Direct Participation in and Indirect Exposure to the Occupy Central Movement and Depressive Symptoms: A Longitudinal Study of Hong Kong Adults

The Harvard community has made this article openly available. Please share how this access benefits you. Your story matters

Citation	Ni, Michael Y., Tom K. Li, Herbert Pang, Brandford H. Y. Chan, Betty Y. Yuan, Ichiro Kawachi, C. Mary Schooling, and Gabriel M. Leung. 2016. "Direct Participation in and Indirect Exposure to the Occupy Central Movement and Depressive Symptoms: A Longitudinal Study of Hong Kong Adults." American Journal of Epidemiology 184 (9): 636–43. https://doi.org/10.1093/aje/kww103.
Citable link	http://nrs.harvard.edu/urn-3:HUL.InstRepos:41275493
Terms of Use	This article was downloaded from Harvard University's DASH repository, WARNING: This file should NOT have been available for downloading from Harvard University's DASH repository.

Original Contribution

Direct Participation in and Indirect Exposure to the Occupy Central Movement and Depressive Symptoms: A Longitudinal Study of Hong Kong Adults

Michael Y. Ni*, Tom K. Li, Herbert Pang, Brandford H. Y. Chan, Betty Y. Yuan, Ichiro Kawachi, C. Mary Schooling, and Gabriel M. Leung

* Correspondence to Dr. Michael Y. Ni, School of Public Health, Li Ka Shing Faculty of Medicine, The University of Hong Kong, Hong Kong SAR, People's Republic of China (e-mail: nimy@hku.hk).

Despite the extensive history of social movements around the world, the evolution of population mental health before, during, and after a social movement remains sparsely documented. We sought to assess over time the prevalence of depressive symptoms during and after the Occupy Central movement in Hong Kong and to examine the associations of direct and indirect exposures to Occupy Central with depressive symptoms. We longitudinally administered interviews to 909 adults who were randomly sampled from the population-representative FAMILY Cohort at 6 time points from March 2009 to March 2015: twice each before, during, and after the Occupy Central protests. The Patient Health Questionnaire-9 was used to assess depressive symptoms and probable major depression (defined as Patient Health Questionnaire-9 score ≥10). The absolute prevalence of probable major depression increased by 7% after Occupy Central, regardless of personal involvement in the protests. Higher levels of depressive symptoms were associated with online and social media exposure to protest-related news (incidence rate ratio (IRR) = 1.28, 95% confidence interval (CI): 1.06, 1.55) and more frequent Facebook use (IRR = 1.38, 95% CI: 1.12, 1.71). Higher levels of intrafamilial sociopolitical conflict was associated with more depressive symptoms (IRR = 1.05, 95% CI: 1.01, 1.09). The Occupy Central protests resulted in substantial and sustained psychological distress in the community.

depression; longitudinal study; protest; social media; social movement; social psychiatry

Abbreviations: CI, confidence interval; PHQ-9, Patient Health Questionnaire-9.

Despite the extensive history of social movements around the world, their effects on population mental health have seldom been studied. By comparison, the mental health consequences of other large-scale population events, such as natural disasters (1–4), terrorist attacks (5–8), and epidemics (9), have been much better documented (2–4). Results from these studies have indicated that mass community trauma takes a significant psychological toll; however, whether similar findings apply to social movements remains unclear. Attributes that are common to both categories of events may include disruption of services and social networks (2, 3). On the other hand, disasters or terrorist attacks that threaten the entire community can be occasions for increased solidarity, whereas social movements might exacerbate ideological divisions within the community.

Demographic factors such as younger age, female sex, and lower socioeconomic status have been identified as risk factors for postdisaster mental illness (2, 10), although the association with age appears to be contextually specific (3). In comparison, the degree of exposure to a disaster has consistently predicted postdisaster mental illness (2, 3). Indirect exposures to terrorist attacks, such as viewing television coverage of the attacks, has been linked to psychological distress (7, 11). Ruminating on negative events, for example, repeatedly viewing distressing images, could perpetuate activation of the fear circuitry in the brain and thus contribute to the development of stress responses (12, 13). Because psychologically vulnerable individuals may tend to ruminate on media coverage of disasters, this tendency could potentially confound associations between media

exposure and psychological distress (7). To control for these potential confounding influences, pre-event mental health data would be required. However, the majority of the disaster- and social movement–related literature consists of cross-sectional studies in the aftermath of the event with limited pre-event data (2, 3, 14). In cross-sectional studies, it is also difficult to determine whether psychopathology was directly related to the event or preceded the event (15). To address these limitations, longitudinal studies have been recommended in which investigators prospectively measure exposures and health outcomes before, during, and after the event (2, 4).

