BMJ Open

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Journal:	*BMJ Open*
Manuscript ID	bmjopen-2020-041191
Article Type:	Original research
Date Submitted by the Author:	04-Jun-2020
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Keywords:	Public health < INFECTIOUS DISEASES, PRIMARY CARE, PUBLIC HEALTH

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Characteristics and well-being of urban informal home care providers during COVID-19 pandemic: a population-based study

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ABSTRACT

Objectives

Globally, the COVID-19 pandemic has overwhelmed many health care systems and individuals are unable to access routine clinical care during lockdowns. Informal home care, care provided by non-healthcare professionals, increases the community's health care surge capacity during pandemics. There is, however, limited research about the characteristics of informal home care providers and the challenges they face during such public health emergencies.

Design

A random, cross-sectional, population-based telephone survey study was conducted to examine patterns of home care, characteristics of informal home care providers and the challenges of these care providers during this pandemic.

Setting

Data were collected from 22 March to 1 April 2020 in Hong Kong, China.

Participants

A population representative study sample of Chinese-speaking adults (n=765) was interviewed.

Primary and secondary outcome measures

The study examined the characteristics of informal home care providers, and the characteristics and health care requirements of the care recipients. The study also examined providers' self-perceived knowledge to provide routine home care as well as COVID-19 risk reduction care. Respondents were asked about mental health related to COVID-19.

Results

Of the respondents, 25.1% of 765 provided informal home care during the studied COVID-19

pandemic period. Of informal home care providers, 18.4% of respondents took leave from school/work during the epidemic to provide care that included fragile elderly and small children. These care providers tended to be younger-aged, female, and housewives. Approximately half of caregivers reported additional mental strain and 37.2 % reported of challenges in daily living during epidemic. Although most informal home care providers felt competent to provide routine care, 49.5% felt inadequately prepared to cope with the additional health risks of COVID-19.

Conclusion
During public health emergencies, heavy reliance on informal home health care providers necessitates better understanding of their specific needs and increased government services to support informal home care.

Keywords: Informal home care, health and well-being, COVID 19, Urban, Asia, Hong Kong

Abstract word count: 300

Strengths and limitation of this study

In a city affected in the early stages of the COVID-19 pandemic, this study was the first to highlight the impact and added burden of care experienced by informal home care providers among the general population.

This telephone-based study was conducted during the peak period of COVID-19 epidemic in Hong Kong, so the citizen would be more compliant and attentive to the telephone survey as they were encouraged to stay at home for work or daily activity.

The cross-sectional design cannot draw a conclusion on any cause-effect relationship.

this study might subject to reporting bias since data were self-reported, and data from non-respondents could not be obtained.

INTRODUCTION

Home care is regarded as one of the major care models to address medical needs for patients and vulnerable populations during COVID-19 pandemic[1]. As described by the World Health Organization (WHO)[2], home care aims to provide high quality and cost-effective care to individuals that will enable them to maintain their independence and the highest possible quality of life. While formal home care providers are usually remunerated workers from medical authorities or registered organizations, informal home care providers are usually family members or others who provide unpaid care to those in need[3]. The typical profile of individuals who require home care are patients with chronic diseases or mental conditions, individuals with disabilities, young children, the elderly and other vulnerable individuals who live alone. Up to the present, the published literature has mainly examined the quality of life of older adults, the care recipients, the mental health of the care providers[4–6] and experience of informal home care providers under non-emergency health situations[7,8].

During the COVID-19 pandemic, in an attempt to reduce the surge of patients requiring hospital care, many countries have implemented epidemic control measures [9] to limit activities outside the home such as closure of non-essential services. Moreover, countries have relied heavily on home quarantine for suspected COVID-19 patients with mild-symptoms in order to maintain resilience of the national health system[1,9,10]. In Hong Kong, in conjunction with prohibitions on mass gatherings, closure of recreational centers, schools and community services[11,12], a mandatory 14-days quarantine was issued for those who entered into Hong Kong from outside its borders[13]. This resulted in 13,649 individuals under compulsory home quarantine from 13 Mar to 26 Mar 2020[14]. There have been no published studies of informal care providers during extreme events or during population-level health emergencies. Hence, the impacts on informal home care providers from the closure of community services and limited access to healthcare services during the COVID-19 are yet unknown.

According to the Hong Kong 2016 By-census, one-fourth of households had children aged under 15 while and one-third household reported having at least one elderly household member[15].

Combined, these households accounted for 27.2% of the whole Hong Kong population. The likely heavy reliance on informal home care during a pandemic emergency in Hong Kong allows examination of the prevalence and special needs of informal home care providers. This study aimed to identify informal home care patterns, characteristics of informal home care providers and their challenges during the COVID-19 epidemic. The study also seeks to examine the knowledge levels and level of preparation for the home quarantine among these care providers and the recipients of their care in Hong Kong.

METHODS

Study design and study population

A cross-sectional, population-based telephone survey was conducted from 22 March to 1 April 2020 during the peak of local COVID-19 pandemic. The computerized Random Digit Dialing (RDD) method was used for each of Hong Kong's 18 districts to randomly select a representative sample. The survey methods and the sample size estimation have been previously detailed[16]. It was designed on the basis of literature review and previous research experience[17–20]. The study only includes respondents who were 18 years old or older, and speak Cantonese.

The study instruments

A self-reported, semi-structured Chinese questionnaire with 141 questions was used for data collection[16]. Care providers were identified through one of the questions in the questionnaire "Do you currently need to look after member(s) of your family and relatives' daily needs (like your children/parents) during COVID-19 epidemic?". Besides the experience and situations of their care duties during the COVID-19, the characteristics of the care recipients under their care were also investigated. Care recipients' age, sex, relationship with the care provider, the reason for the receiving care and their dependency were recorded. Care providers were also asked if they were the primary care providers for their recipients (defined as having the major responsibility in caregiving duties) and if their care recipient was dependent on them (defined as inability to maintain activities of daily living without caregiver assistance). All self-reported home care providers in this study were confirmed to be informal care provider.

Care providers were asked if they felt that they possessed sufficient knowledge about routine care and COVID-19 risk mitigation. A 5-point Likert scale was used to assess physical, mental, social and other related health impact (ranging from 1= no impact to 5= maximum impact). Respondents were asked about their home care experience, risks perception, household capacity to provide care and home care challenges that they experienced. The instrument also asked about knowledge of infection control during a home quarantine. Specifically, the respondents were asked about their knowledge of infection control in home context such as *the ratio of bleach solution for cleaning* (*1:99 ratio for normal cleaning and 1:49 for cleaning vomit, excreta or secretion*[21]), *the recommended distance for with the quarantine subjects (at least 1 meter*[21]).

Statistical analysis

Descriptive statistics of the study sample were presented with chi-square tests to examine comparability of the study sample with the Hong Kong general census population[22]. Socio-

demographic pattern analyses of respondents who might have care-providing responsibilities, the home care recipients, and the context of care provision during the COVID-19, were conducted. Chi-square test was conducted for comparing the perception toward COVID-19 between care provider and non-care provider subjects. Multivariable logistic regression analysis was conducted to compare the sociodemographic predictors between care providers and non-care providers. In addition, logistic regression analysis was conducted to understand how the socio-demographic of the care provider and their care responsibilities may affect their daily living. For both multivariable logistic regressions, the first step involved bivariate analyses (chi-square test or independent t-test). Explanatory variables whose significance was <0.10 were entered as candidate variables into a multivariable logistic model. Chi-square tests were then conducted between the care providers who believe they possess sufficient or insufficient knowledge in providing routine care and COVID-19 risk mitigation. Missing values will be excluded in the data analysis. No sensitivity analysis was conducted. The level of significance of statistical test was 0.05. All statistical analyses was conducted using IBM SPSS 21 for Windows[23].

Patient and public involvement

The design, or conduct, or reporting, or dissemination plans of our research were done without patient or the public involvement.

RESULTS

Final study sample consisted of 765 respondents (44.0% response rate) and was comparable with the population data in Hong Kong By-census 2016. Of the 765 participants, 53.5% (n=409) were women, 18.7% (n=143) were aged 64 and above, and 60.2% (n=459) were currently married. Information about the respondents and the recruitment process were detailed in a previous study in the same series[16].

Characteristics of the home care recipients (N=345)

The study sample consisted of 192 care providers, who reported that they needed to provide care for 345 care recipients. Among these home care recipients, children represented 55.2% (being taken care of by parents), parents and parent-in-law represented 21.4% (being taken care of by children and children-in-law), while spouses accounted for 17.8%. (*Figure 1a*). As cited by the informal care providers, the main reasons for recipients' need of home care was due to extreme age (24.2%), isolation requirements due to COVID-19 epidemic (23.5%), recipient's chronic medical conditions (8.0%) and physical activities limitation (4.3%). Over half (533.8%) of home care recipients in the sample were considered as completely care dependent. Figure 1b showed most of the dependent care recipient were aged 0-18 and aged 75 or above (chi-square p-value: p<0.001). Gender difference was not significant between dependent and non-dependent care recipient.

Who were the informal care provider during the COVID-19? (n=192)

In our study sample, one-quarter of respondents reported to have undertaken care responsibilities during the COVID-19 epidemic (Table 1). Notably, about 83.7% of informal home care providers were the primary home care providers and informal home care providers were predominantly

female (67%, 129/192). Of informal home care providers, 44.8% were middle aged (45-64 years age), 38% were (73/192) aged 18-44 and 17.2% were aged 65 or above. Although full-time housewives represented nearly one-quarter of the informal care providers while 13.4% were unemployed or retired, more than 50% of informal home care providers were concurrently employed (44% were white collar employees). Multivariable logistic regression results indicated that *younger adults, female, married, housewives* were more likely to be informal home care providers during COVID 19 (Table 1)

Table 1. Factors associated with having informal home care responsibilities during the COVID-19 pandemic in Hong Kong (N=765)

N	Non-care provider (N=573)	Care provider (N=192)	p	AOR (95% Confident Interval)	p
Age			<0.001*		
18-24	12.0%	1.0%		Ref.	
25-44	30.9%	37.0%		5.34 (1.01 – 28.37)	0.049*
45-64	37.9%	44.8%		4.09 (0.76 – 22.14)	0.102
65 or more	19.2%	17.2%		3.63 (0.63 – 20.85)	0.148
Gender			<0.001*		
Male	51.1%	32.8%		Ref.	
Female	48.9%	67.2%		1.90 (1.29 – 2.82)	0.001*
Education attainment			0.125		
Primary level or below	8.1%	7.8%			
Secondary level	41.2%	49.5%			
Tertiary level	50.7%	42.7%			
Housing			0.370		
Public housing	28.4%	24.5%			
Subsidized housing	14.9%	12.0%			
Private housing	55.3%	62.5%			
Others	1.4%	1.0%			
Housing size			0.499		
Small (350ft or below)	22.1%	18.4%			
Medium (351 ft- 800ft)	63.0%	67.6%			
Large (801 ft. or above)	15.0%	14.0%			
Chronic disease?			0.155		
No	82.7%	78.1%			
Yes	17.3%	21.9%			
Marital status			<0.001*		
Currently unmarried	44.8%	25.0%		Ref.	
Currently married	55.2%	75.0%		2.20 (1.45 – 3.35)	<0.001*
Employment			<0.001*		
White collar	45.5%	44.4%		Ref.	
Blue collar	16.4%	18.7%		1.43 (0.88 – 2.32)	0.144

Housewives	8.8%	23.0%		1.89 (1.08 – 3.31)	0.026*
Students	8.1%	0.5%		0.38 (0.04 – 3.88)	0.412
Unemployed and retired	21.2%	13.4%		0.80 (0.43 – 1.50)	0.488
Household income			0.335		
<7999	10.0%	6.7%			
8000 – 19999	14.5%	12.8%			
20000 – 39999	25.2%	30.7%			
40000 or more	50.3%	49.7%			
*p<0.05 In the multivariable logistic regression, there were 2 missing values in *marital status*, and 11 missing values in *employment*.					

Nearly one in five of informal home care providers reported that they had to take personal leave from work or school to take care of their families. Informal home care providers who had taken personal leave were significantly more likely to be younger age (18-44 years of age), and were significantly more likely to have 2 or more dependent care recipients (chi-square p-value: <0.05). Although care provider's underlying chronic disease status, education attainment, housing types, and household income were not statistically significant.

The association between income levels and informal home care duties was statistically insignificant (chi-square p-value: >0.05). Yet, analysis showed home care providers from lower income subgroups (HKD 8000 – 19999) tended to have to be responsible for more than one care recipient when compare with the higher income counterparts (Figure 2). In addition, Female was found to be the predominant gender to have taken up the primary informal care provider's role (73.4%, chi-square p-value: <0.001).

