Depression and Post-Traumatic Stress During Major Social Unrest in Hong Kong: a ten-year prospective cohort

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ABSTRACT

Background: Hong Kong has been embroiled in increasingly violent social unrest since June 2019. We examined the associated population mental health burden, risk factors and health care needs.

Methods: In a population-based prospective cohort, adult participants aged ≥18 years were assessed at nine timepoints (n=1,213 to 1,736) since 2009. Probable depression was measured using the Patient Health Questionnaire-9 (PHQ-9 score ≥10) and suspected post-traumatic stress disorder (PTSD) by the Posttraumatic Stress Disorder Checklist–Civilian version (PCL-C ≥14). We used multivariable logistic regression to identify factors associated with both outcomes. Based on routine service statistics and respondents' intention to seek professional care, we projected the number of additional ambulatory specialist psychiatric visits required.

Findings: Probable depression was reported by 11·2% (95% CI: 9·8% to 12·7%), compared to 1·9% (95% CI: 1·6% to 2·1%) during 2009-14 and 6.5% (95% CI: 5·3% to 7·6%) in 2017 after Occupy Central and prior to the current unrest. Prevalence of suspected PTSD was estimated to be 12·8% (95% CI: 11·2% to 14·4%). Age, sex, educational attainment, or household income did not predict either outcome. Heavy social media use was associated with both outcomes. Political attitude or protest participation was not associated with probable depression, but neutrality halved the risk of suspected PTSD. Family support mitigated against probable depression. We estimated that the mental health burden identified would translate into an excess 12% service requirement to the public sector queue or equivalent.

Interpretation: We have identified a major mental health burden during the social unrest in Hong Kong, which will require substantial increases in service surge capacity. Health and social care professionals should be vigilant in recognising possible mental

health sequelae. In a world of increasing unrest, our findings may have implications for service planning to better protect population mental health globally.

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Research in context

Evidence before this study

We searched PubMed, Web of Science, PsycINFO, and CINAHL Plus for studies published from the inception of each database to November 7, 2019 on collective actions and mental health. We used the following search terms with no language restrictions ((“civil disorders”[MeSH] OR “protest”[All Fields] OR “riot”[All Fields] OR “civil conflict”[All Fields] OR “revolution”[All Fields] OR “armed conflicts”[MeSH] OR “civil disobedience”[All Fields] OR “demonstration”[All Fields] OR “social movement”[All Fields] OR “political movement”[All Fields] OR “campaign”[All Fields]) AND (“mental health”[MeSH] OR “mental disorders”[MeSH] OR “depression”[MeSH] OR “depressive disorder”[MeSH] OR “post-traumatic stress disorder”[MeSH])) for PubMed, and adapted it for other databases. Only one study examined the longitudinal patterns and predictors of mental health in the general population following a collective action, which was a previous study from the present prospective cohort. We previously showed that 8·0% of the general population developed persistent moderate depression one year after 2014 Occupy Central. Depressive and posttraumatic symptoms persisted over 18 months after the 2014 Ferguson unrest for both citizens and law enforcement. Depressive symptoms increased during the 2015 Baltimore unrest and returned to baseline five months after the unrest. For post-traumatic stress disorder (PTSD), probability samples in the general population were restricted to riots, where the prevalence of PTSD ranged from 4% to 41%. Risk factors for depression and PTSD included women, lower socioeconomic status, and the level of violence and media exposure. Health service needs following a collective action are largely undocumented.

Added value of this study

Social unrest is rising globally, including in large prosperous cities such as Paris, Santiago, and Barcelona. The ongoing 2019 major social unrest in Hong Kong has spread to major cities globally with rallies having taken place in Australia, Canada, France, South Korea, UK, and US, amongst others. Using a large population-based prospective cohort with over ten years of longitudinal data, we assessed the population mental health burden, risk factors, and health care needs of the 2019 social unrest and compared the findings with baseline from 2009 and the 2014 Occupy Central protests. Here, we provide the first evidence on the high prevalence of probable depression and suspected PTSD during the major social unrest in Hong Kong. One in five adults reported probable depression or suspected PTSD during the social unrest, which is comparable to those experiencing large-scale disasters, armed conflicts, or terrorist attacks. Intense social media use, particularly social media apps widely used by protestors, was associated with both probable depression and suspected PTSD, while family support mitigated against probable depression. We estimated that the mental health burden identified would translate into an excess 12% service requirement to the public sector queue or equivalent.