From September 28 to December 15, 2014, the civil disobedience campaign "Occupy Central" (latterly also known as the "Umbrella Movement"), in which protesters called for genuine universal suffrage, took place in Hong Kong (Web Figure 1, available at http://aje.oxfordjournals.org/). Major transportation arteries were blocked by camping protesters throughout the 79-day period. Contemporaneous surveys indicated that 17.6%–20.1% of respondents had participated in one way or another (16, 17). What began as a largely peaceful movement was punctuated by escalating violent episodes as the campaign wore on (18). Although hundreds of mostly minor injuries and emergency department visits related to Occupy Central were recorded (19, 20), the protests did not result in any deaths, shootings, or arson.

In the present study, we took advantage of an ongoing population-representative cohort in Hong Kong to track the evolution of psychological reactions to Occupy Central. We administered interviews at 6 time points (waves): twice each before, during, and after Occupy Central. We sought 1) to assess the prevalence of depressive symptoms and probable major depression in response to Occupy Central and 2) to examine the associations of demographic factors and exposures to Occupy Central (direct and indirect) with depressive symptoms and probable major depression.

METHODS

Study design and participants

The sample was drawn from the FAMILY Cohort, a prospective population-representative cohort study that has been described in detail previously (21). The sampling unit of the FAMILY Cohort was a family living in the same household. The sample was obtained using stratified random sampling of households from all 18 districts in Hong Kong with sample sizes proportionate to each of the district populations. Wave 1 of household visits (n = 17,002 adults) was conducted from March 2009 to April 2011, and wave 2 (n = 12,448 adults) took place from August 2011 to June 2013. The follow-up rate from wave 1 to wave 2 was 73.2%, and the Cohen's w effect size for sociodemographic differences by response status in wave 3 were small to medium (<0.3) (21). Information on individual demographic characteristics (age, sex, marital status, education, employment, and household income) was obtained from participants at wave 2 using a structured questionnaire.

A randomly drawn sample of 909 adult participants 18 years of age or older who completed both waves 1 and 2

were surveyed within the first month of Occupy Central (wave 3). No more than 1 participant was enrolled from each eligible household. Follow-up was conducted with this panel of individuals during Occupy Central (waves 3 and 4) and after Occupy Central (waves 5 and 6) using computer-assisted telephone interviews (Web Figure 2). In wave 5, we deliberately only contacted a subset of participants because the survey was conducted to estimate the prevalence of depressive sequelae in the immediate aftermath of Occupy Central; in addition, we aimed to reduce response fatigue. We calculated cooperation and response rates according to the prevailing accepted standards (22). Informed consent was obtained from all individual participants included in the study. This study was approved by the Institutional Review Board of the University of Hong Kong/Hospital Authority Hong Kong West Cluster.

Depressive symptoms and probable major depression. Depressive symptoms during the 2 weeks before the telephone interviews were assessed in waves 1–6 using the Patient Health Questionnaire-9 (PHQ-9). We focused on depression because it is one of the most commonly studied psychological sequelae of trauma and disasters (2, 3). The PHQ-9 is a standardized 9-item scale consistent with the diagnostic criteria for a major depressive episode in the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition*. The PHQ-9 is a reliable and valid tool for measuring depressive symptoms in the population of Hong Kong (23). We considered results from the PHQ-9 as a continuous depressive symptoms score (range, 0–27) and a binary indicator for probable major depression (PHQ-9 score ≥10) (24). We use the term *probable* because the PHQ-9 is a screening instrument and not a diagnostic interview. A score of 10 or greater has a sensitivity of 85% and specificity of 89% for the diagnosis of major depression (24). Participants' mental health histories before the Occupy Central protests were also ascertained in waves 1, 2, and 6 using a dichotomous index for the presence of any one of doctor-diagnosed depression, anxiety disorder, or schizophrenia.

Exposure variables. We assessed direct exposures to Occupy Central during the protests, that is, during the first month, second month, and final 2 weeks of Occupy Central. We assessed the degree of participation by respondents and their family members by measuring factors such as frequency of visiting, assembling at (e.g., sitting down at protest sites), and staying overnight at protest locations.

During the telephone interviews, we assessed indirect exposure during and after the protests as the number of hours per day spent obtaining information about Occupy Central via traditional media (television, newspaper, radio) and new media (online and social media). We specifically measured self-reported use of Facebook (Facebook Inc., Menlo Park, California), which has been the dominant form of social media in Hong Kong (25). Our measures included frequency of Facebook access and number of people "unfriended" and "unfollowed" because of Occupy Central–related posts. Because social movements may result in interpersonal conflicts beyond the protest sites, we also assessed intrafamilial sociopolitical conflict using the question, "Have you had any disputes or conflicts with family members due to social or political reasons over a defined time period (i.e. past 3

months or 1 month or 2 weeks)?" The severity of the dispute or conflict was rated from 1 (very mild) to 10 (very severe).

