Hong Kong during the intervention period. They slowly rebounded after the intervention ceased; nevertheless, they remained lower than the rest of Hong Kong until 2016. The rates of self-harm continuously dropped and remained lower than the rest of Hong Kong. During the intervention period in the Eastern District, the age of people who died by suicide increased; more deaths occurred from jumping and fewer by charcoal burning.

Conclusions: The program coincided with the lowered self-harm and suicide rates after the implementation. Some of the strategies need to be rebooted or routinely and continuously implemented to ensure the sustainability.

KEYWORDS

community-based intervention, multidisciplinary program, multilayer program, program evaluation, suicide prevention

INTRODUCTION

Suicide is a preventable global public health issue which can have devastating consequences for families, friends, and communities (World Health Organziation, 2019). Successful suicide prevention programs have been implemented internationally for high-risk groups to improve health status, daily living activities, family and community support, and reduce suicidal ideation, suicidal behaviors, and depression. Examples are the safeTALK Program in Australian high schools, which provided universal education and awareness programs to 16–18-year-olds (Bailey et al., 2017); interventions targeting elderly Koreans with early-stage dementia (Kim & Yang, 2017); a program in the US Air Force to improve social networks, mental health knowledge, help-seeking systems, and stigma reduction for serving troops and veterans (Knox et al., 2003); and a secondary suicide screening program in US hospital

emergency departments through phone calls to identify risk factors of suicide and promote mental well-being (Miller et al., 2017).

Fewer suicide prevention programs have been conducted to address the needs of communities with heterogeneous suicide risks. Research in Hong Kong found that multilevel design, community-based suicide prevention programs effectively reduced short-term (pre-post) intervention suicide rates (Lai et al., 2020; Wong et al., 2009). However, there are no Hong Kong studies to our knowledge which considered suicide prevention program effectiveness across districts, within age-gender subgroups, or over a longer time period.

Hong Kong, a former British Colony and a Special Administrative Region of the People's Republic of China since 1997, has one of the most rapidly ageing populations in the world (Wong & Yeung, 2019). It is a densely populated city divided into eighteen geographical districts with different socioeconomic profiles. In 2006, the Eastern District Police Commander of the Hong Kong Police Force contacted the Centre for Suicide Research and Prevention (CSRP), the University of Hong Kong, after being alarmed by increasing prevalence of suicides/self-harm attempts by young people, and the elderly. The Eastern District is located at the north-eastern part of the Hong Kong Island. In 2006, 584,300 people lived there, with 24.2% aged 0–24 years, and 13.8% aged over 65 years (Census and Statistics Department, 2007). In response, a multilevel community-based suicide prevention program was designed and implemented in the Eastern District by a partnership led by the police force (specifically the Police Negotiation Cadre (PNC)), the CSRP, the Hong Kong Hospital Authority, the Housing Department, the Social Welfare Department, Caritas Hong Kong, and volunteers (many of them were police officers). One of the authors (P. Morgan) was the Eastern Police District Commander at the time and also the Commander of the PNC. He coordinated the healthcare professionals, social workers, and working group participants and co-created the program with the director of the CSRP (P. S. F. Yip).

The program adopted a public health intervention approach and lasted for 56 months (January 2008–August 2012). It had three operational levels: *indicated* (targeting individuals at risk), *selective* (targeting at-risk subgroups), and *universal* (targeting the whole population) (World Health Organziation, 2019; Yip, 2005) and five elements:

1. support people bereaved by suicide;
2. target individuals with self-harm behaviors;
3. train gatekeepers (healthcare professionals, police officers, social workers, etc.);
4. raise community awareness; and
5. establish a referral system to social services.

The objectives, operational level details, and target beneficiaries of each intervention element are summarized in Table 1. The details of the suicide prevention program documented, and the short- and longer-term evaluation of the program have never been published in any academic journals previously.

The aims of this study are to (1) document the suicide prevention program implemented in the Eastern District in Hong Kong; (2) evaluate short-term and long-term effects of the program; (3) explore the age- and gender-specific impact of the intervention; and (4) examine changes in characteristics of suicides over the study period.