Implications of all the available evidence

Despite the extensive history, social unrest as an emerging socio-political determinant of population mental health remains largely unassessed and is an important line of inquiry. To date, this is the largest and longest prospective cohort study on collective actions and mental health. Our prospective findings show a major and pervasive mental health burden during the 2019 Hong Kong social unrest. This will require substantial increases in service surge capacity in both the health and social sectors. Particularly vulnerable subgroups include those with less family support, heavy social media users,

or express strong political views. Health and social care professionals need to be vigilant in recognising possible psychiatric sequelae during and after widespread unrest. This includes potential spillover effects, where those that have not participated in the protests can be also affected. Fewer than half of affected individuals intended to seek professional care. In particular those with suspected PTSD, unmarried younger men, or low family support were also more likely to report privacy concerns that would deter them from seeking professional help. These subgroups deserve focused attention from the health and social sectors. In a world of increasing unrest, our findings may have implications for service planning to better protect population mental health globally.

INTRODUCTION

Protests, riots, and other forms of collective actions have taken place in more than 180 countries over the past half century, and these countries account for 99% of the world's population.[1-3] Social unrest is rising globally,[2] including in large prosperous cities such as Paris, Santiago, and Barcelona that have been sustained for prolonged periods in 2019 alone. Despite this extensive history and widespread geographies, social unrest as an emerging socio-political determinant of population mental health remains largely unassessed.[4]

Hong Kong is known for its longest life expectancy in the world, economic prosperity, and until most recently as a Chinese city where peaceful protests take place freely and frequently.[3,5] The two largest social unrests since Hong Kong's repatriation in 1997, indeed since the 1967 riots,[5] are the 2014 "Occupy Central/Umbrella Movement" and the ongoing 2019 social unrest triggered by the proposed extradition bill (that has since been withdrawn). While the 2014 Occupy Central Movement took inspiration from "Occupy Wall Street",[6] the ongoing 2019 unrest has inspired other protests and has spread to major cities globally with rallies supporting or in opposition of the pro-democracy movement in Hong Kong having taken place in Australia, Canada, France, South Korea, UK, and US, amongst others.[7,8] Therefore, this globalisation of protests can and does spread rapidly, including potentially the attendant mental health burden on the whole population, irrespective of protest participation per se.

The 2014 protests were a largely non-violent civil disobedience campaign that blocked parts of the city centre for 79 days with no deaths, shooting, or arson.[9] The ongoing 2019 social unrest is entering its seventh month (see Figure 1a for a chronology),

covers all districts, and has seen escalating levels of violence, involving arson, assault, vandalism but no looting.[10] The authorities have deployed tear gas, rubber bullets, and live ammunition (Figure 1b). Apart from direct physical injuries, the potential population mental health impact has not yet been reported.

Using a large population-based prospective cohort with nine waves of longitudinal data over ten years, we assessed the (1) population mental health burden, (2) risk factors, and (3) health care needs of the ongoing 2019 social unrest and compared the findings with those of the 2014 Occupy Central protests with baseline data from 2009.

METHODS

Study design and participants

Our sample was drawn from the FAMILY Cohort, a prospective population-based study of physical, mental, and social well-being at the individual, household and neighbourhood levels in Hong Kong.[11] The sampling unit was a family living in the same household. The sample was obtained by stratified random sampling of households from all 18 districts with sample sizes proportionate to each of the district populations. For each district, we obtained a random sample based on a complete list of living quarters provided by the Government Census and Statistics Department in Hong Kong.[12] The study began with enrolment of 18,045 adults and 1,488 children (aged 10-14) ("wave 1") between March 2009 and April 2011, and wave 2 took place from August 2011 to March 2014.[12] We subsequently randomly sampled members of wave 2 to measure changes in population mental health and associated factors over a ten-year period (Appendix Figure 1). To date, we have collected data at nine timepoints. Participants were surveyed at baseline (waves 1 and 2), during the 2014 Occupy Central/Umbrella

Movement (waves 3 and 4), after Occupy Central (waves 5, 6, and 7), and during the 2019 social unrest (waves 8 and 9). We oversampled young adults aged 18-35 from the cohort during Occupy Central in 2014 and the 2019 social unrest, due to higher levels of support of the protests within this demographic group.[13] We also randomly sampled additional participants aged ≥18 years from the cohort in waves 4, 7, 8, and 9 as replenishment samples over the ten-year period. In each subsequent wave, we calculated cooperation and response rates according to prevailing accepted standards.[14] Informed consent was obtained from all participants. The study was approved by the Institutional Review Board of the University of Hong Kong/Hospital Authority Hong Kong West Cluster.