Statistical analysis

We estimated the prevalence of direct and indirect exposure to Occupy Central, as well as depressive symptoms and probable major depression, across the 6 study waves. We used generalized estimating equations with a log/logit link function to estimate the incidence rate ratios/odds ratios for depressive symptom score/probable major depression. The log link was used because the distribution of depressive symptom scores was similar to that of a count variable and was right-skewed. We accounted for overdispersion by assuming a negative binomial variance in the generalized estimating equations model ([26]). In the model in which we assessed change in depressive symptom score and probable major depression before and after Occupy Central, waves 1 and 2 were grouped into 1 category to serve as the baseline referent. We investigated the associations of baseline characteristics, acute direct and indirect exposures to Occupy Central, and changes in intrafamilial sociopolitical conflict with depressive outcomes during the 6 months after Occupy Central (waves 3, 4, and 6). We adjusted the models for age, sex, marital status, education, household income, occupation, baseline depressive symptom score, and the presence of pre-existing doctor-diagnosed depression, anxiety disorder, or schizophrenia. We used multiple imputation to handle incomplete data for exposures and confounders and combined the results from 20 imputed data sets using Rubin's rule ([27]). We carried out sensitivity analyses with complete case data and with inverse probability weighting to account for nonresponse during follow-up and poststratification weighting. Censoring weights were created to account for the differential probability of dropout. The weights were defined as the inverse of the probability of participating in the follow-up surveys estimated using logistic regression ([26]) with baseline characteristics, including sociodemographic characteristics and PHQ-9 score. Poststratification weighting was then applied using raking ([28]) so that each wave was representative of the population of Hong Kong. All analyses were done using R, version 3.2.1 (R Foundation for Statistical Computing, Vienna, Austria) and SAS, University Edition 2014 (SAS Institute, Inc., Cary, North Carolina).

RESULTS

Sample

In total, we followed-up with 909, 719, 353, and 684 participants in waves 3, 4, 5, and 6, respectively (Web Figure 2). The cooperation rate for wave 3 was 71.5%, and the response or cooperation rates for waves 4, 5, and 6 were higher than 70% (Web Figure 2). Cohen's w effect size for sociodemographic differences by response status in wave 3 were small to medium (<0.3). The rates of incomplete data for each variable were less than 8%. Benchmarked against the census, poorer households and those living in public housing were overrepresented, although this conformed to the demographic

distribution of the original cohort. Populations from each wave were similar to those from census data after poststratification weighting (Web Table 1).

Direct and indirect exposures to Occupy Central

For direct exposures to Occupy Central, 51.8%, 13.6%, and 2.3% of the sample visited, assembled at, or stayed overnight in protest areas, respectively. In comparison, 16.1% of the sample reported that family members had assembled or stayed overnight. Among those who assembled in protest areas during the first month, the median total number of hours assembled was 3.3 (interquartile range, 2.2–6.7). Among those who stayed overnight, the median total number of overnight stays was 2.0 (interquartile range, 1.0–5.8).

With regard to indirect exposures to Occupy Central, 24% of subjects spent 1–2 hours per day, 15.5% spent 2–3 hours per day, and 23.0% spent more than 3 hours per day on Occupy Central–related news during the first month of the protests (Web Table 2). Among users of Facebook (50.9% of the sample), 23.9% accessed it less than daily, 52.5% accessed it 1–9 times per day, and 23.6% accessed it 10 times per day or more. Of Facebook users, 5.5% and 7.9%, respectively, "unfriended" or "unfollowed" people because of Occupy Central–related posts. Intrafamilial sociopolitical conflict peaked in the first month of Occupy Central and then declined thereafter (Figure 1).