METHODS

Study period

Pre-intervention (2003–2007), Peri-intervention (2008–2012), and Post-intervention (2013–2017).

Clinical data

Self-harm/suicidal behavior records were obtained from the Hong Kong Clinical Data Analysis and Reporting System (CDARS). CDARS is an electronic registry system of all public hospital admissions in Hong Kong. Records included a diagnosis of self-harm/suicidal behaviors between January 1, 2004 and December 31, 2016 for hospital inpatient admissions or accident and emergency (A&E) departments. Inpatient admission records with International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes E950-959 and E980-989 were included in analysis. ICD diagnoses codes were not available in A&E records. Instead, an admission was considered to reflect self-harm/suicidal behaviors if the traumatic type code or poison nature code was coded as "self-harm." Small tertiary planning unit group data (STPUG) which provided residential address were extracted where available. The inpatient and A&E records were merged by a unique pseudo-patient identification number. Every year, the first record of each patient was retained.

Suicide data

Data on suicide deaths between 2003 and 2017 in Hong Kong were extracted from the Coroner's Court files. Information included primary suicide methods and demographic characteristics (age, gender, living address, marital status, housing type, receipt of Comprehensive

TABLE 1 Intervention strategies and details of the 56-month suicide prevention program in the Eastern District, Hong Kong

Interventions	Objectives	Target beneficiaries	Level of intervention
Part 1: Support group for people bereaved by suicide			
1000 cards with encouraging words such as the release of the grievance	Enhance their knowledge and awareness on the issue of suicide	People bereaved by suicide	Indicated
2000 concern kits for suicide survivors	Enhance their knowledge and awareness on the issue of suicide	People bereaved by suicide	Indicated
Survivors of suicide psycho-educational group	Provide mutual support to suicide survivors and equip them with knowledge and skills on suicide prevention	People bereaved by suicide	Selective
Trainer's manual and evaluation package	Capacity building for social workers	Social workers	Selective
Part 2: Support program for individuals with self-harm behaviors			
2000 Cheers kits for individuals with self-harm behaviors or their families and friends	Enhance their knowledge and awareness on the issue of self-harm and help seeking	Individuals with self-harm behaviors or their families and friends	Indicated
Training for health professionals	Enhance their knowledge and awareness on the issue of suicide and community resources	100 health and allied health professionals	Selective
Training for police officers	Enhance their knowledge and awareness on the issue of suicide	100 police officers	Universal
Support program for discharged young people with self-harm behaviors	Provide emotional support to the discharged young people with self-harm behaviors	40 young people with self-harm behaviors	Indicated
Part 3: Gatekeep training			
Training for housing staff	Enhance their knowledge and awareness on the issue of suicide	20 security guards, housing managers, and officers	Universal
Awareness talk for teachers and parents	Enhance their knowledge and awareness on the issue of suicide	43 parents and teachers	Selective
Training for volunteers	Enhance their knowledge and awareness on the issue of self-harm behaviors	60 volunteers	Universal
Part 4: Community education			
Talks for secondary school students	Enhance their mental health literacy	1926 students and 48 teachers	Universal
Posters and exhibition boards for community education	Raise the residents' awareness on mental health and help-seeking	Residents	Universal
Community resource card	Ease assess to the community resources	Residents	Universal
Suicide prevention roadshows	Promoting suicide prevention and ways to seek help	Residents	Universal
Part 5: Referral system			
Establishment of referral system	Develop a better-connected care service to shorten the pathway to assess social service for self-harm patients admitted to the accident and emergency department of the regional hospital	Self-harm individuals and their families and friends, suicide survivors	Indicated

Social Security Assistance (CSSA) Scheme, and living status (alone, with others)).

Population statistics

Population statistics by district were obtained from the Population and Household Statistics Analysed by District Council District 2003–2017 (Census and Statistics Department, 2003, 2005–2018). Numbers of residents were retrieved by age group and gender for the 15-year study period, from the Eastern District and the rest of Hong Kong.