*There are 13 missing values in household income.

More than half of the informal home care providers were responsible for caring for more than one individual with nearly 20% (36/192) of respondents reporting that they needed to provide care to 3 or more household members. Of note, 64.7% care providers reported that there was at least 1 dependent care recipient under their caring duties; 32.3% and 47.6% care providers reported to be giving care to elderly family members (aged 65 or above) and children under the age of 18 or younger, respectively. Moreover, nearly 28% of households providing informal home care for fragile elderly while 7.4% had people with disabilities.

A statistically significant age association was found between care provider and recipient. Elderly care providers were more likely to provide home care to those 65 or older (p<0.05), while younger (aged (18-44) tend to provide care for aged 18 or younger care recipient (p<0.05). Younger care providers (aged 18-44) were more likely to provide home care to 2 or more dependent care recipient (31.4%) than the older age group (age 45-64: 21.0%, age 65 or above: 12.1%, p-value: 0.018). Meanwhile, other socio-demographic factor like gender, Education attainment, housing factors of the care provider were not statistically significant. About 11.9% care providers reported they had family members requiring care mainly due to their chronic disease condition. Non-

married care providers (26.7%; married: 7.1%) were more likely to provide care for household members with chronic disease (p<0.001).

Physical, mental and social health of informal care providers during COVID-19

Among the informal care provider, nearly 22% reported having an underlying chronic medical condition themselves but this proportion did not significantly differ from the non-informal care providers (17.3%) (Table 1). The perception of COVID-19's impact between provider and non-care provider is shown in Table 2. Those providing informal home care showed no significant differences in self-reported impacts on physical health, social life, and financial status, while significant difference was found for self-report impact of mental health status when compared between people with and without home care duties.

Table 2. Differences in perception between care provider and non-caregiver provider

	Non-care provider (N=573)	Care provider (N=192)	P
Self-reported COVID-19 impact on physical, mental, social well-being			
Believed COVID-19 had large effect on their physical health	50.3%	55.7%	0.190
Believed COVID-19 had large effect on their mental health	44.5%	53.6%	0.028*
Believed COVID-19 had large effect on their social life	70.7%	76.0%	0.152
Believed COVID-19 had large effect on their financial status	32.6%	35.4%	0.479
Believed COVID-19 had large effect on the Hong Kong	94.6%	93.8%	0.662
*p<0.05			

Notably, 53.9% reported that they had experienced additional strain in their care providers' duties. The most common cited reasons for additional strains included COVID-19 health risk concern (40.2%), increased time spent with care recipient (27.5%), and more things need to take care of during the pandemic (21.6%). For changes of community services (e.g. day care center) utilization that facilitated pre-COVID 19 care, 41 subjects reported to have used community services regularly and among them 39% had stopped or decreased the use of the services due to the epidemic.

Of the informal home care providers, 37.2% reported that their daily lives became more challenging due to the need to care for their family during COVID-19 epidemic. Multivariable regression analysis, however, showed that these perceptions were not associated with age, sex and education attainment nor the number of care recipient. But providers who were having a dependent care recipient(s), and individuals having to take personal leave reported significantly increased difficulty in daily living (p<0.001) (Table S1 in supplementary file).

Care provider's perceived knowledge sufficiency

While nearly 90% of these home care providers believed that they had sufficient knowledge to provide routine care, only 50.5% believed that they had sufficient knowledge to manage the additional risk brought on by COVID-19 (Table S2 in supplementary file). Although various sociodemographic factors and care recipient characteristics were associated with care providers' perceived adequacy of knowledge for providing routine home care, there was no statistically significant difference for perceived adequacy of knowledge in COVID-19 risk mitigation by any sociodemographic or care recipient factors.

Home environment to facilitate home care and household COVID-19 risk control

Among the study population (n=765), only 32 subjects (4.2%) reported to have undergone home-quarantine/isolation during the COVID-19 epidemic. Among these subgroups, 23 (71.9%) took voluntary-based/self-imposed home isolation while 9 (28.1%) had to be home-bound due to government compulsory home isolation requirements. Reasons cited for quarantine due to recent travel abroad (41.9%) and in close contacts with confirmed patients (19.4%). Among the care providers, about 3.6% (7/192) reported that they had applied quarantine. Subjects were also asked about their preparation adequacy for potential home quarantine for 2 weeks. More than half of the subjects claimed they had sufficient masks, detergent, disposable gloves and sufficient independent rooms for isolation use. For the general household preparation, more than 80% participants have prepared alcohol rub, sufficient medicine and food and storage after COVID-19 epidemic started (Table 3).

Table 3. Self-reported household items for COVID-19 control during the epidemic (N=765)

	N (%)
Household preparation items for potential quarantine	
Masks	86.8%
Detergent	92.9%
Disposable gloves	51.9%
Sufficient independent room for isolation use	65.2%
General household preparation items	
Alcohol rub	95.2%
Basic medicine (for fevers and common cold)	92.4%
Food and water storage sufficient for 1 day	87.2%
Chronic disease medication enough for 1 week (N=241)	90.9%

Respondents reported awareness and knowledge of home quarantine instructions found most of the subjects agreed that family members living with quarantined patients should check their temperature daily (97.5%) and the quarantined subject should wear masks at home all the time (96.1%). However, only half of the subjects (51.3%) were able to answer that the ideal number of care providers for the person who is ill with COVID-19 should be only one. About 70% and 26%

answered the ideal ratio of bleach solution for cleaning were 1:99 and 1:49 respectively. As to the ideal distance with the quarantine subject in the same room, 324 (42.4%) and 264 (34.6%) subjects answered 2 meters and 1 meter respectively.

DISCUSSION

During large-scale public health emergencies, home care may be the only viable method of providing continuous health care due to disruption of services and transportation. In many regions around the world, health care systems have been overwhelmed by high caseloads of COVID-19 patients with life-threatening conditions, necessitating greater reliance on informal home care providers. Home care during COVID-19 includes not only people caring for those with confirmed or suspected COVID-19; but also care for non-COVID-related conditions that may require essential life sustaining care, health maintaining support, or/and additional care during this period. This is the first study to examine informal home care provision in high-income, urban context during a large-scale public health emergency. In our general population study sample of Hong Kong adults, approximately one-fourth reported to have provided informal home care during COVID-19 epidemic. Consistent with previous literature[8], females shouldered the main burden of being a primary home care provider. The COVID-19 pandemic presents a complex set of additional burdens on these home care providers. More than half of the informal home care providers reported additional mental strain during the epidemic.

Although the majority of informal home care providers believed that they had sufficient knowledge for their normal home care duties, we noted that some subgroups felt themselves to be insufficiently knowledgeable to provide even routine care. Previous studies have shown that older age and less educated care providers reported a higher mental burden from caregiving[24,25]. Consistent with this, we noted home care providers who were older, housewives, and with lower education and income were more likely to believe themselves as lacking knowledge to provide routine care. Moreover, those caring for dependent individuals (e.g. fragile elderly and disabled) felt inadequately knowledgeable, possibly due to heavy reliance on existing services for regular management of fragile elderly and people with disabilities by the government[26]. In contrast to the provision of routine informal home care, nearly half of the informal home care providers reported that they had insufficient knowledge to mitigate the additional health risks from the COVID-19 epidemic and these findings were not associated with education or other factors.

On top of the additional economic and knowledge burden brought on by the worldwide pandemic, approximately half of the care providers reported additional mental strain during the epidemic. The most common reasons cited were the concerns of risk of COVID-19 infection in family, the longer duration of providing care and the additional caregiving tasks brought about from the pandemic. Nearly 40% of informal care provider reported that their caregiving duties had also caused increased difficulty in their daily life. Those reporting higher mental burden were often caring for dependent family members, and necessitating taking personal leave for the caregiving duties. Due to the COVID-19 pandemic, many community services like social community center[27], day care center[12] and schools [28]were closed in Hong Kong. Hence, these home care providers with dependent care recipients require additional support services during public health emergencies. Furthermore, more than half of the care recipients were children and teenagers, who added to the caregiving burden during the nearly four-month, territory-wide school closures. The closure of

schools and elderly services has curtailed health access during the epidemic with 40% of the care providers reporting to have ceased or reduced using those services. In addition, it was found that the caregiving burden was highest in the economically-active age group (aged 18 to 44). These individuals were often faced with a double burden of working and providing informal home care. Although government had subsidized the wages to employees[29] , further support should target this care provider group. For example, providing sufficient information and services in internet or smartphone app, as younger aged care provider was found to be using more internet and smartphone app as their main information source comparing to other aged group[16].

There were a few limitations in this study. First, the study recruitment relied on land-based telephone. Households without land-based telephone services would be missed. However, the penetration rate of the residential fixed line services in Hong Kong was 85.5% in December 2019[30]. In addition, our study population was comparable with the latest population Census in Hong Kong, which was generalizable to the general population. Furthermore, the study was conducted during the peak period of COVID-19 epidemic in Hong Kong. Citizens were encouraged to stay at home for work or daily activity. Hence, the respondents would be more compliant and attentive to the telephone survey [31]. Secondly, the cross-sectional study design can only demonstrate associations between patterns and social-demographic predictors, as causation cannot be attributed to the findings. Thirdly, this study might subject to reporting bias since data were self-reported, and data from non-respondents could not be obtained. Lastly, for the sample size of the subjects who perceived lacking knowledge to provide routine care was small (n=20). Hence, advanced statistical analysis was not possible. Qualitative interviews might have revealed more rich and detailed insights.

Although the SARS-CoV-2/COVID-19 pandemic has engendered a huge amount of clinical, epidemiological and vaccine-related research, the socio-economic impact of COVID-19 has not yet been well-examined. Home care, being one of the crucial pillars in supporting people's health outside the formal healthcare setting during this pandemic, needs much stronger research and support from stakeholders at various levels[32]. In addition to research in formal healthcare services, better understanding of the challenges posed by the various home care settings (even informal settlements) is urgently required. This includes disease management in home care settings and strategies to optimize resources and support for informal care providers during global pandemics such as COVID-19. This study examined informal home care providers in a high-income Asian city during the early phase of the pandemic. However, the long-term implications on care providers, health outcomes of care recipients, and coping strategies of vulnerable people (particularly those living alone) are largely unknown. Research in these areas is urgently needed to improve pandemic preparedness of national health systems.

CONCLUSION

This study explores home care situation in Hong Kong, an Asia metropolis in China which experienced the early phase of COVID-19 in 2020. Findings showed home care during pandemic can present a complex set of care recipient needs and providers' duties in densely-high-rise building based aging community with a high dependency ratio. The study also showed that younger workers with higher education and income had to bear the main burden of care for

dependent care recipients during the epidemic but the heaviest routine care burden fell upon those with deficit resource. Governments should consider supplementing service support during large-scale public health emergencies when access to routine health care is disrupted. Policy should focus on continuous support to those informal care providers and their mental health needs during these public health emergencies.

Figures

Figure 1a. Characteristics of care provider-recipient relationship among all care recipients, as reported by informal care providers (N=345)

Figure 1b. Age distribution of dependent care receiver (who cannot live normally without caregivers' help)

Figure 2. The relationship between household income and informal home care duties

Funding

This work was supported by CCOUC-Oxford research support fund (#0008).

Competing interests

All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare: no support from any organization for the submitted work; no financial relationships with any organizations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.

Contributors

EYYC, KKCH, ELYW, SYSW, & NG conceived the project. EYYC, ESKL, KKCH, ZH designed the study tool, obtained, validated, and cleaned the data. ESKL, ZH and JHK performed the data analysis. EYYC, ELYW, ESKL, JHK, HH and ZH involved in literature review and write up. All authors contributed to the manuscript drafting, review, revision and approval of the final manuscript. KKCH, ESKL, HH SYSW and ZH provided administrative and operational support. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

Ethical Approval

Verbal consent was obtained from the participant and ethics approval and consent procedure of the study was reviewed and obtained from the Survey and Behavioral Research Ethics Committee at The Chinese University of Hong Kong (SBRE-19-498).

Data sharing statement

No additional data are available.