Depression

The weighted prevalence of probable major depression was 1.5% (95% confidence interval (CI): 1.0, 3.0) in wave 1, 1.6% (95% CI: 1.0, 3.0) in wave 2, 6.7% (95% CI: 5.0, 9.0)
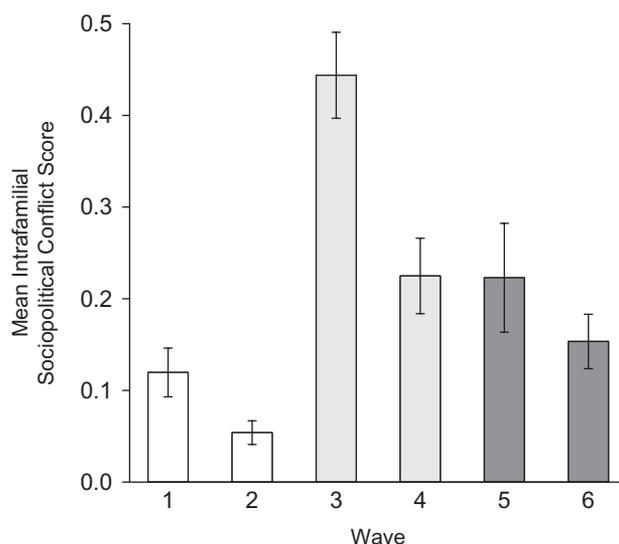
Figure 1. Trends in intrafamilial sociopolitical conflict before (white), during (light gray), and after (medium gray) the Occupy Central movement, FAMILY Cohort, 2009–2015. Mean values from weighted samples are presented. Higher scores indicate more intrafamilial sociopolitical conflict. Bars, standard errors.

in wave 3, 6.3% (95% CI: 4.5, 9.0) in wave 4, 6.8% (95% CI: 4.3, 11.0) in wave 5, and 8.5% (95% CI: 6.4, 11.0) in wave 6. The absolute prevalence of probable major depression increased by 5.1% (95% CI: 3.3, 6.9), 4.8% (95% CI: 2.8, 6.7), 5.3% (95% CI: 2.5, 8.0), and 7.0% (95% CI: 4.7, 9.2), during the first, second, third, and sixth months after the start of the protests, respectively, as compared with the time period before Occupy Central (average of waves 1 and 2) (Web Table 2). In the fully adjusted models, depressive symptom scores were higher during and after the Occupy Central protests than before the protests (Table 1). The odds of probable major depression were more than 4 times higher during and after Occupy Central than previously (Table 1).

Predictors of depression

Table 2 shows that age, sex, marital status, and education in the wave immediately preceding Occupy Central (wave 2) were not independently associated with depressive symptoms or probable major depression. Unemployment was associated with more depressive symptoms during and after Occupy Central.

Increased depressive symptoms were found regardless of whether or not the respondents personally participated in the protests (i.e., assembled or stayed overnight) (Table 3). Discordant protest participation status between respondents and their family members appeared to be associated with more depressive symptoms, although this was only evident in the sensitivity analysis with inverse probability weighting to account for nonresponse during follow-up (incidence rate ratio = 1.32, 95% CI: 1.06, 1.64). Time spent on Occupy Central–related news via traditional media of television, newspaper, and radio was not associated with depressive outcomes. By contrast, in the fully adjusted model, more intense social media use concerning Occupy Central–related news predicted more depressive symptoms (Table 3). A 1-unit increase in intrafamilial sociopolitical conflict from before Occupy Central to the first month of the protests was associated with a 5% higher depressive symptom score during the 6 months after Occupy Central. We repeated our analyses with complete cases only and

with inverse probability weighting, both of which yielded similar findings (results not shown).

DISCUSSION

To our knowledge, this is one of the first longitudinal studies in which the psychological sequelae of a major social movement have been investigated. In our population-representative sample who were prospectively enrolled several years before the Occupy Central movement, we found that a significant proportion of respondents had directly taken part in this social movement and were intensively exposed via traditional and social media. Our findings show a substantial increase in psychological distress associated with Occupy Central that persisted for at least 6 months in the aftermath of the protests. Moreover, the mental health consequences were pervasive across most socioeconomic strata and spilled over to individuals who did not personally take part in the protests.

Level of direct exposure to Occupy Central, defined as the degree of participation in the protests, was not associated with depressive outcomes 6 months after the protests. This diverges from disaster studies, in which greater exposure to the event is consistently a strong predictor of psychopathology (2, 7). Disaster exposure may serve as a proxy for the level of exposure to highly stressful or traumatic events, such as threats to life and the witnessing of disturbing events (2, 3). However, this may not apply to social movements, especially when the protests are largely nonviolent. The absence of large-scale violence may also explain the null association between time spent on television coverage of Occupy Central and depressive symptoms. Our findings contrast the mental health consequences attributed to watching television coverage of terrorist attacks, images of which are often more graphic and gruesome (7).