Case identification

The self-harm/suicidal behaviors and suicide cases were divided into Eastern District and the rest of Hong Kong, based on living address or STPUG (where areas 148, 151–158, and 161–167 were designated as Eastern District) (Rating and Valuation Department, 2019). As only part of the STPUG, 148, 151, and 152 areas were classified as Eastern District, including these three areas provided a more conservative estimate of location.

Rates calculation

We calculated the annual rate of self-harm/suicidal behaviors per 100,000 population from 2004 to 2016, and suicide death rate per 100,000 population from 2003 to 2017, using the number of people with self-harm/suicidal behaviors, or suicide death cases, each year in the Eastern District, or the rest of Hong Kong, divided by the annual number of residents in each area. Age was classified as 0–24 years, 25–64 years, and 65+ years. Gender was classified as male or female. Gender-age-group specific rates within the study periods were explored.

Comparisons

Changes in suicide rates and/or self-harm/suicidal behavior rates over the study period were evaluated in two ways: within-Eastern District comparison using pre-intervention data and comparing this with peri- and post-intervention data; and between-group comparisons for the Eastern District with the rest of Hong Kong (pre-, peri-, and post-intervention time periods). Graphical methods compared the overall change in rates between Eastern District and the rest of Hong Kong across the study periods, as well as rate changes for gender-age groups.

Statistical analysis

Within-district and between-group comparisons of the characteristics of suicide deaths were examined using Kruskal–Wallis tests for continuous variables or chi-squared tests for categorical variables. Jonckheere–Terpstra tests (for continuous variables) and Cochran–Mantel–Haenszel tests (for binary or categorical variables) were further performed for trend analysis. Two-sided p-values were reported (significant at $p < 0.05$). All statistical analyses were conducted using SAS 9.4.

Ethics

This research was approved by the Hong Kong Coroner's Court (JUD CC 6-5/1) and the Human Research Ethics Committee (HREC) of the University of Hong Kong (EA1707016).

RESULTS

Demography

The percentage of people aged over 65 years increased in the Eastern District over the study period, from 13.8% in 2006 to 15.7% in 2012 and then to 16.5% in 2017; while the percentage of young people (0–24 years old) decreased from 24.2% in 2006 to 21.1% in 2012 and then to 21.1% in 2017 (Census and Statistics Department, 2007, 2013, 2018). There was no significant change in the percentage of males or females over time.

Figure 1 reports the self-harm/suicidal behavior rates from 2004 to 2016 from the Eastern District and the rest of Hong Kong. The intervention period (2008–2012) is highlighted in gray. There was an over-time rate decline in both groups, steeper in the Eastern District. While over-time male rates were similar between groups, women had quite different findings. The rates in the rest of Hong Kong remained relatively constant, but in the Eastern District, there was a per-100,000 population rate peak in 2006 (126.4) and 2009 (114.3), which dropped to 55.6 in 2016. The self-harm/suicidal behavior rates for young people in the Eastern District peaked in 2006, and then fell to lower than the rest of Hong Kong throughout the study period. For middle-aged people, rates in the Eastern District were higher than the rest of Hong Kong in 2004 and 2005, but then from 2006 were lower than the rest of Hong Kong for the rest of the study. The elderly rates were generally higher in the Eastern District than the rest of Hong Kong from

2004 to 2010 (except 2008). The rates then dropped in 2011 and remained consistently lower than the rest of Hong Kong ongoing.

Figure 2 summarizes the changes in suicide rates in the Eastern District and the rest of Hong Kong, from 2003 to 2017 (gray area indicating the program intervention period). In general, the overall suicide rate per 100,000 population in the rest of Hong Kong dropped steadily from a peak of 18.7 in 2003 to 12.3 in 2017. The overall suicide rate in the Eastern District increased incrementally from 2007 (pre-intervention) to 2009 (early intervention) and then dropped to a low of 9.9 in 2012. The rate in the Eastern District rebounded in the second year after the intervention ended, but it still remained below the rest

