

## COVID-19-induced health inequality exists even in a city where disease incidence is relatively low. A telephone survey in Hong Kong, China

### Abstract

**Background** When we focus on the number of COVID-19 incident cases, the expected social gradient in health prevalent in many other countries did not seem to exist in Hong Kong. Nevertheless, the COVID-19 epidemic in Hong Kong could have exerted wider impact on the social determinants of health which may in turn lead to health inequalities more generally. This study examined whether COVID-19 could induce inequalities in social conditions and health in Hong Kong, where there has been a relatively low COVID-19 incidence.

**Methods** Based on a previous random sample of 2,282 household adult respondents aged 18 or above in Hong Kong, 752 participated in the telephone survey. We examined the demographic and socioeconomic factors, worry of COVID-19, general physical and mental health, economic activity, and personal protective equipment and related hygiene practice by deprivation status, which was measured by a 21-item Deprivation Index. The associations between deprivation and three potential negative COVID-19-related issues (i.e., low reserve of face masks in the household, worried about coronavirus, and change of economic activity) were then analyzed using univariate and multivariable binary logistic regressions. The associations of the three negative COVID-19-related issues with health were also analyzed using univariate and multivariable linear regressions to determine which of the negative COVID-19-related issues might be a potential mediator of the association between deprivation and health. Path analysis in the form of multivariable linear regression was finally carried out to determine the direct effect of deprivation, and the indirect effects of deprivation via negative COVID-19-related issues on health.

**Results** Deprived individuals were more likely to have job loss or instability, less reserves, less utilization and more concerns over the supply of personal protective equipment including face masks. Even after adjustments for confounders, being deprived was associated with having greater risk of low reserve of face masks in the household, being worried about the disease, and job loss/instability after the COVID-19 outbreak. Also, the deprived had worse physical ( $\beta = -0.154$ ,  $p < 0.001$ ) and mental health ( $\beta = -0.211$ ,  $p < 0.001$ ), and being deprived had a significant indirect effect on mental health via worry about the disease and job loss/instability (total indirect effect:  $\beta = -0.036$ ,  $p = 0.004$ ; proportion of effect being mediated = 14.70%).

**Conclusions** Even in a population where the COVID-19 incidence was kept at a relatively low level, health inequality exists and can be exacerbated by the pandemic through people's real concerns over livelihood and economic activity, which were severely affected by the public health-related laws, policies, and measures. We should look beyond the incidence to address and reduce COVID-19-induced health inequalities in the wider society.

**Keywords:** COVID-19; Coronavirus; Social determinants of health; Health equity; Poverty; Deprivation; Hong Kong; Chinese

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## INTRODUCTION

The coronavirus disease 2019 (COVID-19) pandemic continues to be rampant, resulting in more than 20 million cases and 0.73 million deaths worldwide as of mid-August<sup>1</sup>. With the tremendous disease burden, a growing body of evidence suggested that the COVID-19 pandemic exposes and exacerbates inequalities in health<sup>2,3</sup>. In countries with severe COVID-19 outbreaks, a higher rate of incidence or deaths has been widely observed in the socially vulnerable groups including people of lower socioeconomic position<sup>4,5</sup> and communities of colour<sup>6-8</sup>. Specifically, the Office for National Statistics in the United Kingdom reported a higher COVID-19 mortality rate among low-skilled frontline workers who tend to have lower income and opportunity to work from home<sup>9</sup>. Similar elevated mortality risk also applies to people of Black ethnicity, with about half of the inequality across ethnic groups attributable to their differences in socioeconomic circumstances<sup>10</sup>. However, such a social patterning may not be readily observed when the spread of COVID-19 is under better control. While the social inequality in terms of COVID-19 incident cases is usually less apparent in regions with fewer confirmed cases, the question is whether there are really no health inequalities due to COVID-19 in these regions.