On the other hand, we found that increased intensity of social media use during Occupy Central predicted increased depressive symptomatology. This is consistent with the finding of higher levels of posttraumatic stress symptoms among social media users after Hurricane Sandy (29) and provides support to the hypothesis of massive-scale emotional contagion through

Table 1.   Association Between Depressive Symptoms[a] and Probable Major Depression by Survey Wave, FAMILY Cohort, 2009–2015

Wave	Time Since Occupy Central, months	Depressive Symptoms[b]		Probable Major Depression[b]	
		IRR	95% CI	OR	95% CI
1 and 2	Baseline	1.00	Referent	1.00	Referent
3	1	1.83	1.67, 2.01	4.38	2.85, 6.74
4	2	1.75	1.60, 1.92	3.97	2.52, 6.26
5	3	1.97	1.72, 2.26	4.18	2.40, 7.27
6	6	2.23	2.04, 2.44	5.62	3.63, 8.70

Abbreviations: CI, confidence interval; IRR, incidence rate ratio; OR, odds ratio.
[a] Determined by Patient Health Questionnaire-9 scores.
[b] Models were adjusted for age, sex, marital status, education, employment, and household income.

Table 2. Associations of Demographic Characteristics With Depressive Symptom Score and Probable Major Depression During and After Occupy Central, FAMILY Cohort, 2009–2015

| Baseline Characteristic (Wave 2) | Depressive Symptom Score | | | | | | Probable Major Depression | |
| | Unadjusted | | Adjusted Model 1[a] | | Adjusted Model 2[b] | | Adjusted Model 2[b] | |
	IRR	95% CI	IRR	95% CI	IRR	95% CI	OR	95% CI
Age, years[c]								
18–24	1.00	Referent					1.00	Referent
25–34	1.00	0.78, 1.28					0.90	0.43, 1.88
35–44	0.99	0.79, 1.25					0.73	0.35, 1.49
45–64	1.05	0.84, 1.30					0.86	0.44, 1.66
≥65	1.26	0.92, 1.73					1.18	0.50, 2.79
Female sex[c]	1.03	0.90, 1.19					0.78	0.53, 1.18
Marital status								
Married	1.00	Referent	1.00	Referent	1.00	Referent	1.00	Referent
Never married	1.14	0.98, 1.33	1.26	1.03, 1.54	1.12	0.92, 1.36	1.16	0.62, 2.16
Widowed, divorced, or separated	1.39	1.13, 1.70	1.23	0.99, 1.53	1.14	0.93, 1.40	1.60	0.88, 2.91
Employment								
Unemployed	1.00	Referent	1.00	Referent	1.00	Referent	1.00	Referent
Economically inactive	0.72	0.46, 1.15	0.68	0.43, 1.07	0.60	0.38, 0.95	0.40	0.12, 1.34
Employed	0.61	0.39, 0.97	0.64	0.41, 1.00	0.59	0.38, 0.92	0.49	0.15, 1.58
Education								
Primary	1.00	Referent	1.00	Referent	1.00	Referent	1.00	Referent
Secondary	0.86	0.71, 1.04	0.93	0.76, 1.14	0.94	0.77, 1.14	0.95	0.54, 1.66
Tertiary	0.76	0.63, 0.93	0.84	0.66, 1.06	0.85	0.67, 1.06	0.76	0.36, 1.61
Household income, HK$								
<10,000	1.00	Referent	1.00	Referent	1.00	Referent	1.00	Referent
10,000–19,999	0.83	0.69, 1.00	0.90	0.74, 1.09	0.95	0.80, 1.13	0.96	0.56, 1.64
20,000–39,999	0.69	0.58, 0.82	0.75	0.62, 0.89	0.83	0.70, 0.99	0.61	0.34, 1.08
≥40,000	0.68	0.56, 0.84	0.79	0.63, 1.00	0.89	0.71, 1.11	0.50	0.22, 1.15

Abbreviations: CI, confidence interval; IRR, incidence rate ratio; OR, odds ratio.

[a] Adjusted for age, sex, marital status, education, household income, and occupation.

[b] Additionally adjusted for baseline depressive symptom score and the presence of pre-existing doctor-diagnosed depression, anxiety disorder, or schizophrenia before Occupy Central.

[c] We present only unadjusted models for age and sex because these covariates could not be common causes of the exposures and outcomes.

social networks (30), especially during major events (29). An additional explanation for the association between social media use during Occupy Central and depressive symptoms relates to interactions with other online users with different ideological views (31), which could possibly lead to interpersonal conflict among friends and acquaintances. This is consistent with our findings that Facebook users "unfriended" and "unfollowed" contacts because of Occupy Central–related posts.