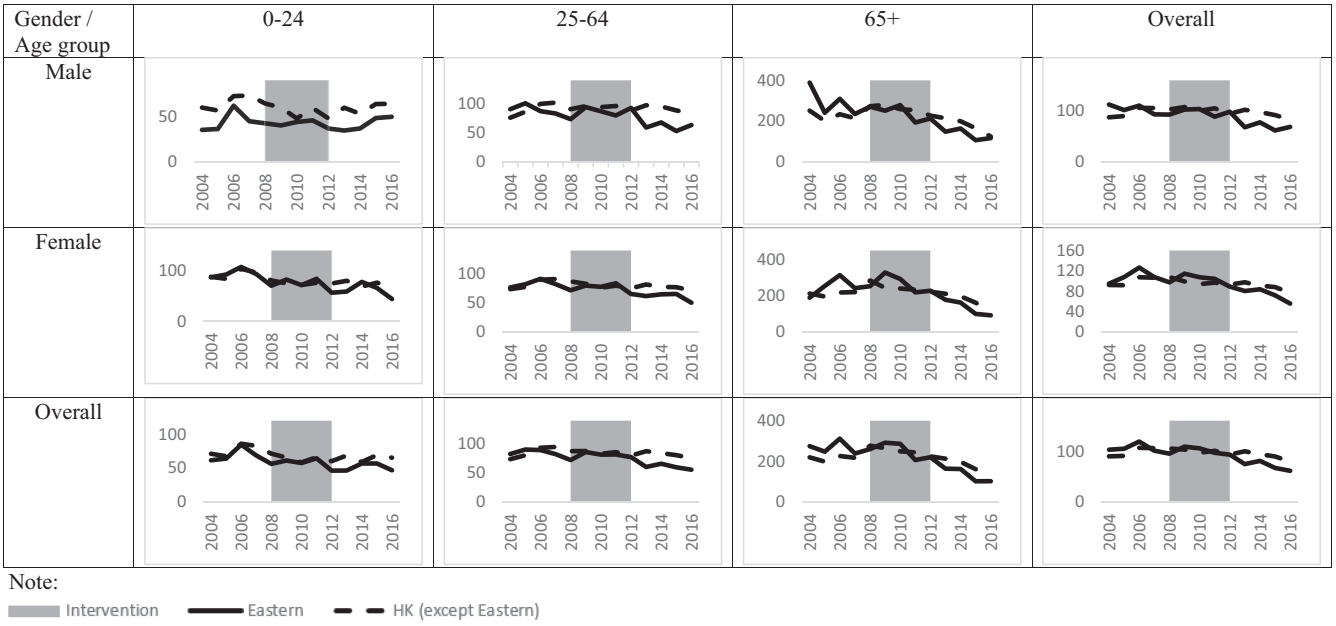

FIGURE 1 Self-harm/suicidal behavior rates in the Eastern District and the rest of Hong Kong from 2004 to 2016