Hong Kong, a densely populated coastal city located in Southern China with around 7.5 million people<sup>11</sup>, can serve as an exemplary setting to address the above question given its relatively low incidence of COVID-19 compared to other world regions being hard hit by the pandemic. Before the resurgence of local cases since early July 2020, local spread of COVID-19 was sporadic and most of the incident cases were imported<sup>12</sup>. Starting from late January 2020, cases were primarily imported by visitors from Wuhan, China and then by travelers and return-students studying overseas, leading to a minor surge in local cases between mid-March and mid-April 2020 of around 875 new cases (cumulative cases rose from 143 on 15 March 2020 to 1,017 on 15 April 2020). Afterwards, the COVID-19 epidemic maintained at a low level until late June with less than 200 new confirmed cases (cumulative cases rose from 1,017 on 15 April 2020 to 1,206 on 30 June 2020) and only about 20 cases related to local spread over the period<sup>12</sup>. Most of these imported cases, however, tended to be people of a higher socioeconomic position who can afford travelling and studying abroad. With limited spread from imported cases to the local community by early July, the COVID-19 disease burden in Hong Kong appears to be significant in the higher socioeconomic group<sup>13</sup>. Therefore, the expected social gradient in health did not seem to exist in Hong Kong when we focus only on COVID-19-specific outcomes. Nonetheless, the COVID-19 epidemic in Hong Kong could have exerted wider impact on the social determinants of health that in turn lead to health inequalities more generally<sup>2</sup>. In light of this, the present study examines whether COVID-19 could induce any inequalities in social conditions and health in Hong Kong, where there has been a relatively low COVID-19 incidence.

## METHODS

### Subjects and methods

Participants were from a previous longitudinal study entitled “*Trends and Implications of Poverty and Social Disadvantages in Hong Kong: A Multi-disciplinary and Longitudinal Study*”, which initially consisted of 2,282 household respondents aged 18 or above from a random sample of all households in Hong Kong. Procedures of the study had been described previously elsewhere<sup>14-18</sup>. Of all these participants, 1,855 respondents in 2014 agreed to provide their contact numbers for participation in future research. Telephone survey was carried out from 20 April to 11 May 2020 by the Centre for Epidemiology and Biostatistics of the Chinese University of Hong Kong, during which the average daily number of incident case was 1.09<sup>12</sup>. Interviews were carried out by experienced interviewers between 10:00 and 20:00 on weekdays. Prior appointments were arranged for suitable subjects in other periods including weekends and public holidays. Among the 1,855 dialed telephone numbers, 522 were unanswered and 239 were invalid.

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**Commented [MOU7]:** And that there were stringent containment measures which impacted on the whole population and economic activity

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**Commented [MOU9]:** through unequal socioeconomic impacts as a result of containment measures.

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i) susceptibility to infection  
ii) vulnerable from the effect of the interventions in control  
iii) distributive effect of socioeconomic mitigation

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Among the 1,094 answered calls, 332 refused to join the study, 8 and 2 were excluded due to health problem or passed away, resulting in a final sample of 752 respondents. The response rate was 69%.

## Measurements

Information on demographic factors, socioeconomic factors (i.e., educational level, social security status, income-poverty, deprivation), economic activity, personal protective equipment and personal hygiene, as well as impact on well-being and health during the COVID-19 outbreak in Hong Kong were collected.

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### *Demographic factors*

Information on age, sex, marital status, number of people within the household, household composition, and place of birth were collected. Particularly, for household composition, we asked about whether the household had younger persons 16 or under who were legally not allowed to be left at home alone, adults with chronic disease or disability, and/or older persons aged 65 or above. These categories of household members are likely to be associated with greater caregiving burden.

### *Socioeconomic factors*

Information on educational level, social security status, income-poverty, and deprivation were collected. Anyone receiving the means-tested comprehensive social security assistance would be regarded as a recipient of social security. Income-poverty was measured by equivalised household income, which was derived by dividing household income by the square root of household size. This allows for economies of scale when comparing different sized households<sup>19</sup>. Respondents were asked to estimate their total pre-tax monthly household income including social security benefits. People whose equivalised monthly household incomes fell below half of sample's median equivalised household monthly income (HK\$5,250) were classified as "Poor", whereas those above were classified as "Non-poor".

In addition to income-poverty, we also collected information regarding the participants' relative deprivation, which had been consistently shown to have stronger association with health outcomes than income-poverty in Hong Kong<sup>14,16</sup>. Following Townsend's theory of relative deprivation, which has been defined as a lack of command over resources covering material and social necessities<sup>20</sup>, a 21-item Deprivation Index (DI) was adopted to assess whether respondents could (not) afford a range of items which were considered to be necessities by the majority of the adults in Hong Kong. Four of these items were measures of social deprivation, while the remaining 17 items were measures of material deprivation including food deprivation (3 items), clothing deprivation (3 items), medical care deprivation (3 items), household facilities and equipment (5 items), repair and maintenance (2 items), and finance (1 item). The DI showed a high reliability with the Cronbach alpha at 0.832. A DI score of 2 or above was considered "Deprived." Details on validity and reliability of the DI had been described previously<sup>14</sup>.