Our study has limitations. First, the original cohort was susceptible to sampling bias. The FAMILY Cohort enrolled complete households in which all adult members agreed to participate, thus potentially selecting better-functioning family units. However, the "healthy volunteer effect" could still have occurred if individuals were sampled instead (21). Sensitivity analysis with censoring weights showed that loss to follow-up had little influence on our results. Second, even

with our true cohort design, as opposed to a serial cross-sectional design involving different individuals, causality between Occupy Central and depression cannot be definitively inferred. However, it is difficult to wholly attribute the dramatic findings to other causes. Third, findings on interpersonal sociopolitical conflict and social media are subject to reverse causality. Depressed individuals during the protests might have experienced poorer social relationships and ruminated on Occupy Central–related news. However, we adjusted for past mental health history and baseline depressive symptoms to mitigate confounding by pre-existing psychological vulnerabilities. Fourth, we assessed depressive symptoms and major depression using a self-reported scale rather than diagnostic interviews. However, depressive symptoms are associated with functional impairment (32) and predict the onset of major depression (33). Moreover,

Table 3. Associations of Direct and Indirect Exposures to Occupy Central With Depressive Symptom Score and Probable Major Depression During and After Occupy Central, FAMILY Cohort, 2009–2015

Exposures to Occupy Central (Wave 3)	Depressive Symptom Score						Probable Major Depression	
	Unadjusted Model		Adjusted Model 1[a]		Adjusted Model 2[b]		Adjusted Model 2[b]	
	IRR	95% CI	IRR	95% CI	IRR	95% CI	OR	95% CI
Direct Exposures								
Self participation								
Did not visit	1.00	Referent	1.00	Referent	1.00	Referent	1.00	Referent
Visited	0.95	0.80, 1.11	1.03	0.87, 1.22	0.99	0.85, 1.15	1.04	0.62, 1.75
Assembled or stayed overnight	1.01	0.82, 1.24	1.16	0.92, 1.46	1.10	0.88, 1.37	0.84	0.37, 1.87
Family participation								
Concordant	1.00	Referent	1.00	Referent	1.00	Referent	1.00	Referent
Discordant	1.13	0.94, 1.36	1.20	0.99, 1.45	1.16	0.98, 1.37	1.23	0.70, 2.16
Indirect Exposures								
Television viewing, minutes per day								
None	1.00	Referent	1.00	Referent	1.00	Referent	1.00	Referent
1–59	0.80	0.60, 1.09	0.81	0.60, 1.08	0.89	0.67, 1.17	0.51	0.25, 1.06
≥60	0.93	0.68, 1.27	0.94	0.69, 1.27	1.00	0.74, 1.34	0.65	0.30, 1.39
Newspaper/radio exposure, minutes per day								
None	1.00	Referent	1.00	Referent	1.00	Referent	1.00	Referent
1–59	1.04	0.89, 1.22	1.05	0.90, 1.24	1.07	0.92, 1.25	0.92	0.56, 1.51
≥60	1.09	0.89, 1.34	1.11	0.91, 1.37	1.11	0.91, 1.35	0.96	0.52, 1.77
Online/social media exposure, minutes per day								
None	1.00	Referent	1.00	Referent	1.00	Referent	1.00	Referent
1–59	0.87	0.74, 1.02	1.01	0.85, 1.20	1.05	0.89, 1.23	0.88	0.53, 1.47
≥60	1.11	0.93, 1.32	1.40	1.15, 1.70	1.28	1.06, 1.55	1.12	0.60, 2.09
Facebook usage, times per week								
None	1.00	Referent	1.00	Referent	1.00	Referent	1.00	Referent
1–6	1.05	0.84, 1.32	1.14	0.90, 1.43	1.23	0.98, 1.54	2.19	1.18, 4.07
<10 (daily)	0.79	0.66, 0.94	0.88	0.72, 1.06	0.92	0.76, 1.10	0.63	0.31, 1.28
≥10 (daily)	1.09	0.90, 1.31	1.31	1.05, 1.63	1.38	1.12, 1.71	1.74	0.84, 3.62

Abbreviations: CI, confidence interval; IRR, incidence rate ratio; OR, odds ratio.

[a] Adjusted for age, sex, marital status, education, household income, and occupation.

[b] Additionally adjusted for baseline depressive symptom score and the presence of pre-existing doctor-diagnosed depression, anxiety disorder, or schizophrenia before Occupy Central.

the PHQ-9 has a diagnostic validity comparable to that of clinician-administered assessments (34). Fifth, waves 1 and 2 were conducted via face-to-face interviews, whereas waves 3–6 were conducted via telephone interviews. Although the same PHQ-9 was administered in all waves, the difference in mode of interview administration could have potentially led to reporting bias. However, good agreement between face-to-face and telephone-administered standardized scales when assessing depression has been reported (35), and classification of major depression by telephone-based interview has shown generally good agreement with that from face-to-face interviews in the Hong Kong Chinese population (36).