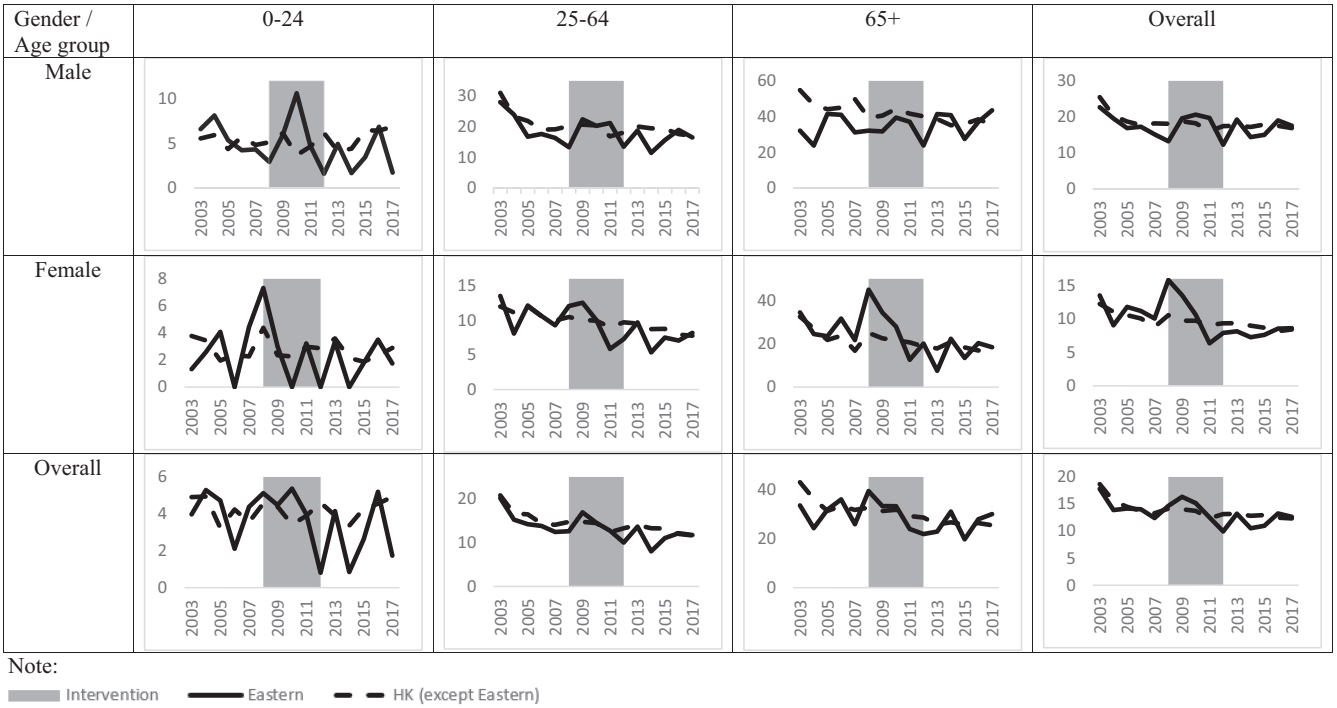

FIGURE 2 Suicide rates in the Eastern District and the rest of Hong Kong from 2003 to 2017

of Hong Kong until 2016. In both Eastern District and the rest of Hong Kong, suicide rates in the elderly were the highest, followed by middle-aged and then young people. The suicide rate in the elderly in the Eastern District was higher than the rest of the Hong Kong at the beginning of the intervention period (2008), and then the rate dropped during the intervention period to be lower than the rest of Hong Kong by the end of the intervention (2012). Suicide rates were higher in males than females in both Eastern District and the rest of Hong Kong. Male suicide rate in the Eastern District was below the rest of Hong Kong from 2003 to 2008, then increased in 2009 to peak in 2011 (19.7). It then dropped sharply to 12.3 in 2012 (lower than the rest of the Hong Kong (17.4)) and remained low. Female suicide rate in the Eastern District peaked in 2008 (15.8), being higher than the rest of Hong Kong (10.6). It dropped during the intervention period to 7.9 in 2012 compared with the rate in the rest of Hong Kong at the same time (9.4).

Table 2 reports the over-time characteristics of the people who died by suicide in the Eastern District. The number of suicide deaths dropped from 426 pre-intervention, to 403 peri-intervention, and to 343 post-intervention (five-year average crude suicide rate 14.5 pre-intervention, 13.7 peri-intervention, and 12.1 post-intervention). However, mean age increased significantly over the study period (51.7 years to 53.6 years to 57.2 years, respectively) ($p < 0.001$). Male-to-female ratio was about 3:2 over the study period. About 30% suicide cases lived in public housing and around 20% lived alone. There was a significantly lower percentage of married cases peri-intervention, and a higher percentage

TABLE 2 Characteristics of suicide deaths in the Eastern District before, during and after the intervention period