### *Economic activity*

Information on general economic activity status and change of status after the COVID-19 outbreak were collected. Particularly for those under employment, including the full-time and part-time employees and self-employed, information on their general economic activity (including salary mode, having paid annual/sick leave or not, and place of work), as well as changes of their activity after the emergence of the

COVID-19 outbreak (including number of days working outside and from home, change of income, whether being forced to take unpaid leave, and their perceived impact on livelihood if they stopped going out to work) were collected.

#### *Personal protective equipment and personal hygiene practice*

Information on availability of personal protective equipment (PPE) commonly regarded as essential in protecting against the disease (i.e., face mask hand sanitizer) and the corresponding behavioral practice were collected. In particular, these include current mask reserves in the household, difficulty in buying masks, worry about supply, and days of wearing mask and using hand sanitizer in the past week.

#### *Impact on well-being and health*

We asked how much they worried about the COVID-19 in general. In addition, physical and mental health-related quality of life (HRQOL) was assessed using the 12-item Short-Form Health Survey version 2 (SF-12 v2), which had been validated for the Hong Kong Chinese population<sup>21</sup>. The instrument covered eight domains which were used to derive two distinct continuous summary scores, physical component summary (PCS) for physical health and mental component summary (MCS) for mental health. We applied a norm-based scoring algorithm with reference to the data from a Hong Kong general population survey<sup>22</sup>.

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#### **Statistical Methods**

Compared with the demographics of the Hong Kong general population, participants in this study were older and more likely to be female. To ensure the sample could represent the population aged 18 and older in Hong Kong, proportional weighting was adopted to reduce the discrepancies of surveyed adults and Hong Kong general population with respect to age and sex at mid-year of 2019. Reference data were obtained from the Census and Statistics Department of Hong Kong SAR. All analyses were conducted using the weighted sample.

Mean and their corresponding standard deviation were presented for continuous variables, while count with their corresponding percentage were presented for categorical variables. Confidence intervals were provided wherever appropriate. Descriptive statistics on demographic factors, socioeconomic factors, worry of COVID-19, general physical and mental HRQOL, economic activity, and PPE and hygiene practice were presented by status of deprivation. Independent two-sample t-tests for continuous variables and chi-square tests for categorical variables were used to test difference between those deprived and non-deprived.

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The associations between deprivation and three potential negative COVID-19-related issues (i.e., low reserve of face masks in the household, worried about coronavirus, and change of economic activity) were then analyzed using univariate logistic regression and multivariable binary logistic regression adjusting for potential confounders. The associations of the three negative COVID-19-related issues with physical and mental HRQOL were also analyzed using univariate linear regression and multivariable linear regression adjusting for potential confounders to determine which of the negative COVID-19-related issues might be a potential mediator of the association between deprivation and health outcomes. Path analysis in the form of multivariable linear regression was then carried out to determine the direct effect of deprivation, and the indirect effects of deprivation via negative COVID-19-related issues on HRQOL, adjusting for potential

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confounders. The statistical package SPSS version 26 (IBM Corp, Armonk, NY) and SAS 9.4 were employed for statistical analyses. All statistical tests were two-tailed with a significant level of 0.05.

## RESULTS

Table 1 presents the demographic, socioeconomic characteristics, and health of respondents by deprivation status. All figures presented were based on the weighted sample (the original and weighted demographic and socioeconomic characteristics of the respondents are reported in Appendix Table 1). 21.3% were deprived. Those being deprived were more likely to be older, separated /divorced /widowed, having children in the household, less educated, receiving social security, born abroad, and income-poor. They were also more likely to be worried about the disease and less healthy in terms of both physical and mental HRQOL.

Table 2 shows the descriptive statistics on economic activity and by deprivation status. Those being deprived were significantly less prone to be employed, to be paid monthly, to have paid annual or sick leave, and working in a district other than their living district. Regarding COVID-19-related changes in terms of economic activity, for those who were deprived, there were significantly much higher chance of having job loss/instability (i.e., being unemployed / having insufficient working hours / having uncertain working hours), having reduced day of working outside, having reduced income, and perceiving an impact on their livelihood if they stopped going outside to work. Specifically, up to 17.7% in total had job loss/instability, while the percentage was significantly higher among the deprived (32.3%) than the non-deprived (13.8%). This is echoed by the observation that over half (52.2%) of the deprived individuals worked outside for fewer number of days, versus 34.5% of the non-deprived individuals. Moreover, 33.3% in total had income decrease after the outbreak, but the percentage was much higher among the deprived (55.1%) than the non-deprived (28.9%).