Outcomes and co-variables measured

We focused on depression and post-traumatic stress disorder (PTSD) as these are the two most commonly observed mental health outcomes for collective actions, disasters, and armed conflicts.[4,15,16]

Depressive symptoms and probable depression: Probable current depression and depressive symptoms in the past two weeks were assessed using the Patient Health Questionnaire-9 (PHQ-9)[17] in all waves (see Box).

Suicidal ideation: Suicidal ideation was assessed using the ninth item of PHQ-9[17] (see Box).

PTSD symptoms and suspected PTSD: Probable current PTSD and PTSD symptoms were assessed using the 6-item Posttraumatic Stress Disorder Checklist – Civilian

version (PCL-C)[18] following the 2014 Occupy Central/Umbrella Movement (waves 5 and 6) and during the 2019 social unrest (waves 8 and 9) (See Box).

Intention to seek professional care: In wave 9, we asked participants whether they would seek professional help for health problems related to the 2019 social unrest. For those responding in the affirmative, we further enquired which specific types of health professionals (can choose more than one option), and for those responding in the negative we asked for the reasons.

Attitude towards extradition bill: We asked whether respondents had been for, against, or neutral towards the extradition bill at wave 8.

Attendance at initial mass rallies: We asked if respondents had joined in the two rallies held on June 9 and 16, 2019 (Figure 1a) at wave 8. Government approval is required for protests, rallies, or any public gathering, and many subsequent protests were declared illegal assemblies.[19] We therefore did not ask about participation in subsequent protests because this could be potentially incriminating behaviour which could lead to reporting bias.

Direct exposure to the unrest: We asked respondents whether they had witnessed or were exposed to tear gas, and whether they had witnessed violence or serious injury in relation to the unrest.

Time spent on socio-political news and events via social media was assessed at wave 9. We specifically asked about frequency of access to Facebook, Instagram, LIHKG

Forum, and Telegram. LIHKG is a local Reddit-like online forum and Telegram is an encrypted messaging app, and both are widely used social media platforms particularly among protestors.[20,21]

Family support: The Family Adaptation, Partnership, Growth, Affect, Resolve (Family APGAR) was used to assess family support at all waves.[22]

Statistical analysis

We estimated the prevalence of probable major depression, suspected PTSD, suicidal ideation, depressive symptoms, and PTSD symptoms across the nine waves of longitudinal surveys. We examined the prevalence of probable depression and suspected PTSD in various socio-demographic subgroups. To account for demographic differences between each survey sample and the underlying population, we applied post-stratification weighting and inverse probability of censoring weighting to the data. Inverse probability weighting was used to account for potential attrition bias in a prospective cohort study.[23] The censoring weights were defined as the inverse of the probability of participating in the study after wave 2, estimated using logistic regression with baseline characteristics.[24] Post-stratification weighting was then applied using raking so that each wave would be representative of the general population.[25] We then used multivariable logistic regression analysis to estimate factors associated with probable depression and suspected PTSD in wave 9 participants. We additionally adjusted for doctor-diagnosed depression or anxiety disorders prior to the unrest. Responses to the questions on help-seeking behaviour were weighted to population structure. In each analysis we used multiple imputation to handle any incomplete data,

and combined the results from 20 imputed datasets using Rubin's rule.[26] All analyses were conducted using R version 3.5.2 and MATLAB 2019b.

Role of the funding source

The funders had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; or the decision to submit the manuscript for publication. MYN, XIY, and GML had access to all the data, and all authors were responsible for the decision to submit the manuscript.

FINDINGS

After the two baseline surveys (waves 1 and 2), we followed up random subsets of 1,213-1,736 of these adults in waves 3, 4, 5, 6, 7, 8, and 9, respectively (Appendix Figure 1). The median response and cooperation rates for waves 3 to 9 were 73·4% and 73·7%, respectively (Appendix Figure 1). The demographic distribution of wave 9 conformed to the original cohort and socio-demographic differences between the weighted samples and the 2016 Hong Kong Population by-census were small[12] (Appendix Tables 1 and 2).