Word count: 3903

Licence

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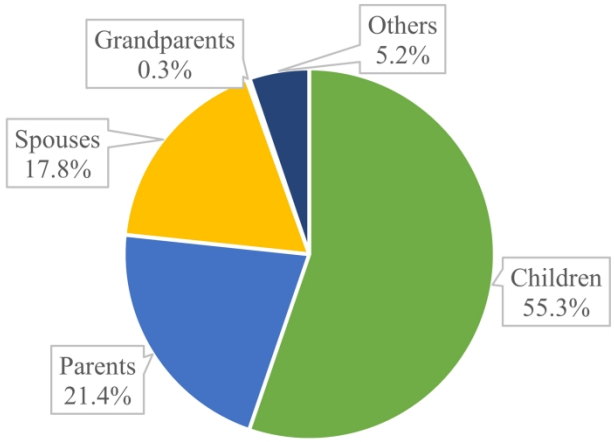

Figure 1a. Characteristics of care provider-recipient relationship among all care recipients, as reported by informal care providers (N=345)

135x101mm (600 x 600 DPI)

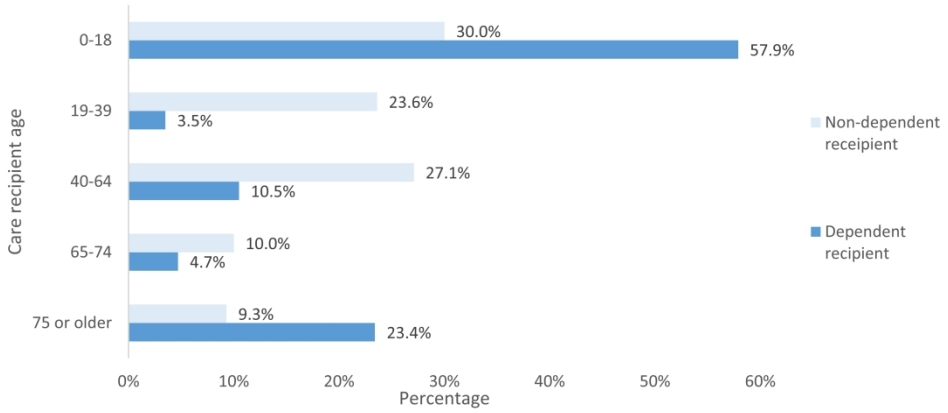

Figure 1b. Age distribution of dependent care receiver (who cannot live normally without caregivers' help)

177x88mm (600 x 600 DPI)

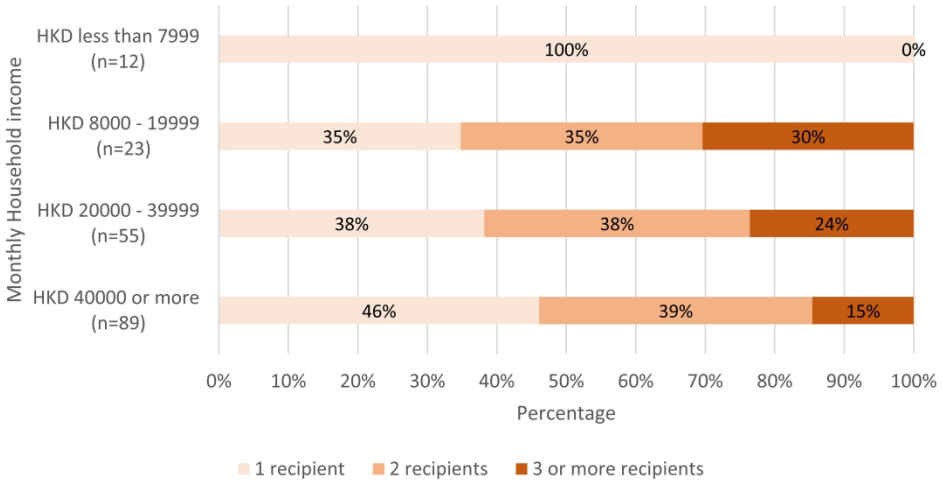

Figure 2. The relationship between household income and informal home care duties

177x88mm (600 x 600 DPI)

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Table S1. Factors associated with self-perceived increased difficulty in daily living

	No	Yes	p	AOR (LB-UB)	p
N	120	71			
Socio-demographic					
Age[a]			0.306		
18-44	34.2%	43.7%			
45-64	49.2%	38.0%			
65 or more	16.7%	18.3%			
Gender			0.441		
Male	35.0%	29.6%			
Female	65.0%	70.4%			
Education attainment			0.356		
Primary level or below	10.0%	4.2%			
Secondary level	48.3%	52.1%			
Tertiary level	41.7%	43.7%			
Occupation			0.903		
White collar	44.8%	44.3%			
Blue collar (including services and sales)	19.0%	17.1%			
Housewives	21.6%	25.7%			
Students	0.9%	0.0%			
Unemployed or retired	13.8%	12.9%			
Housing			0.703		
Public housing	25.8%	21.1%			
Subsidized housing	13.3%	9.9%			
Private housing (including independent villa)	60.0%	67.6%			
Others	0.8%	1.4%			
Household income			0.422		
<7999	4.5%	10.6%			
8000 – 19999	14.3%	10.6%			
20000 – 39999	30.4%	30.3%			
40000 or more	50.9%	48.5%			
Housing size			0.397		
Small (350ft or below)	16.2%	22.4%			
Medium (351 ft- 800ft)	67.6%	67.2%			
Large (801 ft. or above)	16.2%	10.4%			
Chronic disease condition			0.616		
No	79.2%	76.1%			
Yes	20.8%	23.9%			
Marital status			0.001		
Unmarried (including divorced or widow)	32.5%	11.3%		Ref.	
Married	67.5%	88.7%		2.81 (0.98 – 8.09)	0.055

Having sufficient knowledge to take care their family members			0.463		
Not sure or No	9.6%	13.0%			
Yes	90.4%	87.0%			
Characteristics of the care recipient					
Number of care recipient			0.797		
1 recipient	47.5%	43.7%			
2 recipients	35.0%	35.2%			
3 or more recipients	17.5%	21.1%			
Family member as fragile elderly or disabilities			0.958		
No	68.6%	69.0%			
Yes (with either one)	31.4%	31.0%			
Children were the care recipients			0.075		
No	42.5%	29.6%		Ref.	
Yes	57.5%	70.4%		0.83 (0.34 – 2.05)	0.688
Spouse was the care recipient			0.148		
No	73.3%	63.4%			
Yes	26.7%	36.6%			
Parents or parents-in-law were the care recipients*			0.033		
No	65.8%	80.3%		Ref.	
Yes	34.2%	19.7%		0.23 (0.08- 0.70)	0.009
Family member who were dependent recipients *			<0.001		
No	49.1%	13.0%		Ref.	
Yes	50.9%	87.0%		6.38 (2.69 – 15.14)	<0.001
Family member received care due to staying at home during COVID-19 outbreak ^			0.053		
No	81.9%	69.6%		Ref.	
Yes	18.1%	30.4%		1.70 (0.70 – 4.13)	0.238
Family member who receive care mainly due to their chronic condition			0.709		
No	88.8%	87.0%			
Yes	11.2%	13.0%			
The effect brought by COVID-19					
Stopped or decrease the use of community services during COVID-19 outbreak+			0.007		
No	95.8%	84.5%		Ref.	

Yes	4.2%	15.5%		3.22 (0.73 – 14.19)	0.122
Need to take personal leave for caregiving responsibility*			<0.001		
No	92.4%	63.4%		Ref.	
Yes	7.6%	36.6%		7.15 (2.44 – 20.91)	<0.001

+Using Fisher's exact test, ^p<0.10, * p<0.05,

[a]The age group "18-24" and "25-44" were collapsed

In the multivariable logistic regression, there were 7 missing values in variable *family member who were dependent recipients*, 2 missing values in s*topped or decrease the use of community services during COVID-19 outbreak*, 2 missing values in *need to take personal leave for caregiving responsibility*, 7 missing values in *stay at home during COVID-19 outbreak*, and 1 missing value in *perceived increased difficulty in daily live*

Table S2. Sociodemographic predictors for care providers who believed to have adequate knowledge for routine care and COVID infection control

	Knowledge for routine care			Knowledge of COVID-19 risk mitigation		
N	20 (10.9%)	164 (89.1%)		95 (49.5%)	97 (50.5%)	
	Not enough knowledge	Enough knowledge	p	Not enough knowledge	Enough knowledge	p
Socio-demographic details						
Age[ab]			0.036*			0.349
18-44	25.0%	39.6%		43.2%	33.0%	
45-64	35.0%	45.1%		41.1%	48.5%	
65 or more	40.0%	15.2%		15.8%	18.6%	
Gender			0.455			0.958
Male	40.0%	31.7%		32.6%	33.0%	
Female	60.0%	68.3%		67.4%	67.0%	
Education attainment			<0.001*			0.160
Primary or below	30.0%	4.3%		10.5%	5.2%	
Secondary	45.0%	49.4%		52.6%	46.4%	
Tertiary	25.0%	46.3%		36.8%	48.5%	
Marital status[a]			0.786			0.453
Non-married	20.0%	25.0%		27.4%	22.7%	
Married	80.0%	75.0%		72.6%	77.3%	
Housing[a]			0.236			0.897
Public housing	40.0%	22.0%		23.2%	25.8%	
Subsidized housing	15.0%	12.2%		13.7%	10.3%	
Private housing (including independent villa)	45.0%	65.2%		62.1%	62.9%	
Others	0.0%	0.6%		1.1%	1.0%	
Living density (household size / number of people)[a]			0.900			0.428
<200 ft per ppl	62.5%	60.9%		65.5%	59.8%	
200 ft or more per ppl	37.5%	39.1%		34.5%	40.2%	
Main information channel[a]			0.653			0.249
Television	50.0%	34.1%		38.9%	34.0%	
Internet or smartphone app	45.0%	57.9%		56.8%	55.7%	

Others (newspaper, radio)	5.0%	7.9%		4.2%	10.3%	
Housing size[a]			0.104			0.547
Small (350ft or below)	31.3%	16.7%		20.7%	16.3%	
Medium (351 ft-800ft)	68.8%	67.3%		67.8%	67.4%	
Large (801 ft. or above)	0.0%	16.0%		11.5%	16.3%	
Family income group[a]			<0.001*			0.323
<7999	27.8%	4.5%		5.8%	7.5%	
8000 – 19999	11.1%	13.5%		12.8%	12.9%	
20000 – 39999	50.0%	27.6%		37.2%	24.7%	
40000 or more	11.1%	54.5%		44.2%	54.8%	
Employment[a]			0.010*			0.699
White collar	15.0%	49.1%		44.6%	44.2%	
Blue collar (including services and sales)	20.0%	17.6%		18.5%	18.9%	
Students	0.0%	0.0%		25.0%	21.1%	
Housewives	45.0%	20.1%		1.1%	0.0%	
Unemployment and retired	20.0%	13.2%		10.9%	15.8%	
Care recipient characteristics						
Children were the care recipients			0.059			0.528
No	55.0%	33.5%		35.8%	40.2%	
Yes	45.0%	66.5%		64.2%	59.8%	
Spouse was the care recipient			0.723			0.594
No	65.0%	68.9%		71.6%	68.0%	
Yes	35.0%	31.1%		28.4%	32.0%	
Parents or parents-in-law were the care recipients			0.597			0.480
No	65.0%	70.7%		73.7%	69.1%	
Yes	35.0%	29.3%		26.3%	30.9%	
Family members were dependent recipients			0.044*			0.817
No	15.0%	37.8%		34.8%	36.5%	

Yes	85.0%	62.2%		65.2%	63.5%	
Members were fragile elderly or disabilities			0.040*			0.709
No	47.4%	70.6%		70.2%	67.7%	
Yes	52.6%	29.4%		29.8%	32.3%	

[a]Fisher's exact test was performed for analysis about "knowledge for routine care"
[b]The age group "18-24" and "25-44" were combined as the age group "18-24" only have 2 subjects
*p<0.05

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	1
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	4
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	4
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	4
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*4*
Bias	9	Describe any efforts to address potential sources of bias	5
Study size	10	Explain how the study size was arrived at	4
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	4
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	5
		(*b*) Describe any methods used to examine subgroups and interactions	5
		(*c*) Explain how missing data were addressed	5
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	5
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5,7
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	5
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	5,7
		(b) Indicate number of participants with missing data for each variable of interest	8
Outcome data	15*	Report numbers of outcome events or summary measures	6-11
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	6-11

		(*b*) Report category boundaries when continuous variables were categorized	6-11
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	12
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	11-12
Generalisability	21	Discuss the generalisability (external validity) of the study results	12-13
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	14

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Characteristics and well-being of urban informal home care providers during COVID-19 pandemic: a population-based study

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2020-041191.R1
Article Type:	Original research
Date Submitted by the Author:	31-Aug-2020
Complete List of Authors:	Chan, Emily; The Chinese University of Hong Kong, JC School of Public Health and Primary Care; University of Oxford, Nuffield Department of Medicine Lo, Eugene; The Chinese University of Hong Kong, JC School of Public Health and Primary Care Huang, Zhe; The Chinese University of Hong Kong, JC School of Public Health and Primary Care Kim, Jean ; The Chinese University of Hong Kong, JC School of Public Health and Primary Care Hung, Heidi; The Chinese University of Hong Kong, JC School of Public Health and Primary Care Hung, Kevin KC; Chinese University of Hong Kong, Accident and Emergency Medicine Academic Unit Wong, Eliza LY; The Chinese University of Hong Kong, JC School of Public Health and Primary Care Wong, Samuel; The Chinese University of Hong Kong, JC School of Public Health and Primary Care Gobat, Nina; University of Oxford, Nuffield Department of Medicine
Primary Subject Heading:	Public health
Secondary Subject Heading:	General practice / Family practice
Keywords:	Public health < INFECTIOUS DISEASES, PRIMARY CARE, PUBLIC HEALTH

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Characteristics and well-being of urban informal home care providers during COVID-19 pandemic: a population-based study

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ABSTRACT

Objectives

Globally, the COVID-19 pandemic has overwhelmed many health care systems and individuals are unable to access routine clinical care during lockdowns. Informal home care, care provided by non-healthcare professionals, increases the community's health care capacity during pandemics. There is, however, limited research about the characteristics of informal home care providers and the challenges they face during such public health emergencies.