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Table 3 shows the descriptive statistics on PPE and related hygiene practice by deprivation status. Those being deprived were less likely to have one-month or more reserves of face masks in their household, more likely to have difficulty in buying masks and to be worried about the supply, and wear masks less frequently. Specifically, up to 18.2% of the deprived had less than 3 weeks or less reserves of face masks in their household, versus 7.8% of the non-deprived. They were also more worried about the supply of hand sanitizer and used hand sanitizer less frequently.

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The crude and adjusted odds ratios (OR), with their corresponding 95% confidence intervals (95% CI), of the associations between deprivation and three potential negative COVID-19-related issues were presented in Table 4. Even after adjusting for other confounders, being deprived remained strongly associated with having low reserve of face masks in the household (OR = 2.23, 95% CI: 1.21 – 4.10), being worried about the disease (OR = 4.07, 95% CI: 2.55 – 6.49), and having greater risk of job loss/instability (i.e., becoming unemployed / having insufficient working hours / having uncertain working hours) (OR = 2.62, 95% CI: 1.41 – 4.88).

Table 5 presents the crude and adjusted beta coefficients, with their corresponding 95% CI, of the associations of the three negative COVID-19-related issues with physical and mental HRQOL, and we found that being worried about the disease ( $\beta = -2.18$ , 95% CI: -3.54 – -0.82) and job loss/instability ( $\beta = -3.61$ , 95% CI: -5.72 – -1.49) were significantly associated with worse MCS, even after adjustments. Therefore, these two variables were treated as the potential mediators of the association between deprivation and health in the path analysis.

Figure 1 presents the results of the path analysis on the association among deprivation, the potential mediators of being worried about the disease and job loss/instability, and physical and mental HRQOL,

adjusting for other confounders. Being deprived was negatively associated with PCS ( $\beta = -0.154, p < 0.001$ ) and MCS ( $\beta = -0.211, p < 0.001$ ), while being worried about the disease (PCS:  $\beta = -0.012, p = 0.743$ ; MCS:  $\beta = -0.057, p = 0.121$ ) and job loss/instability (PCS:  $\beta = -0.009, p = 0.814$ ; MCS:  $\beta = -0.111, p = 0.002$ ) were negatively associated with PCS and MCS. In addition, being deprived had a significant indirect effect on MCS with being worried about the disease and job loss/instability as the mediating variables (total indirect effect:  $\beta = -0.036, p = 0.004$ ; proportion of effect being mediated = 14.70%).

## DISCUSSION

In summary, the deprived individuals fared worse in every aspects of life than their non-deprived counterparts after the emergence of the COVID-19 outbreak. Deprived individuals were more likely to lose their job, work insufficient hours, more in daily and hourly jobs, decrease their number of days working outside, and have income cut. For materialistic concerns of PPE and related hygiene practice, the deprived also faced more challenges as well, with less reserve of face masks in their household, greater difficulty in getting PPE, more concern over the supply of PPE, and lower frequency in using PPE. Even after adjustments for other confounding factors, being deprived was also associated with having greater risk of low reserve of face masks in the household, being worried about COVID-19, and job loss/instability after the COVID-19 outbreak. These results are alarming because the deprived individuals had already been more prone to having worse demographic and socioeconomic characteristics even before the outbreak, and the outbreak seems to expose and amplify these social inequalities. This is consistent with the observations made in other countries<sup>2,3,23</sup>.