Probable major depression remained elevated by 7.0% 6 months after the start of the protests, which roughly translates into an estimated 360,000 excess cases of probable major

depression among adults in Hong Kong. However, this is likely an overestimation of the excess psychiatric burden because probable major depression may represent substantial psychological distress in response to an abnormal event as opposed to true psychopathology (4, 15). Nevertheless, health-care professionals need to be vigilant about recognizing symptoms of possible psychological distress during widespread social protests and their aftermaths. Clinicians and public health professionals should be particularly aware of potential "community spillover effects," in which even those who did not take part in the protests can experience adverse mental health outcomes.

In conclusion, the mental health consequences of the Occupy Central movement appear to be substantial and pervasive, which is remarkable given the largely nonviolent

nature of the protests. Because social movements vary considerably, longitudinal studies are needed on the health impact of future social movements. Studies should consider leveraging existing cohorts (1, 8) in order to have pre-event exposures and medical histories prospectively assessed and to facilitate early data collection from a population-representative sample. Factors that predict psychological responses during a social movement could be identified, including social media behaviors. With the decline in armed conflicts and the continued emergence of social movements globally (37), the mental health impact of social movements could become a timely and important field of inquiry.

REFERENCES

1. Fergusson DM, Horwood LJ, Boden JM, et al. Impact of a major disaster on the mental health of a well-studied cohort. *JAMA Psychiatry*. 2014;71(9):1025–1031.
2. Goldmann E, Galea S. Mental health consequences of disasters. *Annu Rev Public Health*. 2014;35(1):169–183.
3. Norris FH, Friedman MJ, Watson PJ, et al. 60,000 disaster victims speak: Part I. An empirical review of the empirical literature, 1981–2001. *Psychiatry*. 2002;65(3):207–239.
4. North CS. Current research and recent breakthroughs on the mental health effects of disasters. *Curr Psychiatry Rep*. 2014; 16(10):481.
5. Perlman SE, Friedman S, Galea S, et al. Short-term and medium-term health effects of 9/11. *Lancet*. 2011;378(9794): 925–934.
6. Galea S, Ahern J, Resnick H, et al. Psychological sequelae of the September 11 terrorist attacks in New York City. *N Engl J Med*. 2002;346(13):982–987.
7. Schlenger WE, Caddell JM, Ebert L, et al. Psychological reactions to terrorist attacks: findings from the National Study of Americans' Reactions to September 11. *JAMA*. 2002; 288(5):581–588.
8. Silver RC, Holman E, McIntosh DN, et al. Nationwide longitudinal study of psychological responses to September 11. *JAMA*. 2002;288(10):1235–1244.
9. Leung GM, Ho LM, Chan SK, et al. Longitudinal assessment of community psychobehavioral responses during and after the 2003 outbreak of severe acute respiratory syndrome in Hong Kong. *Clin Infect Dis*. 2005;40(12):1713–1720.
10. Maguen S, Neria Y, Conoscenti LM, et al. Depression and prolonged grief in the wake of disasters. In: Neria Y, Galea S, Norris FH, eds. *Mental Health and Disasters*. New York, NY: Cambridge University Press; 2009:116–130.
11. Holman EA, Garfin DR, Silver RC. Media's role in broadcasting acute stress following the Boston Marathon bombings. *Proc Natl Acad Sci USA*. 2014;111(1):93–98.
12. Marshall RD, Bryant RA, Amsel L, et al. The psychology of ongoing threat: relative risk appraisal, the September 11 attacks, and terrorism-related fears. *Am Psychol*. 2007;62(4): 304–316.
13. Parsons RG, Ressler KJ. Implications of memory modulation for post-traumatic stress and fear disorders. *Nat Neurosci*. 2013;16(2):146–153.
14. Hanson RF, Kilpatrick DG, Freedy JR, et al. Los Angeles County after the 1992 civil disturbances: degree of exposure and impact on mental health. *J Consult Clin Psychol*. 1995; 63(6):987–996.
15. North CS, Pfefferbaum B. Research on the mental health effects of terrorism. *JAMA*. 2002;288(5):633–636.
16. Centre for Communication and Public Opinion Survey. *Public Opinion & Political Development in Hong Kong: Survey Results*. Shatin, Hong Kong: The Chinese University of Hong Kong; 2014. http://www.com.cuhk.edu.hk/ccpos/images/news/TaskForce_PressRelease_141218_English.pdf. Published December 18, 2014. Accessed June 8, 2015.
17. Public Opinion Programme. Survey on CE Election and Occupy Central Campaign. Kennedy Town, Hong Kong: The University of Hong Kong; 2014. http://hkupop.hku.hk/english/report/mpCEnOCCw7/index.html. Published November 10, 2014. Updated September 27, 2016. Accessed July 22, 2015.
18. BBC News. *Hong Kong Protests: What changed at Mong Kok?* http://www.bbc.com/news/world-asia-china-29054196. Published December 3, 2014. Accessed July 7, 2015.
19. Apple Daily. *More than 470 injury cases in emergency medical service due to Occupy Central* (in Chinese). hk.apple.nextmedia.com/realtime/news/20141129/53178553. Published November 29, 2014. Accessed January 11, 2016.
20. Cheng K, Lau K. Protest probe: top cop speaks. *The Standard*. http://www.thestandard.com.hk/section-news.php?id=152398&story_id=43546869&d_str=20141216&sid=11. Published December 16, 2014. Accessed January 12, 2016.
21. Leung GM, Ni MY, Wong PT, et al. Cohort profile: FAMILY Cohort [published online ahead of print January 23, 2015]. *Int J Epidemiol*. (doi:10.1093/ije/dyu257).
22. American Association for Public Opinion Research. *Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys*; 2015. http://www.aapor.org/AAPOR_Main/media/publications/Standard-Definitions20169theditionfinal.pdf. Published April 2015. Revised 2016. Accessed January 3, 2016.
23. Yu X, Tam WW, Wong PT, et al. The Patient Health Questionnaire-9 for measuring depressive symptoms among the general population in Hong Kong. *Compr Psychiatry*. 2012;53(1):95–102.
24. Manea L, Gilbody S, McMillan D. Optimal cut-off score for diagnosing depression with the Patient Health Questionnaire (PHQ-9): a meta-analysis. *CMAJ*. 2012;184(3):E191–E196.