Design

A random, cross-sectional, population-based telephone survey study was conducted to examine patterns of home care, characteristics of informal home care providers and the challenges of these care providers during this pandemic.

Setting

Data were collected from 22 March to 1 April 2020 in Hong Kong, China.

Participants

A population representative study sample of Chinese-speaking adults (n=765) was interviewed.

Primary and secondary outcome measures

The study examined the characteristics of informal home care providers, and the characteristics and health care requirements of the care recipients. The study also examined providers' self-perceived knowledge to provide routine home care as well as COVID-19 risk reduction care. Respondents were asked about mental health related to COVID-19.

Results

Of the respondents, 25.1% of 765 provided informal home care during the studied COVID-19 pandemic period. Of informal home care providers, 18.4% of respondents took leave from school/work during the epidemic to provide care that included fragile elderly and small children.

These care providers tended to be younger-aged, female, and housewives. Approximately half of care providers reported additional mental strain and 37.2 % reported of challenges in daily living during epidemic. Although most informal home care providers felt competent to provide routine care, 49.5% felt inadequately prepared to cope with the additional health risks of COVID-19.

Conclusion
During public health emergencies, heavy reliance on informal home health care providers necessitates better understanding of their specific needs and increased government services to support informal home care.

Keywords: Informal home care, health and well-being, COVID 19, Urban, Asia, Hong Kong

Abstract word count: 300

Strengths and limitation of this study

In a city affected in the early stages of the COVID-19 pandemic, this study was the first to highlight the impact and added burden of care experienced by informal home care providers among the general population.

This telephone-based study was conducted during the peak period of COVID-19 epidemic in Hong Kong, so the citizen would be more compliant and attentive to the telephone survey as they were encouraged to stay at home for work or daily activity.

The cross-sectional design cannot draw a conclusion on any cause-effect relationship.

this study might subject to reporting bias since data were self-reported, and data from non-respondents could not be obtained.

INTRODUCTION

Home care is regarded as one of the major care models to address medical needs for patients and vulnerable populations during COVID-19 pandemic[1]. As described by the World Health Organization (WHO)[2], home care aims to provide high quality and cost-effective care to individuals that will enable them to maintain their independence and the highest possible quality of life. While formal home care providers are usually remunerated workers from medical authorities or registered organizations, informal home care providers are usually family members or others who provide unpaid care to those in need[3]. The typical profile of individuals who require home care are patients with chronic diseases or mental conditions, individuals with disabilities, young children, the elderly and other vulnerable individuals who live alone. Up to the present, the published literature has mainly examined the quality of life of older adults, the care recipients, the mental health of the care providers[4–6] and experience of informal home care providers under non-emergency health situations[7,8].

During the COVID-19 pandemic, in an attempt to reduce the surge of patients requiring hospital care, many countries have implemented epidemic control measures [9] to limit activities outside the home such as closure of non-essential services. Moreover, countries have relied heavily on home quarantine for suspected COVID-19 patients with mild-symptoms in order to maintain resilience of the national health system[1,9,10]. In Hong Kong, in conjunction with prohibitions on mass gatherings, closure of recreational centers, schools and community services[11,12], a mandatory 14-days quarantine was issued for those who entered into Hong Kong from outside its borders[13]. This resulted in 13,649 individuals under compulsory home quarantine from 13 Mar to 26 Mar 2020[14]. In such a public health emergency, informal care may be the only care option for people in need[15]. There have been no published studies of informal care providers during extreme events or during population-level health emergencies. Hence, the impacts on informal home care providers from the closure of community services and limited access to healthcare services during the COVID-19 are yet unknown.

According to the Hong Kong 2016 By-census, one-fourth of households had children aged under 15 while and one-third household reported having at least one elderly household member[16]. Combined, these households were particularly in need of home care even in ordinary setting, accounting for 27.2% of the whole Hong Kong population. The likely heavy reliance on informal home care during a pandemic emergency in Hong Kong allows examination of the prevalence and special needs of informal home care providers. This study aimed to identify the pattern of informal home care , characteristics of informal home care providers and their challenges in Hong Kong during the COVID-19 epidemic. The study also seeks to examine the knowledge levels and level of preparation for the home quarantine among these care providers and the recipients of their care in Hong Kong.

METHODS

Study design and study population

A cross-sectional, population-based telephone survey was conducted from 22 March to 1 April 2020 during the peak of local COVID-19 pandemic. The computerized Random Digit Dialing (RDD) method was used for each of Hong Kong's 18 districts to randomly select a representative sample. The survey methods and the sample size estimation have been previously detailed[17]. It was designed on the basis of literature review and previous research experience[18–21]. The study only includes respondents who were 18 years old or older, and speak Cantonese.

The study instruments

A self-reported, semi-structured Chinese questionnaire was used for data collection[17]. The data collected includes the subjects' perception, knowledge preparedness, their home care experience if available toward and during the COVID-19 pandemic. Since the home care recipients could include a wide range of different groups (e.g. healthy children due to the closure of schools), care providers were identified through one of the questions in the questionnaire "Do you currently need to look after member(s) of your family and relatives' daily needs (like your children/parents) during COVID-19 epidemic?". Besides the experience and situations of their care duties during the COVID-19, the characteristics of the care recipients under their care were also investigated. Care recipients' age, sex, relationship with the care provider, the reason for the receiving care and their dependency were recorded. Care providers were also asked if they were the primary care providers for their recipients (defined as having the major responsibility in caregiving duties) and if their care recipient was dependent on them (defined as inability to maintain activities of daily living without care provider assistance). All self-reported home care providers in this study were confirmed to be informal care provider.

Care providers were asked if they felt that they possessed sufficient knowledge about routine care and COVID-19 risk mitigation. A 5-point Likert scale was used to assess physical, mental, social and other related health impact (ranging from 1= no impact to 5= maximum impact). Respondents were asked about their home care experience, risks perception, household capacity to provide care and home care challenges that they experienced. The instrument also asked about knowledge of infection control during a home quarantine. Specifically, the respondents were asked about their knowledge of infection control in home context such as *the ratio of bleach solution for cleaning*

(*1:99 ratio for normal cleaning and 1:49 for cleaning vomit, excreta or secretion*[22]), *the recommended distance for with the quarantine subjects (at least 1 meter*[22]).

Statistical analysis

Descriptive statistics of the study sample were presented with chi-square tests to examine comparability of the study sample with the Hong Kong general census population[23]. Socio-demographic pattern analyses of respondents who might have care-providing responsibilities, the home care recipients, and the context of care provision during the COVID-19, were conducted. Chi-square test was conducted for comparing the perception toward COVID-19 between care provider and non-care provider subjects. Multivariable logistic regression analysis was conducted to compare the sociodemographic predictors between care providers and non-care providers. In addition, logistic regression analysis was conducted to understand how the socio-demographic of the care provider and their care responsibilities may affect their daily living. For both multivariable logistic regressions, the first step involved bivariate analyses (chi-square test or independent t-test). Explanatory variables whose significance was <0.10 were entered as candidate variables into a multivariable logistic model. Chi-square tests were then conducted between the care providers who believe they possess sufficient or insufficient knowledge in providing routine care and COVID-19 risk mitigation. Missing values will be excluded in the data analysis. No sensitivity analysis was conducted. The level of significance of statistical test was 0.05. All statistical analyses was conducted using IBM SPSS 21 for Windows[24].

Patient and public involvement

The design, or conduct, or reporting, or dissemination plans of our research were done without patient or the public involvement.

RESULTS

Final study sample consisted of 765 respondents (44.0% response rate) and was comparable with the population data in Hong Kong By-census 2016. Of the 765 participants, 53.5% (n=409) were women, 18.7% (n=143) were aged 64 and above, and 60.2% (n=459) were currently married. Information about the respondents and the recruitment process were detailed in a previous study in the same series[17].

Characteristics of the home care recipients (N=345)

The study sample consisted of 192 care providers, who reported that they needed to provide care for 345 care recipients. Among these home care recipients, children represented 55.2% (being taken care of by parents), parents and parent-in-law represented 21.4% (being taken care of by children and children-in-law), while spouses accounted for 17.8%. (*Figure 1a*). As cited by the informal care providers, the main reasons for recipients' need of home care was due to extreme age (24.2%), had to stay at home due to COVID-19 epidemic (23.5%), recipient's chronic medical conditions (8.0%) and physical activities limitation (4.3%). Over half (533.8%) of home care recipients in the sample were considered as completely care dependent during the epidemic. Figure 1b showed most of the dependent care recipient were aged 0-18 and aged 75 or above (chi-square p-value: p<0.001). Gender difference was not significant between dependent and non-dependent care recipient.

Who were the informal care provider during the COVID-19? (n=192)

In our study sample, one-quarter of respondents reported to have undertaken care responsibilities during the COVID-19 epidemic (Table 1). Notably, about 83.7% of informal home care providers were the primary home care providers and informal home care providers were predominantly female (67%, 129/192). Of informal home care providers, 44.8% were middle aged (45-64 years age), 38% were (73/192) aged 18-44 and 17.2% were aged 65 or above. Although full-time housewives represented nearly one-quarter of the informal care providers while 13.4% were unemployed or retired, more than 50% of informal home care providers were concurrently employed (44% were white collar employees). Multivariable logistic regression results indicated that *younger adults, female, married, housewives* were more likely to be informal home care providers during COVID 19 (Table 1)

Table 1. Factors associated with having informal home care responsibilities during the COVID-19 pandemic in Hong Kong (N=765)

N	Non-care provider (N=573)	Care provider (N=192)	p	AOR (95% Confident Interval)	p
Age			<0.001*		
18-24	12.0%	1.0%		Ref.	
25-44	30.9%	37.0%		5.34 (1.01 – 28.37)	0.049*
45-64	37.9%	44.8%		4.09 (0.76 – 22.14)	0.102
65 or more	19.2%	17.2%		3.63 (0.63 – 20.85)	0.148
Gender			<0.001*		
Male	51.1%	32.8%		Ref.	
Female	48.9%	67.2%		1.90 (1.29 – 2.82)	0.001*
Education attainment			0.125		
Primary level or below	8.1%	7.8%			
Secondary level	41.2%	49.5%			
Tertiary level	50.7%	42.7%			
Housing			0.370		
Public housing	28.4%	24.5%			
Subsidized housing	14.9%	12.0%			
Private housing	55.3%	62.5%			
Others	1.4%	1.0%			
Housing size			0.499		
Small (350ft or below)	22.1%	18.4%			
Medium (351 ft- 800ft)	63.0%	67.6%			
Large (801 ft. or above)	15.0%	14.0%			
Chronic disease?			0.155		
No	82.7%	78.1%			
Yes	17.3%	21.9%			
Marital status			<0.001*		

Currently unmarried	44.8%	25.0%		Ref.	
Currently married	55.2%	75.0%		2.20 (1.45 – 3.35)	<0.001*
Employment			<0.001*		
White collar	45.5%	44.4%		Ref.	
Blue collar	16.4%	18.7%		1.43 (0.88 – 2.32)	0.144
Housewives	8.8%	23.0%		1.89 (1.08 – 3.31)	0.026*
Students	8.1%	0.5%		0.38 (0.04 – 3.88)	0.412
Unemployed and retired	21.2%	13.4%		0.80 (0.43 – 1.50)	0.488
Household income			0.335		
<7999	10.0%	6.7%			
8000 – 19999	14.5%	12.8%			
20000 – 39999	25.2%	30.7%			
40000 or more	50.3%	49.7%			
*p<0.05 In the multivariable logistic regression, there were 2 missing values in *marital status*, and 11 missing values in *employment*.					