Moreover, we found that the deprived were less healthy both physically and mentally. While these health inequalities have been present even before the emergence of COVID-19<sup>14,24,25</sup>, our results also showed that part of the health impact was also contributed via general worry about the disease and the changes in terms of economic activity (i.e., job loss/instability) that happened after the emergence of COVID-19. These observations are consistent with other findings made in the US and Canada<sup>26,27</sup>. This is an important finding because first of all, it implies that the observed health inequalities might be exacerbated by the COVID-19 pandemic even when the number of incident cases were not high or rapidly increasing; and second, the mechanisms that contributed in producing such health inequalities were related to the bigger concerns of the impact of the disease on one's livelihood and economic activity, but not necessarily the materialistic concern over adequacy of face masks and hand hygiene products per se which drew much of the media attention. This is reasonable because the main objective of PPE is primarily disease prevention and health protection against COVID-19, but does not necessarily have direct impact on one's livelihood and economic activity that have been consistently shown to have significant association with health<sup>28</sup>. On the contrary, such public health-related laws, policies, and measures as economic lockdown, mandatory social distancing, and change of work arrangements in a population, have direct impact on the livelihood and economic activity of its members<sup>29-32</sup>. Therefore, focusing on the incident cases of COVID-19 as the outcome of concern to address health inequalities is like a story half-told, and left out important aspects of life that contributes significantly to our health.

As mentioned above, early in the outbreak in March 2020, many of the COVID-19 cases were imported by travelers and boarding students who returned to Hong Kong during spring break, and these people tended to be more well-off. If we used this evidence to claim that the COVID-19-related socioeconomic gradient in health that was not present in Hong Kong, then we would severely truncate and distort the reality. Health inequalities were in fact induced by the disease even in a city where incidence is relatively low via other social determinants of health that directly concerned the livelihood and economic activity of the people. In other words, social determinants of health cannot be overlooked in devising and designing any public

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Longer term – expect impacts on health outcomes and life expectancy – as a result of impoverishment during containment.

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health-related laws, policies, and measures, and this is coherent with another argument made using a public health ethics framework<sup>33</sup>.

### Limitations

There are caveats to this study. First, answers were self-reported by the respondents, and the results may therefore be subject to recall bias. Second, there might be selection bias because our sample tended to be those who agreed to be followed up from earlier data collection timepoint; nevertheless, results of our analyses were based on age-and-sex-weighted sample to better represent the Hong Kong general adult population, and we were especially interested in examining the difference between the deprived and the non-deprived, as well as the associations of different factors with deprivation. Third, the nature of the analyses was still cross-sectional; hence, direct temporality cannot be established.

### Conclusion

Our study is unique in showing that even in a population where the COVID-19 incidence was kept at a relatively low level, health inequality exists and can still be exacerbated by the pandemic through people's real concerns over livelihood and economic activity, which were severely affected by the public health-related laws, policies, and measures. Although the COVID-19 incident case number is drawing much of the attention in gauging the severity of the pandemic throughout the world, we should look beyond this health outcome if indeed we espouse to address and reduce COVID-19-induced health inequalities in the wider society.

(Word count: 3,143)

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**Table 1. Demographic, socioeconomic information, and health of respondents by deprivation status**

	Total	Non-deprived	Deprived	p-value
Age (year)				0.002
18-30	133 (17.7%)	115 (15.3%)	18 (11.3%)	
31-40	136 (18.1%)	117 (19.8%)	19 (11.9%)	
41-50	133 (17.7%)	94 (15.9%)	39 (24.4%)	
51-60	143 (19.0%)	116 (19.6%)	27 (16.9%)	
61-70	112 (14.9%)	80 (13.5%)	32 (20.0%)	
71-80	54 (7.1%)	42 (7.1%)	12 (7.5%)	
81 or above	40 (5.3%)	27 (4.6%)	13 (8.1%)	
Sex				0.089
Male	336 (44.7%)	274 (46.3%)	62 (38.8%)	
Female	416 (55.3%)	318 (53.7%)	98 (61.3%)	
Marital status				<0.001
Never married	188 (25.0%)	166 (28.0%)	22 (13.8%)	
Married / Cohabit	493 (65.6%)	384 (64.9%)	109 (68.6%)	
Separated / Divorced / Widowed	70 (9.3%)	42 (7.1%)	28 (17.6%)	
Number of people within the household				0.435
1	60 (8.0%)	43 (7.3%)	17 (10.6%)	
2	156 (20.7%)	130 (21.9%)	26 (16.3%)	
3	94 (12.4%)	72 (12.1%)	22 (13.8%)	
4	198 (26.4%)	156 (26.3%)	42 (26.3%)	
5	165 (21.9%)	132 (22.3%)	33 (20.6%)	
6 or above	80 (10.6%)	60 (10.1%)	20 (12.5%)	
Categories of family members				0.001
16 years or under				
0	536 (71.2%)	439 (74.2%)	97 (60.2%)	
1 - 4	217 (28.8%)	153 (25.8%)	64 (39.8%)	
17 to 64 years old, with chronic illnesses or disabilities				0.127
0	721 (95.9%)	571 (96.5%)	150 (93.8%)	
1 - 2	31 (4.1%)	21 (3.5%)	10 (6.3%)	
65 years or above				0.212
0	621 (82.7%)	494 (83.6%)	127 (79.4%)	
1 - 2	130 (17.3%)	97 (16.4%)	33 (20.6%)	
Education level				<0.001
Primary or below	166 (22.3%)	112 (19.1%)	54 (33.8%)	
Secondary	351 (47.1%)	269 (46.0%)	82 (51.2%)	
Tertiary or above	228 (30.6%)	204 (34.9%)	24 (15.0%)	
Social security				<0.001
Yes	28 (3.7%)	12 (2.0%)	16 (10.0%)	
No	724 (96.3%)	580 (98.0%)	144 (90.0%)	
Place of birth				<0.001
Hong Kong	426 (56.7%)	363 (61.4%)	63 (39.4%)	
Others	325 (43.3%)	228 (38.6%)	97 (60.6%)	
Income poverty				<0.001
Non-poor	489 (73.8%)	399 (77.9%)	90 (59.6%)	
Poor	174 (26.2%)	113 (22.1%)	61 (40.4%)	
Worried about coronavirus				<0.001
Worried	433 (57.6%)	306 (51.8%)	127 (78.9%)	
Neutral / Not worried	319 (42.4%)	285 (48.2%)	34 (21.1%)	
SF-12				
PCS	52.7±7.3	53.4±6.5	49.9±9.2	<0.001
MCS	57.4±9.0	58.8±7.5	52.3±11.6	<0.001