2019 social unrest

After weighting to account for differences between the sample and the population, we estimated that around 0·9 million adults (95% confidence interval, CI: 0·8 to 1·0 million) and 1·2 million adults (95% CI: 1·1 to 1·3 million) in Hong Kong participated in the rallies on June 9 and 16, 2019, respectively. We estimated that 20·8% and 20·9% of adults witnessed/were exposed to tear gas or witnessed violence/serious injury, respectively. In terms of social media, 21·8% were non-users, 51·2% spent less than 2

hours per day, and 27·0% spent more than 2 hours per day on socio-political news and events on social media.

*Mental health burden (Figures **2** and 3a)*

In wave 9, during the 2019 social unrest, the weighted prevalence of depressive symptoms amongst adults aged at least 18 years was 37·4% (95% CI: 35·1% to 39·7%) and suicidal ideation was 4·3% (95% CI: 3·3% to 5·2%). Probable depression was reported by 11·2% (95% CI: 9·8% to 12·7%), which was significantly higher than at any time prior (Figure 2). The prevalence of probable depression was low prior to 2014, increased considerably during the 2014 Occupy Central period, and did not appear to decline afterwards (Figure 2). In wave 7, the most recent timepoint prior to the 2019 social unrest, the weighted prevalence of probable depression was 6·5%. An increase from 1·9% at baseline (average of waves 1 and 2) to 11·2% during the unrest (wave 9) corresponds to an additional 590,000 (95% CI: 500,000 to 690,000) adults with probable depression. An increase from 6·5% at wave 7 (2017), which was the most recent timepoint before the protest, to 11·2% during the 2019 unrest (wave 9) corresponds to an additional 300,000 (95% CI: 180,000 to 420,000) adults with probable depression (or a relative increase of over 70%).

We measured PTSD symptoms in waves 5, 6, 8, and 9. In wave 5, shortly after the Occupy Central period, the prevalence of PTSD symptoms was 4·9% (95% CI: 3·7% to 6·1%), and declined to 2·1% (95% CI: 1·3% to 3·0%) in wave 6 nearly a year later (Figure 2). There were very large increases in PTSD symptoms in waves 8 and 9, during the 2019 social unrest. In wave 8, the weighted prevalence of PTSD symptoms had risen

to 16·6% (95% CI: 14·8% to 18·5%) and in wave 9 it rose even further to 31·6% (95% CI: 29·4% to 33·8%) (Figure 2). An increase from 2·1% (in wave 6) to 31·6% (in wave 9) corresponds to an additional 1·9 million (95% CI: 1·7 to 2·0 million) adults with PTSD symptoms.

The prevalence of suspected PTSD, defined with the additional requirement of direct exposure to traumatic events related to the social unrest, at wave 9 was 12·8% (95% CI: 11·2% to 14·4%) which corresponds to 810,000 (95% CI: 710,000 to 910,000) adults with suspected PTSD (Figure 3a). The combined prevalence of suspected PTSD or probable depression was 21·8% (95% CI: 19·9% to 23·7%), while the prevalence of suspected PTSD and depression co-morbidity was 2·5% (95% CI: 1·8% to 3·3%) (Figure 3a).

Risk factors of probable depression and suspected PTSD (Figures 4 and 5)

Bivariable comparisons show that older adults aged ³ 60 years, those with lower educational attainment or income reported a higher prevalence of probable depression. In contrast, the age, education attainment, and income gradients were reversed for suspected PTSD. Respondents who were economically inactive, widowed/divorced/separated had a higher prevalence of probable depression, compared to those unemployed and never married reporting the highest rates of suspected PTSD. Adjusting for other factors, those singletons who had been previously married stayed a significant predictor of probable depression, whereas the bivariable associations observed for suspected PTSD did not hold. Political attitudes towards the extradition bill, which triggered the 2019 social unrest, or participation in rallies against

the bill, appear unrelated to probable depression. However, respondents who held a neutral view on the bill or did not wish to comment and those who did not take part in either of the initial large rallies reported half the prevalence of suspected PTSD (Figure 5). Spending more than two hours every day on socio-political news via social media was strongly associated with probable depression and suspected PTSD. In particular, frequent use of Telegram was associated with both probable depression and suspected PTSD, while daily use of LIHKG was only associated with suspected PTSD (Appendix Table 3). In mitigation, family support demonstrated an inverse dose-response gradient with probable depression but not suspected PTSD.