During this COVID-19 epidemic, nearly one in five of informal home care providers reported that they had to take personal leave from work or school to take care of their families. Informal home care providers who had taken personal leave were significantly more likely to be younger age (18-44 years of age), and were significantly more likely to have 2 or more dependent care recipients (chi-square p-value: <0.05). Although care provider's underlying chronic disease status, education attainment, housing types, and household income were not statistically significant.

The association between income levels and informal home care duties was statistically insignificant (chi-square p-value: >0.05). Yet, analysis showed home care providers from lower income subgroups (HKD 8000 – 19999) tended to have to be responsible for more than one care recipient when compare with the higher income counterparts (Figure 2). In addition, Female was found to be the predominant gender to have taken up the primary informal care provider's role (73.4%, chi-square p-value: <0.001).

*There are 13 missing values in household income.

More than half of the informal home care providers were responsible for caring for more than one individual with nearly 20% (36/192) of respondents reporting that they needed to provide care to 3 or more household members. Of note, 64.7% care providers reported that there was at least 1 dependent care recipient under their caring duties; 32.3% and 47.6% care providers reported to be giving care to elderly family members (aged 65 or above) and children under the age of 18 or younger, respectively. Moreover, nearly 28% of households providing informal home care for fragile elderly while 7.4% had people with disabilities.

A statistically significant age association was found between care provider and recipient. Elderly care providers were more likely to provide home care to those 65 or older (p<0.05), while younger (aged (18-44) tend to provide care for aged 18 or younger care recipient (p<0.05). Younger care

providers (aged 18-44) were more likely to provide home care to 2 or more dependent care recipient (31.4%) than the older age group (age 45-64: 21.0%, age 65 or above: 12.1%, p-value: 0.018). Meanwhile, other socio-demographic factor like gender, Education attainment, housing factors of the care provider were not statistically significant. About 11.9% care providers reported they had family members requiring care mainly due to their chronic disease condition. Non-married care providers (26.7%; married: 7.1%) were more likely to provide care for household members with chronic disease ($p<0.001$).

Physical, mental and social health of informal care providers during COVID-19

Among the informal care provider, nearly 22% reported having an underlying chronic medical condition themselves but this proportion did not significantly differ from the non-informal care providers (17.3%) (Table 1). The perception of COVID-19's impact between provider and non-care provider is shown in Table 2. Those providing informal home care showed no significant differences in self-reported impacts on physical health, social life, and financial status, while significant difference was found for self-report impact of mental health status when compared between people with and without home care duties.

Table 2. Differences in perception between care provider and non-caregiver provider

	Non-care provider (N=573)	Care provider (N=192)	P
Self-reported COVID-19 impact on physical, mental, social well-being			
Believed COVID-19 had large effect on their physical health	50.3%	55.7%	0.190
Believed COVID-19 had large effect on their mental health	44.5%	53.6%	0.028*
Believed COVID-19 had large effect on their social life	70.7%	76.0%	0.152
Believed COVID-19 had large effect on their financial status	32.6%	35.4%	0.479
Believed COVID-19 had large effect on the Hong Kong	94.6%	93.8%	0.662
*p<0.05			

Notably, 53.9% reported that they had experienced additional strain in their care providers' duties. The most common cited reasons for additional strains included COVID-19 health risk concern (40.2%), increased time spent with care recipient (27.5%), and more things need to take care of during the pandemic (21.6%). For changes of community services (e.g. day care center) utilization that facilitated pre-COVID 19 care, 41 subjects reported to have used community services regularly and among them 39% had stopped or decreased the use of the services due to the epidemic.

Of the informal home care providers, 37.2% reported that their daily lives became more

challenging due to the need to care for their family during COVID-19 epidemic. Multivariable regression analysis, however, showed that these perceptions were not associated with age, sex and education attainment nor the number of care recipient. But providers who were having a dependent care recipient(s), and individuals having to take personal leave reported significantly increased difficulty in daily living ($p<0.001$) (Table S1 in supplementary file).

Care provider's perceived knowledge sufficiency

While nearly 90% of these home care providers believed that they had sufficient knowledge to provide routine care, only 50.5% believed that they had sufficient knowledge to manage the additional risk brought on by COVID-19 (Table S2 in supplementary file). Although various sociodemographic factors and care recipient characteristics were associated with care providers' perceived adequacy of knowledge for providing routine home care, there was no statistically significant difference for perceived adequacy of knowledge in COVID-19 risk mitigation by any sociodemographic or care recipient factors.

Home environment to facilitate home care and household COVID-19 risk control

Among the study population (n=765), only 32 subjects (4.2%) reported to have undergone home-quarantine/isolation during the COVID-19 epidemic. Among these subgroups, 23 (71.9%) took voluntary-based/self-imposed home isolation while 9 (28.1%) had to be home-bound due to government compulsory home isolation requirements. Reasons cited for quarantine due to recent travel abroad (41.9%) and in close contacts with confirmed patients (19.4%). Among the care providers, about 3.6% (7/192) reported that they had applied quarantine. Subjects were also asked about their preparation adequacy for potential home quarantine for 2 weeks. More than half of the subjects claimed they had sufficient masks, detergent, disposable gloves and sufficient independent rooms for isolation use. For the general household preparation, more than 80% participants have prepared alcohol rub, sufficient medicine and food and storage after COVID-19 epidemic started (Table 3).

Table 3. Self-reported household items for COVID-19 control during the epidemic (N=765)

	N (%)
Household preparation items for potential quarantine	
Masks	86.8%
Detergent	92.9%
Disposable gloves	51.9%
Sufficient independent room for isolation use	65.2%
General household preparation items	
Alcohol rub	95.2%
Basic medicine (for fevers and common cold)	92.4%
Food and water storage sufficient for 1 day	87.2%
Chronic disease medication enough for 1 week (N=241)	90.9%

Respondents reported awareness and knowledge of home quarantine instructions found most of the subjects agreed that family members living with quarantined patients should check their temperature daily (97.5%) and the quarantined subject should wear masks at home all the time (96.1%). However, only half of the subjects (51.3%) were able to answer that the ideal number of care providers for the person who is ill with COVID-19 should be only one. About 70% and 26% answered the ideal ratio of bleach solution for cleaning were 1:99 and 1:49 respectively. As to the ideal distance with the quarantine subject in the same room, 324 (42.4%) and 264 (34.6%) subjects answered 2 meters and 1 meter respectively.

DISCUSSION

During large-scale public health emergencies, home care may be the only viable method of providing continuous health care due to disruption of services and transportation. In many regions around the world, health care systems have been overwhelmed by high caseloads of COVID-19 patients with life-threatening conditions, necessitating greater reliance on informal home care providers. Home care during COVID-19 includes not only people caring for those with confirmed or suspected COVID-19; but also care for people with non-COVID-related conditions (for example the health maintaining support and essential life sustaining care), and their usual care responsibility for their family members. This is the first study to examine informal home care provision in high-income, urban context during a large-scale public health emergency. In our general population study sample of Hong Kong adults, approximately one-fourth reported to have provided informal home care during COVID-19 epidemic. In addition, about 20% among the caregivers reported that they have to provide care to 3 or more care recipients during the pandemic. In Hong Kong, many of the adults will live with their parents and children in the same household. Hence, the adult would have to take care of their parents and children. Consistent with previous literature[8], females shouldered the main burden of being a primary home care provider. The COVID-19 pandemic presents a complex set of additional burdens on these home care providers. More than half of the informal home care providers reported additional mental strain during the epidemic.

Although the majority of informal home care providers believed that they had sufficient knowledge for their normal home care duties, we noted that some subgroups felt themselves to be insufficiently knowledgeable to provide even routine care. Previous studies have shown that older age and less educated care providers reported a higher mental burden from caregiving[25,26]. Consistent with this, we noted home care providers who were older, housewives, and with lower education and income were more likely to believe themselves as lacking knowledge to provide routine care. Moreover, those caring for dependent individuals (e.g. fragile elderly and disabled) felt inadequately knowledgeable, possibly due to heavy reliance on existing services for regular management of fragile elderly and people with disabilities by the government[27]. In contrast to the provision of routine informal home care, nearly half of the informal home care providers reported that they had insufficient knowledge to mitigate the additional health risks from the COVID-19 epidemic and these findings were not associated with education or other factors.

On top of the additional economic and knowledge burden brought on by the worldwide pandemic, approximately half of the care providers reported additional mental strain during the epidemic. The most common reasons cited were the concerns of risk of COVID-19 infection in family, the

longer duration of providing care and the additional caregiving tasks brought about from the pandemic. Nearly 40% of informal care provider reported that their caregiving duties had also caused increased difficulty in their daily life. Those reporting higher mental burden were often caring for dependent family members, and necessitating taking personal leave for the caregiving duties. Due to the COVID-19 pandemic, many community services like social community center[28], day care center[12] and schools [29]were closed in Hong Kong. Hence, these home care providers with dependent care recipients require additional support services during public health emergencies. Furthermore, more than half of the care recipients were children and teenagers, who added to the caregiving burden during the nearly four-month, territory-wide school closures. The closure of schools and elderly services has curtailed health access during the epidemic with 40% of the care providers reporting to have ceased or reduced using those services. In addition, it was found that the caregiving burden was highest in the economically-active age group (aged 18 to 44). These individuals were often faced with a double burden of working and providing informal home care. Although government had subsidized the wages to employees[30] , further support should target this care provider group. For example, providing sufficient information and services in internet or smartphone app, as younger aged care provider was found to be using more internet and smartphone app as their main information source comparing to other aged group[17].

There were a few limitations in this study. First, the study recruitment relied on land-based telephone. Households without land-based telephone services would be missed. However, the penetration rate of the residential fixed line services in Hong Kong was 85.5% in December 2019[31]. In addition, our study population was comparable with the latest population Census in Hong Kong, which was generalizable to the general population. Furthermore, the study was conducted during the peak period of COVID-19 epidemic in Hong Kong. Citizens were encouraged to stay at home for work or daily activity. Hence, the respondents would be more compliant and attentive to the telephone survey [32]. Secondly, the cross-sectional study design can only demonstrate associations between patterns and social-demographic predictors, as causation cannot be attributed to the findings. Thirdly, this study might subject to reporting bias since data were self-reported, and data from non-respondents could not be obtained. Fourthly, our study did not further investigate the burdens, coping method and their perceived wellbeing of the care provider, which were potentially associated with the perceived difficulty of care giving. Lastly, for the sample size of the subjects who perceived lacking knowledge to provide routine care was small (n=20). Hence, advanced statistical analysis was not possible. Qualitative interviews might have revealed more rich and detailed insights.

Although the SARS-CoV-2/COVID-19 pandemic has engendered a huge amount of clinical, epidemiological and vaccine-related research, the socio-economic impact of COVID-19 has not yet been well-examined. Home care, being one of the crucial pillars in supporting people's health outside the formal healthcare setting during this pandemic, needs much stronger research and support from stakeholders at various levels[33]. In addition to research in formal healthcare services, better understanding of the challenges posed by the various home care settings (even informal settlements) is urgently required. This includes disease management in home care settings and strategies to optimize resources and support for informal care providers during global pandemics such as COVID-19. This study examined informal home care providers in a high-income Asian city during the early phase of the pandemic. However, the long-term implications on care providers, health outcomes of care recipients, and coping strategies of vulnerable people

(particularly those living alone) are largely unknown. Research in these areas is urgently needed to improve pandemic preparedness of national health systems.

CONCLUSION

This study explores home care situation in Hong Kong, an Asia metropolis in China which experienced the early phase of COVID-19 in 2020. Findings showed home care during pandemic can present a complex set of care recipient needs and providers' duties in densely-high-rise building based aging community with a high dependency ratio. The study also showed that younger workers with higher education and income had to bear the main burden of care for dependent care recipients during the epidemic but the heaviest routine care burden fell upon those with deficit resource. Governments should consider supplementing service support during large-scale public health emergencies when access to routine health care is disrupted. Policy should focus on continuous support to those informal care providers and their mental health needs during these public health emergencies.

Figures

Figure 1a. Characteristics of care provider-recipient relationship among all care recipients, as reported by informal care providers (N=345)

Figure 1b. Age distribution of dependent care receiver (who cannot live normally without caregivers' help)

Figure 2. The relationship between household income and informal home care duties

Funding

This work was supported by CCOUC-Oxford research support fund (#0008).