**Table 2. Economic activity by deprivation status**

	Total	Non-deprived	Deprived	p-value
<b>General economic activity</b>				
Current economic activity status				<0.001
Full time employee	326 (43.2%)	280 (47.3%)	46 (28.4%)	
Part time employee	54 (7.2%)	37 (6.3%)	17 (10.5%)	
Self employed	33 (4.4%)	26 (4.4%)	7 (4.3%)	
Unemployed	45 (6.0%)	21 (3.5%)	24 (14.8%)	
Retired	141 (18.7%)	103 (17.4%)	38 (23.5%)	
Student / Homemaker / Permanently sick or disabled	155 (20.6%)	125 (21.1%)	30 (18.5%)	
<i>For those under employment (n=413)</i>				
Salary mode				0.042
Monthly	330 (80.5%)	282 (82.7%)	48 (69.6%)	
Daily	34 (8.3%)	23 (6.7%)	11 (15.9%)	
Hourly	43 (10.5%)	34 (10.0%)	9 (13.0%)	
Others	3 (0.7%)	2 (0.6%)	1 (1.4%)	
Have paid annual leave or paid sick leave	312 (75.9%)	270 (78.9%)	42 (60.9%)	0.001
Place of work				0.016
Same district	121 (29.4%)	94 (27.4%)	27 (39.1%)	
Another district	254 (61.7%)	222 (64.7%)	32 (46.4%)	
No fixed places	34 (8.3%)	24 (7.0%)	10 (14.5%)	
Work at home	3 (0.7%)	3 (0.9%)	0 (0%)	
<b>Changes due to COVID-19</b>				
Change of economic activity status				<0.001
No	611 (82.3%)	506 (86.2%)	105 (67.7%)	
Unemployed / Insufficient working hours / Uncertain working hours	131 (17.7%)	81 (13.8%)	50 (32.3%)	
<i>For those under employment (n=413)</i>				
Working days outside				0.005
Increase	13 (3.2%)	9 (2.6%)	4 (5.8%)	
No change	244 (59.4%)	215 (62.9%)	29 (42.0%)	
Decrease	154 (37.5%)	118 (34.5%)	36 (52.2%)	
Working days from home				0.180
Increase	83 (20.1%)	73 (21.3%)	10 (14.3%)	
No change or decrease	329 (79.9%)	269 (78.7%)	60 (85.7%)	
Change of income				<0.001
No change or increase	274 (66.7%)	243 (71.1%)	31 (44.9%)	
Decrease	137 (33.3%)	99 (28.9%)	38 (55.1%)	
Being forced to take unpaid leave				0.481
No	321 (90.4%)	270 (90.9%)	51 (87.9%)	
Yes	34 (9.6%)	27 (9.1%)	7 (12.1%)	
Perceived impact on livelihood if did not go outside to work				0.001
Severe impact	60 (14.6%)	40 (11.7%)	20 (29.0%)	
Impacted	115 (28.0%)	95 (27.8%)	20 (29.0%)	
Little impact	58 (14.1%)	49 (14.3%)	9 (13.0%)	
No impact	178 (43.3%)	158 (46.2%)	20 (29.0%)	