Intention and barriers to seek health professional help

In the event that individuals developed health problems related to social unrest, participants intended to seek help from doctors, social workers, clinical psychologists, counsellors then nurses (Figure 3b). Nearly half of the weighted sample would not seek help from health care professionals. Reasons included self-management, seek help from family or friends, and the perception that health care professionals would not be able to help. Socioeconomic status, political views, or protest participation were not associated with intention to seek help (Appendix Table 4). Older adults and low family support were associated with being less likely to seek professional help. Suspected PTSD was associated with less help-seeking. In the bivariable comparisons, men and young adults were associated with more privacy concerns that would deter them from seeking professional help. Adjusting for other factors, being never married, low family support, and suspected PTSD were more likely to have privacy concerns.

Potential service need and health system capacity (Figure 3)

Taking the estimated 300,000 excess probable depressive cases associated with the 2019 social unrest, and multiplying by 45·7% who intended to seek professional care would yield around 140,000 potential new patients who needed to be seen (Figure 3c). Among potential new patients, 64% would prefer consulting a medical professional (Figure 3b). Even if only 10% of these would eventually require specialist care by a psychiatrist (with the rest being looked after in primary health and social care), around 9,000 additional initial specialist consultations would be generated. Assuming a follow-up frequency of every 16 weeks (equivalent to an average of 3 ambulatory visits over the next year), which is a common norm in the Hospital Authority, this would be roughly equivalent to 3% of the annual public sector case load (where during 2017/18, 873,141 psychiatry specialist episodes were recorded by the Hospital Authority).[27] Similarly, assuming our estimate of 810,000 suspected PTSD cases were accurate, an additional 8·8% of the public sector annual outpatient case load would be required to meet the need. Together, probable depression and suspected PTSD would roughly add an extra 12% to the public sector queue or equivalent (Figure 3c).

DISCUSSION

Our prospective findings show a high prevalence of probable depression and suspected PTSD during the 2019 social unrest in Hong Kong. Probable depression has increased by an order of magnitude from baseline, and has doubled from the 2014 Occupy Central period. PTSD symptoms increased by a factor of six compared to post-Occupy Central. One in five adults now report probable depression or suspected PTSD, which is comparable to those experiencing armed conflicts (e.g. 22.1%[16]), large-scale disasters, or terrorist attacks (e.g. 10%[15]).

Of import, these mental health consequences transcended socio-demographics. As would be expected, participation in the two initial mass rallies, which might be predictive of subsequent direct exposure to violent conflicts, were associated with more PTSD. Heavy politics-related social media use in the top tertile strongly predicted mental ill health, in particular the preferred social media apps of LIHKG and Telegram widely used by protestors,[20,21] perhaps attributable to the increasingly extreme content (including fake news) and emotional contagion through social networks.[28,29] For suspected PTSD, Telegram was also the main communication tool used in planning and disseminating protest tactics, thus likely predictive of participation which would fulfil the direct witness or exposure requirement.[30] On the contrary, the protective role of family support could be explained by its stress buffering function.[9,15]

Fewer than half of those affected intended to seek professional care; how much of the residual self-care burden would eventually become unmet need should be carefully monitored. Privacy concerns were cited by over one-fifth of those with suspected PTSD, reflecting deep mistrust of the authorities in accessing medical records for potential law enforcement purposes.[31] Indeed, some have avoided seeking medical treatment in Hong Kong due to concerns that doctor-patient confidentiality is compromised.[32]

Our estimates did not account for those under 18. Given that a substantial proportion of the protesters are believed to be teenagers, which is substantiated by the tip-of-the-iceberg arrest statistics of 15% belonging to that age group, the reported prevalence of probable depression and suspected PTSD would be the lower bound of the real population burden. Whereas our sample is representative of the general adult

population, we did not purposively sample members of the Police. The strength of the Force as at 2018 totalled 29,398[33] out of Hong Kong's total adult population of 6,320,875,[34] would translate into about 8 officers who should have been included in our sample, assuming a similar response rate by occupation which is less likely given their 12-hour shift duty rosters as part of the "force mobilisation" at present. One may however anticipate that their mental health burden would be at least that of the general population, thus potentially presenting another unmeasured downward bias of the reported estimates.