Competing interests

All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare: no support from any organization for the submitted work; no financial relationships with any organizations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.

Contributors

EYYC, KKCH, ELYW, SYSW, & NG conceived the project. EYYC, ESKL, KKCH, ZH designed the study tool, obtained, validated, and cleaned the data. ESKL, ZH and JHK performed the data analysis. EYYC, ELYW, ESKL, JHK, HH and ZH involved in literature review and write up. All authors contributed to the manuscript drafting, review, revision and approval of the final manuscript. KKCH, ESKL, HH SYSW and ZH provided administrative and operational support.

The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

Ethical Approval

Verbal consent was obtained from the participant and ethics approval and consent procedure of the study was reviewed and obtained from the Survey and Behavioral Research Ethics Committee at The Chinese University of Hong Kong (SBRE-19-498).

Data sharing statement

No additional data are available.

Word count: 3903

Licence

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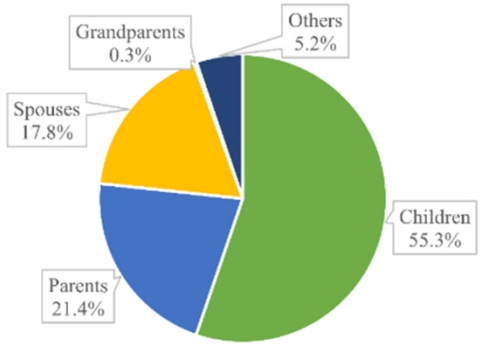

Fig. 1a

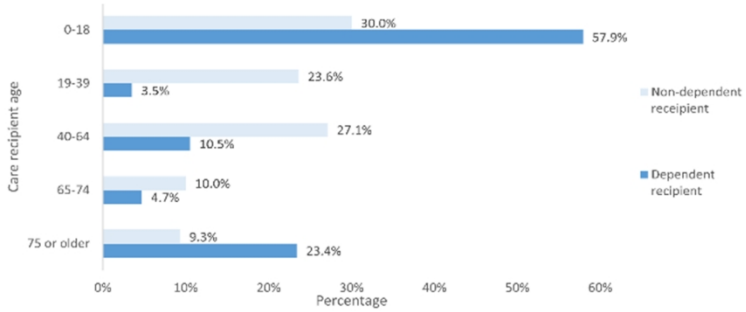

Fig. 1b

Figure 1a. Characteristics of care provider-recipient relationship among all care recipients, as reported by informal care providers (N=345)
Figure 1b. Age distribution of dependent care receiver (who cannot live normally without caregivers' help)

101x76mm (600 x 600 DPI)

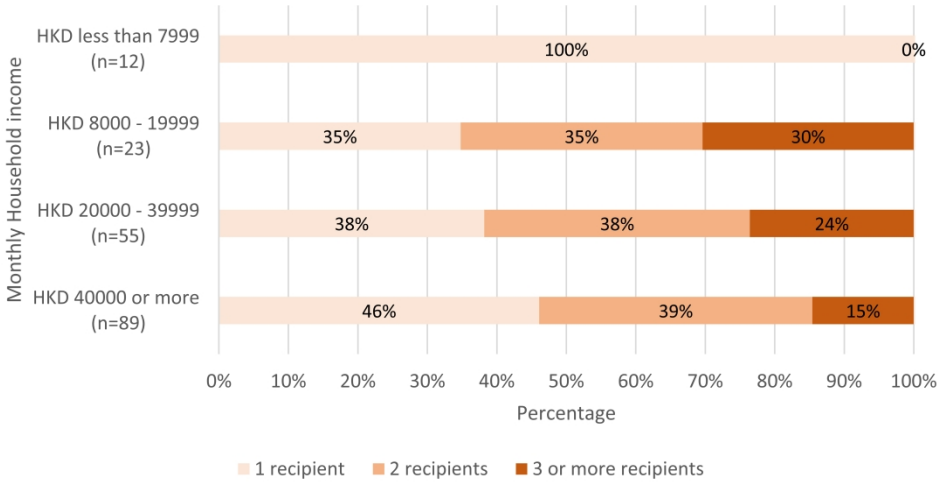

Figure 2. The relationship between household income and informal home care duties

177x88mm (768 x 768 DPI)

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Table S1. Factors associated with self-perceived increased difficulty in daily living

	No	Yes	p	AOR (LB-UB)	p
N	120	71			
Socio-demographic					
Age[a]			0.306		
18-44	34.2%	43.7%			
45-64	49.2%	38.0%			
65 or more	16.7%	18.3%			
Gender			0.441		
Male	35.0%	29.6%			
Female	65.0%	70.4%			
Education attainment			0.356		
Primary level or below	10.0%	4.2%			
Secondary level	48.3%	52.1%			
Tertiary level	41.7%	43.7%			
Occupation			0.903		
White collar	44.8%	44.3%			
Blue collar (including services and sales)	19.0%	17.1%			
Housewives	21.6%	25.7%			
Students	0.9%	0.0%			
Unemployed or retired	13.8%	12.9%			
Housing			0.703		
Public housing	25.8%	21.1%			
Subsidized housing	13.3%	9.9%			
Private housing (including independent villa)	60.0%	67.6%			
Others	0.8%	1.4%			
Household income			0.422		
<7999	4.5%	10.6%			
8000 – 19999	14.3%	10.6%			
20000 – 39999	30.4%	30.3%			
40000 or more	50.9%	48.5%			
Housing size			0.397		
Small (350ft or below)	16.2%	22.4%			
Medium (351 ft- 800ft)	67.6%	67.2%			
Large (801 ft. or above)	16.2%	10.4%			
Chronic disease condition			0.616		
No	79.2%	76.1%			
Yes	20.8%	23.9%			
Marital status			0.001		
Unmarried (including divorced or widow)	32.5%	11.3%		Ref.	
Married	67.5%	88.7%		2.81 (0.98 – 8.09)	0.055

Having sufficient knowledge to take care their family members			0.463		
Not sure or No	9.6%	13.0%			
Yes	90.4%	87.0%			
Characteristics of the care recipient					
Number of care recipient			0.797		
1 recipient	47.5%	43.7%			
2 recipients	35.0%	35.2%			
3 or more recipients	17.5%	21.1%			
Family member as fragile elderly or disabilities			0.958		
No	68.6%	69.0%			
Yes (with either one)	31.4%	31.0%			
Children were the care recipients			0.075		
No	42.5%	29.6%		Ref.	
Yes	57.5%	70.4%		0.83 (0.34 – 2.05)	0.688
Spouse was the care recipient			0.148		
No	73.3%	63.4%			
Yes	26.7%	36.6%			
Parents or parents-in-law were the care recipients*			0.033		
No	65.8%	80.3%		Ref.	
Yes	34.2%	19.7%		0.23 (0.08- 0.70)	0.009
Family member who were dependent recipients *			<0.001		
No	49.1%	13.0%		Ref.	
Yes	50.9%	87.0%		6.38 (2.69 – 15.14)	<0.001
Family member received care due to staying at home during COVID-19 outbreak ^			0.053		
No	81.9%	69.6%		Ref.	
Yes	18.1%	30.4%		1.70 (0.70 – 4.13)	0.238
Family member who receive care mainly due to their chronic condition			0.709		
No	88.8%	87.0%			
Yes	11.2%	13.0%			
The effect brought by COVID-19					
Stopped or decrease the use of community services during COVID-19 outbreak+			0.007		
No	95.8%	84.5%		Ref.	

Yes	4.2%	15.5%		3.22 (0.73 – 14.19)	0.122
Need to take personal leave for caregiving responsibility*			<0.001		
No	92.4%	63.4%		Ref.	
Yes	7.6%	36.6%		7.15 (2.44 – 20.91)	<0.001

+Using Fisher's exact test, ^p<0.10, * p<0.05,
[a]The age group "18-24" and "25-44" were collapsed
In the multivariable logistic regression, there were 7 missing values in variable *family member who were dependent recipients*, 2 missing values in s*topped or decrease the use of community services during COVID-19 outbreak*, 2 missing values in *need to take personal leave for caregiving responsibility*, 7 missing values in *stay at home during COVID-19 outbreak*, and 1 missing value in *perceived increased difficulty in daily live*

Table S2. Sociodemographic predictors for care providers who believed to have adequate knowledge for routine care and COVID infection control

	Knowledge for routine care			**Knowledge of COVID-19 risk mitigation**		
N	20 (10.9%)	164 (89.1%)		95 (49.5%)	97 (50.5%)	
	Not enough knowledge	Enough knowledge	p	Not enough knowledge	Enough knowledge	p
Socio-demographic details						
Age[ab]			0.036*			0.349
18-44	25.0%	39.6%		43.2%	33.0%	
45-64	35.0%	45.1%		41.1%	48.5%	
65 or more	40.0%	15.2%		15.8%	18.6%	
Gender			0.455			0.958
Male	40.0%	31.7%		32.6%	33.0%	
Female	60.0%	68.3%		67.4%	67.0%	
Education attainment			<0.001*			0.160
Primary or below	30.0%	4.3%		10.5%	5.2%	
Secondary	45.0%	49.4%		52.6%	46.4%	
Tertiary	25.0%	46.3%		36.8%	48.5%	
Marital status[a]			0.786			0.453
Non-married	20.0%	25.0%		27.4%	22.7%	
Married	80.0%	75.0%		72.6%	77.3%	
Housing[a]			0.236			0.897
Public housing	40.0%	22.0%		23.2%	25.8%	
Subsidized housing	15.0%	12.2%		13.7%	10.3%	
Private housing (including independent villa)	45.0%	65.2%		62.1%	62.9%	
Others	0.0%	0.6%		1.1%	1.0%	
Living density (household size / number of people)[a]			0.900			0.428
<200 ft per ppl	62.5%	60.9%		65.5%	59.8%	
200 ft or more per ppl	37.5%	39.1%		34.5%	40.2%	
Main information channel[a]			0.653			0.249
Television	50.0%	34.1%		38.9%	34.0%	
Internet or smartphone app	45.0%	57.9%		56.8%	55.7%	

Others (newspaper, radio)	5.0%	7.9%		4.2%	10.3%	
Housing size[a]			0.104			0.547
Small (350ft or below)	31.3%	16.7%		20.7%	16.3%	
Medium (351 ft-800ft)	68.8%	67.3%		67.8%	67.4%	
Large (801 ft. or above)	0.0%	16.0%		11.5%	16.3%	
Family income group[a]			<0.001*			0.323
<7999	27.8%	4.5%		5.8%	7.5%	
8000 – 19999	11.1%	13.5%		12.8%	12.9%	
20000 – 39999	50.0%	27.6%		37.2%	24.7%	
40000 or more	11.1%	54.5%		44.2%	54.8%	
Employment[a]			0.010*			0.699
White collar	15.0%	49.1%		44.6%	44.2%	
Blue collar (including services and sales)	20.0%	17.6%		18.5%	18.9%	
Students	0.0%	0.0%		25.0%	21.1%	
Housewives	45.0%	20.1%		1.1%	0.0%	
Unemployment and retired	20.0%	13.2%		10.9%	15.8%	
Care recipient characteristics						
Children were the care recipients			0.059			0.528
No	55.0%	33.5%		35.8%	40.2%	
Yes	45.0%	66.5%		64.2%	59.8%	
Spouse was the care recipient			0.723			0.594
No	65.0%	68.9%		71.6%	68.0%	
Yes	35.0%	31.1%		28.4%	32.0%	
Parents or parents-in-law were the care recipients			0.597			0.480
No	65.0%	70.7%		73.7%	69.1%	
Yes	35.0%	29.3%		26.3%	30.9%	
Family members were dependent recipients			0.044*			0.817
No	15.0%	37.8%		34.8%	36.5%	

Yes	85.0%	62.2%		65.2%	63.5%	
Members were fragile elderly or disabilities			0.040*			0.709
No	47.4%	70.6%		70.2%	67.7%	
Yes	52.6%	29.4%		29.8%	32.3%	

[a]Fisher's exact test was performed for analysis about "knowledge for routine care"
[b]The age group "18-24" and "25-44" were combined as the age group "18-24" only have 2 subjects
*p<0.05

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	1
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	4
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	4
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	4
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*4*
Bias	9	Describe any efforts to address potential sources of bias	5
Study size	10	Explain how the study size was arrived at	4
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	4
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	5
		(*b*) Describe any methods used to examine subgroups and interactions	5
		(*c*) Explain how missing data were addressed	5
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	5
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5,7
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	5
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	5,7
		(b) Indicate number of participants with missing data for each variable of interest	8
Outcome data	15*	Report numbers of outcome events or summary measures	6-11
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	6-11