**Table 3. Personal protective equipment and hygiene practice by deprivation status**

	Total	Non-deprived	Deprived	p-value
<b>Surgical mask</b>				
Current face mask reserves in the household				<0.001
1 month or more	627 (90.1%)	510 (92.2%)	117 (81.8%)	
3 weeks or less	69 (9.9%)	43 (7.8%)	26 (18.2%)	
Difficulty in buying masks				<0.001
Difficult / Very difficult	89 (11.9%)	64 (10.8%)	25 (15.6%)	
Neutral	76 (10.1%)	49 (8.3%)	27 (16.9%)	
Easy / Very easy	550 (73.2%)	453 (76.6%)	97 (60.6%)	
No need to buy	36 (4.8%)	25 (4.2%)	11 (6.9%)	
Worried about supply				<0.001
Worried	151 (20.1%)	83 (14.0%)	68 (42.2%)	
Not worried / Not sure / Neutral	602 (79.9%)	509 (86.0%)	93 (57.8%)	
Days of wearing mask in past week				<0.001
0	13 (1.7%)	7 (1.2%)	6 (3.7%)	
1-3	59 (7.8%)	37 (6.3%)	22 (13.7%)	
4-6	62 (8.2%)	44 (7.4%)	18 (11.2%)	
7	619 (82.2%)	504 (85.1%)	115 (71.4%)	
<b>Hand sanitizer</b>				
Worried about supply				<0.001
Worried	76 (10.1%)	48 (8.1%)	28 (17.5%)	
Not worried / Not sure / Neutral	676 (89.9%)	544 (91.9%)	132 (82.5%)	
Days of using hand sanitizer in past week				<0.001
0	49 (6.5%)	38 (6.4%)	11 (6.8%)	
1-3	62 (8.2%)	36 (6.1%)	26 (16.1%)	
4-6	70 (9.3%)	48 (8.1%)	22 (13.7%)	
7	573 (76.0%)	471 (79.4%)	102 (63.4%)	

**Table 4. Crude and adjusted odds ratios (and their corresponding 95% confidence intervals) for low reserve of face masks in the household, worried about COVID-19, and job loss/instability in relation to deprivation**

	Low reserve of face masks in the household		Worried about COVID-19		Job loss/instability	
	Crude OR (95%CI)	Adjusted OR (95%CI) <sup>a</sup>	Crude OR (95%CI)	Adjusted OR (95%CI) <sup>a</sup>	Crude OR (95%CI)	Adjusted OR (95%CI) <sup>a</sup>
Deprivation						
Non-deprived	ref	ref	ref	ref	ref	ref
Deprived	2.66 (1.57, 4.50)***	2.23 (1.21, 4.10)**	3.52 (2.33, 5.33)***	4.07 (2.55, 6.49)***	2.95 (1.96, 4.44)***	2.62 (1.41, 4.88)**

\* p-value < 0.05, \*\* p-value < 0.01, \*\*\* p-value < 0.001

<sup>a</sup> Adjusted for income-poverty, age, gender, marital status, education level, employment and co-residence of family member(s) aged 17 to 64 having chronic diseases or disabilities.

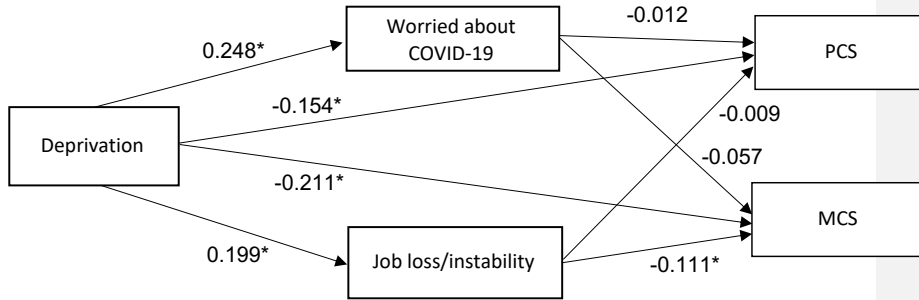
**Table 5. Crude and adjusted beta coefficients (and their corresponding 95% confidence intervals) of negative COVID-19-related issues in relation to physical and mental health**