Mental health care providers should plan for a substantial increase in service needs, tentatively 12% in excess of current baseline, disregarding inpatient care and non-medical services. We used specialist psychiatric care as an illustrative example as it is the tip of the clinical iceberg. If the surge capacity at the top of the referral tree is inadequate to deal with the mental health burden, then the problem elsewhere upstream in the referral chain would be compounded by Hong Kong's underdeveloped primary care and social care for mental illness/wellness.[35,36] There are major uncertainties around this estimate given the many necessary assumptions of care seeking behavior, spectrum of psychopathology and associated sequelae, and of course the ultimate duration and disposition of the ongoing social unrest. While we have cited two major sampling deficiencies that would underestimate the burden thus care need, our survey assessment tools for depression and PTSD, particularly the latter, could have overestimated the excess burden. Probable major depression or suspected PTSD, as measured, may represent substantial psychological distress in response to an abnormal event as opposed to true psychopathology.[37,38] Nevertheless, it would be prudent to plan for a major capacity surge to deal with the anticipated service need. According to a

recent meta-analysis, 47% of patients with major depression would remain depressed by one year if left untreated.[39] For PTSD, 39·1% would suffer a chronic course,[40] with the caveat that the existing literature had been mostly based on single, well-defined events (e.g. wars, natural disasters, physical or sexual abuse) as opposed to massive social unrest.[41] While some patients may experience recovery as the social unrest tapers, others whose condition was triggered by the unrest would be unable to recover simply with a change in the external macro environment.[9,41]

Psychiatry outpatient waiting time in the public sector, which is responsible for about 76% of specialist care overall,[42] currently ranges from 17 to 64 weeks for routine appointments (accounting for 75% of all cases) across different hospitals. Two-thirds of psychiatry specialists and trainees work in the public sector with the rest in private settings. However, Hong Kong only has half the per capita psychiatry capacity as the UK, respectively 7·2 vs 14·6 psychiatrists per 100,000 population.[43] Hong Kong is under-resourced to deal with this excess mental health burden. For simplicity, we did not consider non-medical service needs nor how allied professionals could contribute to alleviating the identified need. This would require a major planning exercise across the health and social care sectors, involving both public and private providers in the mixed health and social care economy of Hong Kong.[44,45] The planning estimates in our illustrative example concern averages, but the inverse care law likely applies here in particular.[46]

A final major limitation bears mention. Despite our longitudinal design, causality between the 2019 social unrest and mental health outcomes cannot and should not be inferred. We examined associations and predictive factors rather than causes of mental

ill health as our primary objective was to identify vulnerable groups. Other caveats include the potential attrition bias of any long-term cohort. The application of censoring weights did not appreciably alter results, suggesting that attrition had little impact. Additionally, our family support and social media findings could be accounted for by depressed individuals becoming withdrawn and ruminating on unrest-related news. However, our findings remained following additional adjustment of past mental health history to mitigate the concern of pre-existing psychological vulnerabilities. Nevertheless, there could be residual confounding due to low life satisfaction or pessimism towards socio-political developments.[47]

In conclusion, our findings show a major mental health burden associated with the ongoing 2019 Hong Kong social unrest. This will require substantial increases in service surge capacity in both the health and social sectors, and in real time. Health and social care professionals need to be vigilant in recognising possible psychiatric sequelae during and after widespread unrest, opportunistically during routine interactions and systematically through deliberate planning. The high prevalence in probable depression and suspected PTSD could result in functional impairment for parenting and work, as well as substantial economic costs.[48,49] Public health measures during an unrest include health needs assessment, ensuring safety, and restoring the population's ability to engage in daily routines and community activities.[4,50] The knowledge gap regarding teenagers and police officers cannot be overemphasised and must be redressed urgently. In future, ongoing surveillance and monitoring of the mental health consequences of major social unrest, in addition to current conventions for infectious epidemics, wars, and natural disasters, should become routinised as part of preparedness efforts worldwide.

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CONTRIBUTORS

GML and MYN conceived and designed the study. MYN, CY, CL, PL, and FPF collected data. MYN, XIY, KL, and FPF analysed data. MYN, WCC, BJC, and GML interpreted data. MYN and GML wrote the first draft of the manuscript. All authors critically revised the manuscript and approved the final version.

DECLARATION OF INTERESTS

BJC has received honoraria from Sanofi Pasteur and Roche, outside the submitted work. All the other authors report no potential conflicts of interest.

DATA SHARING

Data collected for the study will not be made available to others.

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FIGURE LEGENDS

Figure 1: Chronology and the 2019 Hong Kong social unrest in numbers.