	Pre-intervention ($N = 426$)	**Peri-intervention ($N = 403$)**	**Post-intervention ($N = 343$)**	***p*-Value [a]**	***p*-Value [b]**
	Mean ± SD/*N* (%)	**Mean ± SD/*N* (%)**	**Mean ± SD/*N* (%)**		
Age (year)	51.7 ± 19.4	53.6 ± 20.0	57.2 ± 19.9	**<0.001**	**<0.001**
Male	250 (58.7)	230 (57.1)	218 (63.6)	0.18	0.20
Marital status				**<0.01**	0.41
Married	191 (46.8)	160 (41.1)	150 (44.0)		
Cohabiting	10 (2.5)	5 (1.3)	7 (2.1)		
Never married	126 (30.9)	126 (32.4)	103 (30.2)		
Divorced	31 (7.6)	29 (7.5)	39 (11.4)		
Widow	50 (12.3)	55 (14.1)	39 (11.4)		
Married but separated	0 (0)	14 (3.6)	3 (0.9)		
Type of housing				0.14	0.46
Public housing	130 (31.1)	107 (28.3)	104 (30.6)		
Public subsidized sale flats	35 (8.4)	50 (13.2)	37 (10.9)		
Private permanent housing	233 (55.7)	190 (50.3)	178 (52.3)		
Others	20 (4.8)	31 (8.2)	21 (6.2)		
Receive CSSA	50 (54.4)	30 (58.8)	20 (21.3)	**<0.001**	**<0.001**
Living alone	81 (23.0)	80 (23.4)	58 (18.8)	0.29	0.20
Methods of suicide				**<0.001**	**<0.001**
Hanging	93 (22.0)	72 (17.9)	61 (17.8)		
Jumping	219 (51.8)	229 (56.8)	201 (58.6)		
CO poisoning	80 (18.9)	57 (14.1)	32 (9.3)		
Drug overdose	5 (1.2)	9 (2.2)	12 (3.5)		
Drowning	19 (4.5)	20 (5.0)	15 (4.4)		
Others	7 (1.7)	16 (4.0)	22 (6.4)		

Note: Significant *p*-values are highlighted in bold.

[a] *p*-values for Kruskal–Wallis and chi-squared tests.

[b] *p*-values for Jonckheere–Terpstra and Cochran–Mantel–Haenszel tests.

of divorcees at post-intervention ($p < 0.01$); however, trend analysis was nonsignificant ($p > 0.05$). The percentage of suicide cases receiving CSSA dropped from over 50% pre- and peri-intervention to about 20% post-intervention ($p < 0.001$). Jumping was the most common suicide method throughout the study (increasing from 51.8% (pre-intervention) to 58.6% (post-intervention)). However, in both groups, the percentage dying by charcoal burning reduced significantly ($p < 0.001$) (Eastern District 18.9% pre-intervention to 9.3% post-intervention, the rest of Hong Kong 21.0% to 13.9%).

DISCUSSION

This paper documents and provides new information on the short- and long-term impacts of a four-year multilevel multifaceted community-based suicide prevention program implemented in the heterogeneous, densely populated (580,000 people) Eastern District of Hong Kong. During its implementation, the program coincided with the decreasing suicide rate in the studied district, compared not only with pre-intervention district rates, but also with the rest of Hong Kong. However, the effects variably continued post-intervention. This concurs with findings from other research where health promotion intervention impact deteriorates after the program ceases (Chen et al., 2015).

The program had its most obvious short- and long-term effects in decreasing suicide rates for young and middle-aged people. Given the growing elderly population in the Eastern district (Census and Statistics Department, 2018), future suicide prevention interventions should target elderly adults who have physical illnesses, living alone, and otherwise "hidden" in the community, and raise awareness among family members of their suicidal risk especially for those suffering from terminal illnesses or painful conditions (Men et al., 2020).

Over the study period, the pattern of the marital status changed, as there were slightly more divorced suicide cases in the post-intervention period compared to the pre- and peri-intervention periods. Future efforts may be required to address the suicide prevention needs of those with marital problems and those who live alone as a result of marriage breakdown, as divorce has become more a serious community concern in Hong Kong over the last decade (Law, Chan, et al., 2019). Significant decreases in the percentage of people in receipt of CSSA were observed post-intervention. Although there was missing information about CSSA, the study finding may be partially explained by a decrease in the poverty rate during the study period (from 13.0% in 2012 to 12.0% in 2017) (Government of the Hong Kong Special Administrative Region, 2013, 2018). Over the study period, the most common suicide method was jumping, suggesting that practical health promoting initiatives in restricting access to jumping locations, and secure windows in households with suicidal elderly people should be explored and considered (Center for Suicide Research and Prevention, 2020; Men et al., 2020).