		(*b*) Report category boundaries when continuous variables were categorized	6-11
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	12
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	11-12
Generalisability	21	Discuss the generalisability (external validity) of the study results	12-13
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	14

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Characteristics and well-being of urban informal home care providers during COVID-19 pandemic: a population-based study

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2020-041191.R2
Article Type:	Original research
Date Submitted by the Author:	07-Oct-2020
Complete List of Authors:	Chan, Emily; The Chinese University of Hong Kong, JC School of Public Health and Primary Care; University of Oxford, Nuffield Department of Medicine Lo, Eugene; The Chinese University of Hong Kong, JC School of Public Health and Primary Care Huang, Zhe; The Chinese University of Hong Kong, JC School of Public Health and Primary Care Kim, Jean ; The Chinese University of Hong Kong, JC School of Public Health and Primary Care Hung, Heidi; The Chinese University of Hong Kong, JC School of Public Health and Primary Care Hung, Kevin KC; Chinese University of Hong Kong, Accident and Emergency Medicine Academic Unit Wong, Eliza LY; The Chinese University of Hong Kong, JC School of Public Health and Primary Care Wong, Samuel; The Chinese University of Hong Kong, JC School of Public Health and Primary Care Gobat, Nina; University of Oxford, Nuffield Department of Medicine
Primary Subject Heading:	Public health
Secondary Subject Heading:	General practice / Family practice
Keywords:	Public health < INFECTIOUS DISEASES, PRIMARY CARE, PUBLIC HEALTH

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Characteristics and well-being of urban informal home care providers during COVID-19 pandemic: a population-based study

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ABSTRACT

Objectives

Globally, the COVID-19 pandemic has overwhelmed many health care systems and individuals are unable to access routine clinical care during lockdowns. Informal home care, care provided by non-healthcare professionals, increases the community's health care capacity during pandemics. There is, however, limited research about the characteristics of informal home care providers and the challenges they face during such public health emergencies.

Design

A random, cross-sectional, population-based telephone survey study was conducted to examine patterns of home care, characteristics of informal home care providers and the challenges of these care providers during this pandemic.

Setting

Data were collected from 22 March to 1 April 2020 in Hong Kong, China.

Participants

A population representative study sample of Chinese-speaking adults (n=765) was interviewed.

Primary and secondary outcome measures

The study examined the characteristics of informal home care providers, and the characteristics and health care requirements of the care recipients. The study also examined providers' self-perceived knowledge to provide routine home care as well as COVID-19 risk reduction care. Respondents were asked about mental health related to COVID-19.

Results

Of the respondents, 25.1% of 765 provided informal home care during the studied COVID-19 pandemic period. Of informal home care providers, 18.4% of respondents took leave from school/work during the epidemic to provide care that included fragile elderly and small children.

These care providers tended to be younger-aged, female, and housewives. Approximately half of care providers reported additional mental strain and 37.2 % reported of challenges in daily living during epidemic. Although most informal home care providers felt competent to provide routine care, 49.5% felt inadequately prepared to cope with the additional health risks of COVID-19.

Conclusion
During public health emergencies, heavy reliance on informal home health care providers necessitates better understanding of their specific needs and increased government services to support informal home care.

Keywords: Informal home care, health and well-being, COVID 19, Urban, Asia, Hong Kong

Abstract word count: 300

Strengths and limitation of this study

In a city affected in the early stages of the COVID-19 pandemic, this study was the first to highlight the impact and added burden of care experienced by informal home care providers among the general population.

This telephone-based study was conducted during the peak period of COVID-19 epidemic in Hong Kong, so the citizen would be more compliant and attentive to the telephone survey as they were encouraged to stay at home for work or daily activity.

The cross-sectional design cannot draw a conclusion on any cause-effect relationship.

this study might subject to reporting bias since data were self-reported, and data from non-respondents could not be obtained.

INTRODUCTION

Home care is regarded as one of the major care models to address medical needs for patients and vulnerable populations during COVID-19 pandemic[1]. As described by the World Health Organization (WHO)[2], home care aims to provide high quality and cost-effective care to individuals that will enable them to maintain their independence and the highest possible quality of life. While formal home care providers are usually remunerated workers from medical authorities or registered organizations, informal home care providers are usually family members or others who provide unpaid care to those in need[3]. The typical profile of individuals who require home care are patients with chronic diseases or mental conditions, individuals with disabilities, young children, the elderly and other vulnerable individuals who live alone. Up to the present, the published literature has mainly examined the quality of life of older adults, the care recipients, the mental health of the care providers[4–6] and experience of informal home care providers under non-emergency health situations[7,8].

During the COVID-19 pandemic, in an attempt to reduce the surge of patients requiring hospital care, many countries have implemented epidemic control measures [9] to limit activities outside the home such as closure of non-essential services. Moreover, countries have relied heavily on home quarantine for suspected COVID-19 patients with mild-symptoms in order to maintain resilience of the national health system[1,9,10]. In Hong Kong, in conjunction with prohibitions on mass gatherings, closure of recreational centers, schools and community services[11,12], a mandatory 14-days quarantine was issued for those who entered into Hong Kong from outside its borders[13]. This resulted in 13,649 individuals under compulsory home quarantine from 13 Mar to 26 Mar 2020[14]. In such a public health emergency, informal care may be the only care option for people in need[15]. There have been no published studies of informal care providers during extreme events or during population-level health emergencies. Hence, the impacts on informal home care providers from the closure of community services and limited access to healthcare services during the COVID-19 are unknown.

According to the Hong Kong 2016 By-census, one-fourth of households had children aged under 15 while and one-third household reported having at least one elderly household member[16]. Combined, these households were particularly in need of home care even in ordinary setting, accounting for 27.2% of the whole Hong Kong population. The likely heavy reliance on informal home care during a pandemic emergency in Hong Kong allows examination of the prevalence and special needs of informal home care providers. This study aimed to identify the pattern of informal home care, characteristics of informal home care providers and their challenges in Hong Kong during the COVID-19 epidemic. The study also seeks to examine the knowledge levels and level of preparation for the home quarantine among these care providers and the recipients of their care in Hong Kong.

METHODS

Study design and study population

A cross-sectional, population-based telephone survey was conducted from 22 March to 1 April 2020 during the peak of local COVID-19 pandemic. The computerized Random Digit Dialing (RDD) method was used for each of Hong Kong's 18 districts to randomly select a representative sample. The survey methods and the sample size estimation have been previously detailed[17]. It was designed on the basis of literature review and previous research experience[18–21]. The study only includes respondents who were 18 years old or older, and speak Cantonese.

The study instruments

A self-reported, semi-structured Chinese questionnaire was used for data collection[17]. The data collected included the subjects' perception, knowledge, preparedness, their home care experience if available toward and during the COVID-19 pandemic. Since the home care recipients could include a wide range of different groups (e.g. healthy children due to the closure of schools), care providers were identified through one of the questions in the questionnaire "Do you currently need to look after member(s) of your family and relatives' daily needs (like your children/parents) during COVID-19 epidemic?". Besides the experience and situations of their care duties during the COVID-19, the characteristics of the care recipients under their care were also investigated. Care recipients' age, sex, relationship with the care provider, the reason for the receiving care and their dependency were recorded. Care providers were also asked if they were the primary care providers for their recipients (defined as having the major responsibility in caregiving duties) and if their care recipient was dependent on them (defined as inability to maintain activities of daily living without care provider assistance). All self-reported home care providers in this study were confirmed to be informal care provider.

Care providers were asked if they felt that they possessed sufficient knowledge about routine care and COVID-19 risk mitigation. A 5-point Likert scale was used to assess physical, mental, social and other related health impact (ranging from 1= no impact to 5= maximum impact). Respondents were asked about their home care experience, risks perception, household capacity to provide care and home care challenges that they experienced. The instrument also asked about knowledge of infection control during a home quarantine. Specifically, the respondents were asked about their knowledge of infection control in home context such as *the ratio of bleach solution for cleaning*

(*1:99 ratio for normal cleaning and 1:49 for cleaning vomit, excreta or secretion*[22]), *the recommended distance for with the quarantine subjects (at least 1 meter*[22]).

Statistical analysis

Descriptive statistics of the study sample were presented with chi-square tests to examine comparability of the study sample with the Hong Kong general census population[23]. Socio-demographic pattern analyses of respondents who might have care-providing responsibilities, the home care recipients, and the context of care provision during the COVID-19, were conducted. Chi-square test was conducted for comparing the perception toward COVID-19 between care provider and non-care provider subjects. Multivariable logistic regression analysis was conducted to compare the sociodemographic predictors between care providers and non-care providers. In addition, logistic regression analysis was conducted to understand how the socio-demographic of the care provider and their care responsibilities may affect their daily living. For both multivariable logistic regressions, the first step involved bivariate analyses (chi-square test or independent t-test). Explanatory variables whose significance was <0.10 were entered as candidate variables into a multivariable logistic model. Chi-square tests were then conducted between the care providers who believed they possess sufficient or insufficient knowledge in providing routine care and COVID-19 risk mitigation. Missing values will be excluded in the data analysis. No sensitivity analysis was conducted. The level of significance of statistical test was 0.05. All statistical analyses were conducted using IBM SPSS 21 for Windows[24].

Patient and public involvement

The design, or conduct, or reporting, or dissemination plans of our research were done without patient or the public involvement.

RESULTS

Final study sample consisted of 765 respondents (44.0% response rate) and was comparable with the population data in Hong Kong By-census 2016. Of the 765 participants, 53.5% (n=409) were women, 18.7% (n=143) were aged 64 and above, and 60.2% (n=459) were currently married. Information about the respondents and the recruitment process were detailed in a previous study in the same series[17].

Characteristics of the home care recipients (N=345)

The study sample consisted of 192 care providers, who reported that they needed to provide care for 345 care recipients. Among these home care recipients, children represented 55.2% (being taken care of by parents), parents and parent-in-law represented 21.4% (being taken care of by children and children-in-law), while spouses accounted for 17.8%. (*Figure 1a*). As cited by the informal care providers, the main reasons for recipients' need of home care was due to extreme age (24.2%), had to stay at home due to COVID-19 epidemic (23.5%), recipient's chronic medical conditions (8.0%) and physical activities limitation (4.3%). Over half (533.8%) of home care recipients in the sample were considered as completely care dependent during the epidemic. Figure 1b showed most of the dependent care recipient were aged 0-18 and aged 75 or above (chi-square p-value: p<0.001). Gender difference was not significant between dependent and non-dependent care recipient.

Who were the informal care provider during the COVID-19? (n=192)

In our study sample, one-quarter of respondents reported to have undertaken care responsibilities during the COVID-19 epidemic (Table 1). Notably, about 83.7% of informal home care providers were the primary home care providers and informal home care providers were predominantly female (67%, 129/192). Of informal home care providers, 44.8% were middle aged (45-64 years' age), 38% were (73/192) aged 18-44 and 17.2% were aged 65 or above. Although full-time housewives represented nearly one-quarter of the informal care providers while 13.4% were unemployed or retired, more than 50% of informal home care providers were concurrently employed (44% were white collar employees). Multivariable logistic regression results indicated that *younger adults, female, married, housewives* were more likely to be informal home care providers during COVID 19 (Table 1)

Table 1. Factors associated with having informal home care responsibilities during the COVID-19 pandemic in Hong Kong (N=765)

N	Non-care provider (N=573)	Care provider (N=192)	p	AOR (95% Confident Interval)	p
Age			<0.001*		
18-24	12.0%	1.0%		Ref.	
25-44	30.9%	37.0%		5.34 (1.01 – 28.37)	0.049*
45-64	37.9%	44.8%		4.09 (0.76 – 22.14)	0.102
65 or more	19.2%	17.2%		3.63 (0.63 – 20.85)	0.148
Gender			<0.001*		
Male	51.1%	32.8%		Ref.	
Female	48.9%	67.2%		1.90 (1.29 – 2.82)	0.001*
Education attainment			0.125		
Primary level or below	8.1%	7.8%			
Secondary level	41.2%	49.5%			
Tertiary level	50.7%	42.7%			
Housing			0.370		
Public housing	28.4%	24.5%			
Subsidized housing	14.9%	12.0%			
Private housing	55.3%	62.5%			
Others	1.4%	1.0%			
Housing size			0.499		
Small (350ft or below)	22.1%	18.4%			
Medium (351 ft- 800ft)	63.0%	67.6%			
Large (801 ft. or above)	15.0%	14.0%			
Chronic disease?			0.155		
No	82.7%	78.1%			
Yes	17.3%	21.9%			
Marital status			<0.001*		

Currently unmarried	44.8%	25.0%		Ref.	
Currently married	55.2%	75.0%		2.20 (1.45 – 3.35)	<0.001*
Employment			<0.001*		
White collar	45.5%	44.4%		Ref.	
Blue collar	16.4%	18.7%		1.43 (0.88 – 2.32)	0.144
Housewives	8.8%	23.0%		1.89 (1.08 – 3.31)	0.026*
Students	8.1%	0.5%		0.38 (0.04 – 3.88)	0.412
Unemployed and retired	21.2%	13.4%		0.80 (0.43 – 1.50)	0.488
Household income			0.335		
<7999	10.0%	6.7%			
8000 – 19999	14.5%	12.8%			
20000 – 39999	25.2%	30.7%			
40000 or more	50.3%	49.7%			
*p<0.05 In the multivariable logistic regression, there were 2 missing values in *marital status*, and 11 missing values in *employment*.					