(A) Chronology of events from April to December 2019.

(B) The number of deaths, injuries, and ammunition, and the age distribution of arrestees.

Figure 2: Evolution of mental health before, during, and after major protests, 2009-2019.

(A) Weighted prevalence of depressive sequelae (PHQ-9) over the nine waves.

(B) Weighted prevalence (95% confidence interval) of probable depression, depressive symptoms and post-traumatic stress disorder (PTSD) symptoms (PCL-C) before and during the 2014 Occupy Central/Umbrella Movement and 2019 social unrest.

Figure 3: Mental health burden, intention to seek professional help, and potential service need and health system capacity during the 2019 social unrest.

(A) Weighted prevalence of mental health outcomes during the 2019 social unrest. Area of rectangles are proportional to the adult population size of Hong Kong.

(B) Intention to seek professional help among individuals with probable depression and suspected post-traumatic stress disorder (PTSD) for health problems related to the 2019 social unrest. For those responding in the affirmative, we further enquired which specific types of health professionals (can choose more than one option), and for those responding in the negative we asked for the reasons.

(C) Potential service need and health system capacity during the 2019 social unrest. Based on the mental health burden in panel (A) and the proportion of individuals with probable depression/suspected PTSD intending to seek professional care in panel (B),

we estimated the potential service need and additional case load during the social unrest.

Figure 4: Burden and risk factors of probable depression associated with the 2019 Hong Kong social unrest.

Figure 5: Burden and risk factors of suspected post-traumatic stress disorder (PTSD) associated with the 2019 Hong Kong social unrest.

Appendix Figure 1: Sampling and retention of participants in Waves 1-9, FAMILY Cohort, 2009-2019.

TABLE LEGENDS

Appendix Table 1: Demographic composition of wave **9** participants compared to the original cohort (waves **1** and 2).

Appendix Table 2: Demographic composition of wave **9** compared to 2016 Population By-census of Hong Kong.

Appendix Table 3: Social media use and current probable depression and suspected PTSD during **a** major social unrest.

Appendix Table 4: Factors associated with help seeking and privacy concerns for health problems related to social unrest.

Box: Main outcome measures used in this study

Outcome	Description
Probable current depression and depressive symptoms	PHQ-9 is a standardised nine-item scale consistent with the diagnostic criteria for major depressive episode in the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5)*. We considered PHQ-9 as a continuous depressive symptoms score (range=0-27) and a binary indicator for depressive symptoms (PHQ-9 ≥5)[17] and probable major depression (PHQ-9 ≥10).[51] Scores (range 0-27) of 0 to 4, 5 to 9, 10, or greater were used to indicate none, probable mild, or probable moderate depression, respectively.[17] The PHQ-9 has been shown to be a reliable and valid measurement for depressive symptoms in the local population.[52] We use the term *probable* as PHQ-9 is a screening instrument and not a diagnostic interview. Nevertheless, a meta-analysis has shown that a score ≥10 has a sensitivity of 88% and specificity of 85% for the diagnosis of major depression.[51] Participants' mental health history pre-dating the unrest was defined as the presence of any one of doctor-diagnosed depression or anxiety disorder by self-report.
Suicide ideation	Participants were assessed if they had thoughts that they would be better off dead, or of hurting themselves over the past two weeks. Participants providing a positive response were considered as having potential suicidal ideation. A clinical psychologist and trained staff contacted participants who reported suicidal ideation based on a standardised protocol, and provided counselling, information on community centres for mental wellness, mental health hotlines, and referral to health care professionals as appropriate.
PTSD symptoms and suspected PTSD	The PCL-C scores range from 6 to 30. A PCL-C score ≥14 has a sensitivity of 92% and specificity of 72% for PTSD.[18] A score ≥14 was therefore classified as "PTSD symptoms". A score ≥14 plus direct exposure to traumatic events related to the social unrest (i.e. witnessed violence, serious injury, tear gas, or fall from height) in accordance with DSM-5 Criterion A was

classified as suspected PTSD. We use the term *suspected* as PCL-C is a screening instrument and not a diagnostic interview and the unrest is on-going, thus suspected PTSD may represent substantial psychological distress in response to a stressful event as opposed to true psychopathology.[37,53] This is also consistent with the disease surveillance framework adopted by the World Health Organization with likelihood of diagnosis (lowest to highest) ranging from: suspected to probable to confirmed.[54]