25. Lam L. Facebook is Hong Kong's top digital platform in survey commissioned by company. *South China Morning Post*. August 22, 2014. http://www.scmp.com/news/hong-kong/article/1578755/facebook-citys-top-digital-platform-survey-commissioned-company. Accessed August 31, 2015.
26. Fitzmaurice GM, Laird NM, Ware JH. *Applied Longitudinal Analysis*. Hoboken, NJ: John Wiley & Sons; 2012.
27. Rubin DB. *Multiple Imputation for Nonresponse in Surveys*. New York, NY: John Wiley & Sons; 2009.
28. Lumley T. *Complex Surveys: A Guide to Analysis Using R*. New York, NY: John Wiley & Sons; 2011.
29. Goodwin R, Palgi Y, Hamama-Raz Y, et al. In the eye of the storm or the bullseye of the media: social media use during Hurricane Sandy as a predictor of post-traumatic stress. *J Psychiatr Res*. 2013;47(8):1099–1100.
30. Kramer AD, Guillory JE, Hancock JT. Experimental evidence of massive-scale emotional contagion through social networks. *Proc Natl Acad Sci USA*. 2014;111(24): 8788–8790.
31. Bakshy E, Messing S, Adamic LA. Political science. Exposure to ideologically diverse news and opinion on Facebook. *Science*. 2015;348(6239):1130–1132.
32. Kessler RC, Zhao S, Blazer DG, et al. Prevalence, correlates, and course of minor depression and major depression in the National Comorbidity Survey. *J Affect Disord*. 1997;45(1):19–30.
33. Lewinsohn PM, Solomon A, Seeley JR, et al. Clinical implications of "subthreshold" depressive symptoms. *J Abnorm Psychol*. 2000;109(2):345–351.
34. Spitzer RL, Kroenke K, Williams JB, et al. Validation and utility of a self-report version of PRIME-MD: the PHQ primary care study. *JAMA*. 1999;282(18):1737–1744.
35. Evans M, Kessler D, Lewis G, et al. Assessing mental health in primary care research using standardized scales: can it be carried out over the telephone? *Psychol Med*. 2004;34(1): 157–162.
36. Lee S, Tsang A, Mak A, et al. Concordance between telephone survey classification and face-to-face interview diagnosis of one-year major depressive episode in Hong Kong. *J Affect Disord*. 2010;126(1):155–160.
37. Ortiz I, Burke S, Berrada M, et al. *World Protests 2006–2013*. New York, NY: Initiative for Policy Dialogue, Columbia University; 2013. http://policydialogue.org/files/publications/World_Protests_2006-2013-Complete_and_Final_4282014.pdf. Accessed September 29, 2016.