Across all age groups, females benefited more than males from the intervention, potentially reflecting gender differences in the way knowledge is acquired or help-seeking behaviors initiated (Hamilton & Klimes-Dougan, 2015; Wendt & Shafer, 2014). Previous research suggested that men were less likely to seek help (Mok et al., 2020).

The impact of the suicide prevention program in the Eastern district reduced after the program ceased. This suggests that interventions may not have been promoted as actively as previously. One probable reason is high staff turnover in different participating departments in Hong Kong, which leads to knowledge attrition and communication breakdown in local districts. This potentially negatively impacted on the continued application of program knowledge by the diminishing number of staff who remained working in the district after the intervention ceased. Also, the coordinator of the program (P. Morgan) had moved to another district, and the coordination body has disestablished. However, with minimal effort and cost, some intervention strategies could be rebooted. It would be even better if some of the proposed measures can be continuously and routinely incorporated in practice; for instance, a standard district-wide referral system in hospital A&E departments or regular roadshows to broadly promote suicide prevention awareness.

Keys to success

Multidisciplinary collaborations with committed leadership were the key to program success, concurring with the findings from previous research (Lai et al., 2020; Law, Yeung, et al., 2019; Wong et al., 2009). In particular, the commitment and leadership of the Eastern Police District Commander and the CSRP was critical. Future community-based programs should incorporate a coordinating leadership role to champion the initiative and connect stakeholders, while every participant should have a clear role to ensure effective program implementation and efficient allocation of resources. The resources support from the Knowledge Fund of the University has shown to be helpful in organizing activities at district level. The current COVID-19 pandemic might potentially bring an elevated risk of self-harm/suicidal behaviors due to social isolation, loss of employment, and/or uncertainty

(Gunnell et al., 2020; Yip & Chau, 2020). This may result in unforeseen difficulties in establishing multidisciplinary collaborations for future initiatives, though these may be mitigated by strong partnerships, timely actions, and refinement and adaptation of strategies.

Multilayer interventions were also critical to program success as we are dealing with a heterogeneous population. One size does not fit all. Various kinds of interventions were specifically designed to address problems identified by the Police and CSRP. Research has shown that suicide attempters, people with self-harm behaviors, and suicide survivors have higher subsequent risk of suicide (Otsuka et al., 2015; Stallard et al., 2013; Young et al., 2012). This was the driver for the three-pronged intervention, targeting *indicated risk* (individual), *selective risk* (at-risk subgroups), and *universal* risk (whole population) (World Health Organziation, 2019; Yip, 2005). On this basis, timely referral and support programs were developed for at-risk individuals, support groups were established for at-risk groups, and community education was delivered via a range of methods to improve general population awareness and knowledge. Gatekeeper training was provided for frontline police, housing officers, and security guards, and streamlined referral processes enabled at-risk individuals to be referred efficiently by these gatekeepers to healthcare.

Study limitations

Study limitations included missing data from the Coroner's Court records and the lack of diagnostic codes in A&E medical records, where identification of self-harm patients was based on proxy indicators. The reliability of this approach is untested and may incur systematic coding bias. Moreover, only inpatient and A&E records from public hospitals in Hong Kong were included. Thus, we did not capture self-harm patients who did not go to hospital, or who only visited outpatient departments, or attended private clinics and hospitals. STPUG information was also missing in many medical records. As age and gender distribution differed between records with, and without, STPUG information, this may affect the generalizability of study findings.

CONCLUSION

A long-term (4-year) multilayered, multifaceted community-based suicide prevention program specifically developed to address needs in one heterogeneous Hong Kong district showed promising short-term reduction in overall and gender-age-group suicide rates during, and immediately after, the intervention. Suicide rates were generally lower than the rest of Hong Kong. Program impact reduced after the intervention ceased. Key to program success was the partnership between the district police force, academics, community stakeholder groups and volunteers, strong leadership from the district police commander and the Research Centre from the University, and the three-pronged health promotion strategy. Program impact differed in age-gender subgroups, indicating that different health promotion strategies may be required when targeting populations with heterogeneous suicide prevention needs. Implementing cost-effective strategies routinely and continuously is required to improve the sustainability of future health promotion programs.

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