	PCS		MCS	
	Crude $\beta$ (95% CI)	Adjusted $\beta$ (95% CI) <sup>a</sup>	Crude $\beta$ (95% CI)	Adjusted $\beta$ (95% CI) <sup>a</sup>
Current face mask reserves in the household				
1 month or more	ref	ref	ref	ref
3 weeks or less	-1.96 (-3.69, -0.23)*	-0.70 (-2.51, 1.12)	-1.94 (-4.14, 0.27)	-0.57 (-2.93, 1.80)
Worried about coronavirus				
Neutral / Not worried	ref	ref	ref	ref
Worried	-0.82 (-1.88, 0.23)	-0.73 (-1.83, 0.36)	-2.50 (-3.79, -1.21)***	-2.18 (-3.54, -0.82)**
Job loss/instability				
No	ref	ref	ref	ref
Yes	-0.33 (-1.71, 1.05)	-0.62 (-2.33, 1.09)	-2.64 (-4.33, -0.95)**	-3.61 (-5.72, -1.49)***

\* p-value < 0.05, \*\* p-value < 0.01, \*\*\* p-value < 0.001

<sup>a</sup> Adjusted for income-poverty, age, gender, marital status, education level, employment and co-residence of family member(s) aged 17 to 64 having chronic diseases or disabilities.

**Figure 1. Path analysis for association between deprivation and physical and mental health (direct effect), and via worried about coronavirus and job loss/instability (indirect effects)**



Notes:

1. Coefficients within paths were standardized, adjusted for income poverty, age, gender, marital status, education level, employment and co-residence of family member(s) aged 17 to 64 having chronic diseases or disabilities; \* p-value < 0.05
2. PCS: adjusted goodness of fit index = 0.7776, standardized root mean square residual = 0.0512, and Bentler comparative fit index = 0.8828).  
MCS: adjusted goodness of fit index = 0.7776, standardized root mean square residual = 0.0516, and Bentler comparative fit index = 0.8831).
3. Total indirect effect for PCS= -0.005 (p-value = 0.687), proportion of effect being mediated = 2.99%; Total indirect effect for MCS= -0.036 (p-value = 0.004), proportion of effect being mediated = 14.70%

**Appendix Table 1. Demographic and socioeconomic information of respondents**

	Original %	Weighted % *
Age (year)		
18-30	67 (8.9%)	133 (17.7%)
31-40	73 (9.7%)	136 (18.1%)
41-50	135 (18.0%)	133 (17.7%)
51-60	135 (18.0%)	144 (19.1%)
61-70	153 (20.3%)	113 (15.0%)
71-80	111 (14.8%)	54 (7.1%)
81 or above	78 (10.4%)	40 (5.3%)
Sex		
Male	274 (36.4%)	336 (44.7%)
Female	478 (63.6%)	416 (55.3%)
Marital status		
Never married	112 (14.9%)	188 (25.0%)
Married / Cohabit	534 (71.0%)	493 (65.6%)
Separated / Divorced / Widowed	106 (14.1%)	71 (9.4%)
Number of people within the household		
1	81 (10.8%)	60 (8.0%)
2	192 (25.5%)	156 (20.7%)
3	89 (11.8%)	94 (12.4%)
4	177 (23.5%)	198 (26.4%)
5	144 (19.1%)	165 (21.9%)
6 or above	69 (9.2%)	79 (10.6%)
Education level		
Primary or below	255 (34.2%)	167 (22.4%)
Secondary	352 (47.2%)	351 (47.1%)
Tertiary or above	138 (18.5%)	228 (30.6%)
Social security		
Yes	265 (35.2%)	157 (20.8%)
No	487 (64.8%)	595 (79.2%)
Place of birth		
Hong Kong	375 (49.9%)	426 (56.7%)
Others	376 (50.1%)	325 (43.3%)
Income poverty		
Non-poor	409 (62.3%)	489 (73.7%)
Poor	247 (37.7%)	174 (26.3%)
Deprivation		
Non-deprived	570 (75.8%)	592 (78.7%)
Deprived	182 (24.2%)	160 (21.3%)

\* Weighted according to the census data in terms of age and sex (mid 2019 HK population)