During this COVID-19 epidemic, nearly one in five of informal home care providers reported that they had to take personal leave from work or school to take care of their families. Informal home care providers who had taken personal leave were significantly more likely to be younger age (18-44 years of age), and were significantly more likely to have 2 or more dependent care recipients (chi-square p-value: <0.05). Although care provider's underlying chronic disease status, education attainment, housing types, and household income were not statistically significant.

The association between income levels and informal home care duties was statistically insignificant (chi-square p-value: >0.05). Yet, analysis showed home care providers from lower income subgroups (HKD 8000 – 19999) tended to have to be responsible for more than one care recipient when compare with the higher income counterparts (Figure 2). In addition, Female was found to be the predominant gender to have taken up the primary informal care provider's role (73.4%, chi-square p-value: <0.001).

*There are 13 missing values in household income.

More than half of the informal home care providers were responsible for caring for more than one individual with nearly 20% (36/192) of respondents reporting that they needed to provide care to 3 or more household members. Of note, 64.7% care providers reported that there was at least 1 dependent care recipient under their caring duties; 32.3% and 47.6% care providers reported to be giving care to elderly family members (aged 65 or above) and children under the age of 18 or younger, respectively. Moreover, nearly 28% of households providing informal home care for fragile elderly while 7.4% had people with disabilities.

A statistically significant age association was found between care provider and recipient. Elderly care providers were more likely to provide home care to those 65 or older (p<0.05), while younger (aged (18-44) tend to provide care for aged 18 or younger care recipient (p<0.05). Younger care

providers (aged 18-44) were more likely to provide home care to 2 or more dependent care recipient (31.4%) than the older age group (age 45-64: 21.0%, age 65 or above: 12.1%, p-value: 0.018). Meanwhile, other socio-demographic factor like gender, Education attainment, housing factors of the care provider were not statistically significant. About 11.9% care providers reported they had family members requiring care mainly due to their chronic disease condition. Non-married care providers (26.7%; married: 7.1%) were more likely to provide care for household members with chronic disease ($p<0.001$).

Physical, mental and social health of informal care providers during COVID-19

Among the informal care provider, nearly 22% reported having an underlying chronic medical condition themselves but this proportion did not significantly differ from the non-informal care providers (17.3%) (Table 1). The perception of COVID-19's impact between provider and non-care provider is shown in Table 2. Those providing informal home care showed no significant differences in self-reported impacts on physical health, social life, and financial status, while significant difference was found for self-report impact of mental health status when compared between people with and without home care duties.

Table 2. Differences in perception between care provider and non-care provider

	Non-care provider (N=573)	Care provider (N=192)	P
Self-reported COVID-19 impact on physical, mental, social well-being			
Believed COVID-19 had large effect on their physical health	50.3%	55.7%	0.190
Believed COVID-19 had large effect on their mental health	44.5%	53.6%	0.028*
Believed COVID-19 had large effect on their social life	70.7%	76.0%	0.152
Believed COVID-19 had large effect on their financial status	32.6%	35.4%	0.479
Believed COVID-19 had large effect on the Hong Kong	94.6%	93.8%	0.662
*p<0.05			

Notably, 53.9% reported that they had experienced additional strain in their care providers' duties. The most commonly cited reasons for additional strains included COVID-19 health risk concern (40.2%), increased time spent with care recipient (27.5%), and more things need to take care of during the pandemic (21.6%). For changes of community services (e.g. day care center) utilization that facilitated pre-COVID 19 care, 41 subjects reported to have used community services regularly and among them 39% had stopped or decreased the use of the services due to the epidemic.

Of the informal home care providers, 37.2% reported that their daily lives became more

challenging due to the need to care for their family during COVID-19 epidemic. Multivariable regression analysis, however, showed that these perceptions were not associated with age, sex and education attainment nor the number of care recipient. But providers who were having a dependent care recipient(s), and individuals having to take personal leave reported significantly increased difficulty in daily living ($p<0.001$) (Table S1 in supplementary file).

Care provider's perceived knowledge sufficiency

While nearly 90% of these home care providers believed that they had sufficient knowledge to provide routine care, only 50.5% believed that they had sufficient knowledge to manage the additional risk brought on by COVID-19 (Table S2 in supplementary file). Although various sociodemographic factors and care recipient characteristics were associated with care providers' perceived adequacy of knowledge for providing routine home care, there was no statistically significant difference for perceived adequacy of knowledge in COVID-19 risk mitigation by any sociodemographic or care recipient factors.

Home environment to facilitate home care and household COVID-19 risk control

Among the study population (n=765), only 32 subjects (4.2%) reported to have undergone home-quarantine/isolation during the COVID-19 epidemic. Among these subgroups, 23 (71.9%) took voluntary-based/self-imposed home isolation while 9 (28.1%) had to be home-bound due to government compulsory home isolation requirements. Reasons cited for quarantine due to recent travel abroad (41.9%) and in close contacts with confirmed patients (19.4%). Among the care providers, about 3.6% (7/192) reported that they had applied quarantine. Subjects were also asked about their preparation adequacy for potential home quarantine for 2 weeks. More than half of the subjects claimed they had sufficient masks, detergent, disposable gloves and sufficient independent rooms for isolation use. For the general household preparation, more than 80% participants have prepared alcohol rub, sufficient medicine and food and storage after COVID-19 epidemic started (Table 3).

Table 3. Self-reported household items for COVID-19 control during the epidemic (N=765)

	N (%)
Household preparation items for potential quarantine	
Masks	86.8%
Detergent	92.9%
Disposable gloves	51.9%
Sufficient independent room for isolation use	65.2%
General household preparation items	
Alcohol rub	95.2%
Basic medicine (for fevers and common cold)	92.4%
Food and water storage sufficient for 1 day	87.2%
Chronic disease medication enough for 1 week (N=241)	90.9%

Respondents reported awareness and knowledge of home quarantine instructions found most of the subjects agreed that family members living with quarantined patients should check their temperature daily (97.5%) and the quarantined subject should wear masks at home all the time (96.1%). However, only half of the subjects (51.3%) were able to answer that the ideal number of care providers for the person who is ill with COVID-19 should be only one. About 70% and 26% answered the ideal ratio of bleach solution for cleaning were 1:99 and 1:49 respectively. As to the ideal distance with the quarantine subject in the same room, 324 (42.4%) and 264 (34.6%) subjects answered 2 meters and 1 meter respectively.

DISCUSSION

During large-scale public health emergencies, home care may be the only viable method of providing continuous health care due to disruption of services and transportation. In many regions around the world, health care systems have been overwhelmed by high caseloads of COVID-19 patients with life-threatening conditions, necessitating greater reliance on informal home care providers. Home care providers during COVID-19 include not only people caring for those with confirmed or suspected COVID-19; but also care for people with non-COVID-related conditions (for example the health maintaining support and essential life sustaining care), and their usual care responsibility for their family members. This is the first study to examine informal home care provision in high-income, urban context during a large-scale public health emergency. In our general population study sample of Hong Kong adults, approximately one-fourth reported to have provided informal home care during COVID-19 epidemic. In addition, about 20% among the caregivers reported that they have to provide care to 3 or more care recipients during the pandemic. In Hong Kong, many of the adults will live with their parents and children in the same household. Hence, the adult would have to take care of their parents and children. Consistent with previous literature[8], females shouldered the main burden of being a primary home care provider. The COVID-19 pandemic presents a complex set of additional burdens on these home care providers. More than half of the informal home care providers reported additional mental strain during the epidemic.

Although the majority of informal home care providers believed that they had sufficient knowledge for their normal home care duties, we noted that some subgroups felt themselves to be insufficiently knowledgeable to provide even routine care. Previous studies have shown that older age and less educated care providers reported a higher mental burden from caregiving[25,26]. Consistent with this, we noted home care providers who were older, housewives, and with lower education and income were more likely to believe themselves as lacking knowledge to provide routine care. Moreover, those caring for dependent individuals (e.g. fragile elderly and disabled) felt inadequately knowledgeable, possibly due to heavy reliance on existing services for regular management of fragile elderly and people with disabilities by the government[27]. In contrast to the provision of routine informal home care, nearly half of the informal home care providers reported that they had insufficient knowledge to mitigate the additional health risks from the COVID-19 epidemic and these findings were not associated with education or other factors.

On top of the additional economic and knowledge burden brought on by the worldwide pandemic, approximately half of the care providers reported additional mental strain during the epidemic. The most common reasons cited were the concerns of risk of COVID-19 infection in family, the

longer duration of providing care and the additional caregiving tasks brought about from the pandemic. Nearly 40% of informal care provider reported that their caregiving duties had also caused increased difficulty in their daily life. Those reporting higher mental burden were often caring for dependent family members, and necessitating taking personal leave for the caregiving duties. Due to the COVID-19 pandemic, many community services like social community center[28], day care center[12] and schools[29] were closed in Hong Kong. Hence, these home care providers with dependent care recipients require additional support services during public health emergencies. Furthermore, more than half of the care recipients were children and teenagers, who added to the caregiving burden during the nearly four-month, territory-wide school closures. The closure of schools and elderly services has curtailed health access during the epidemic with 40% of the care providers reporting to have ceased or reduced using those services. In addition, it was found that the caregiving burden was highest in the economically-active age group (aged 18 to 44). These individuals were often faced with a double burden of working and providing informal home care. Although government had subsidized the wages to employees[30] , further support should target this care provider group. For example, providing sufficient information and services in internet or smartphone app, as younger aged care provider was found to be using more internet and smartphone app as their main information source comparing to other aged group[17].

There were a few limitations in this study. First, the study recruitment relied on land-based telephone. Households without land-based telephone services would be missed. However, the penetration rate of the residential fixed line services in Hong Kong was 85.5% in December 2019[31].In addition, our study population was comparable with the latest population Census in Hong Kong, which was generalizable to the general population. Furthermore, the study was conducted during the peak period of COVID-19 epidemic in Hong Kong. Citizens were encouraged to stay at home for work or daily activity. Hence, the respondents would be more compliant and attentive to the telephone survey[32]. Secondly, the cross-sectional study design can only demonstrate associations between patterns and social-demographic predictors, as causation cannot be attributed to the findings. Thirdly, this study might subject to reporting bias since data were self-reported, and data from non-respondents could not be obtained. Fourthly, our study did not further investigate the burdens, coping method and their perceived wellbeing of the care provider, which were potentially associated with the perceived difficulty of care giving. Lastly, for the sample size of the subjects who perceived lacking knowledge to provide routine care was small (n=20). Hence, advanced statistical analysis was not possible. Qualitative interviews might have revealed more rich and detailed insights.

Although the SARS-CoV-2/COVID-19 pandemic has engendered a huge amount of clinical, epidemiological and vaccine-related research, the socio-economic impact of COVID-19 has not yet been well-examined. Home care, being one of the crucial pillars in supporting people's health outside the formal healthcare setting during this pandemic, needs much stronger research and support from stakeholders at various levels[33]. In addition to research in formal healthcare services, better understanding of the challenges posed by the various home care settings (even informal settlements) is urgently required. This includes disease management in home care settings and strategies to optimize resources and support for informal care providers during global pandemics such as COVID-19. This study examined informal home care providers in a high-income Asian city during the early phase of the pandemic. However, the long-term implications on care providers, health outcomes of care recipients, and coping strategies of vulnerable people

(particularly those living alone) are largely unknown. Research in these areas is urgently needed to improve pandemic preparedness of national health systems.

CONCLUSION

This study explores home care situation in Hong Kong, an Asia metropolis in China which experienced the early phase of COVID-19 in 2020. Findings showed home care during pandemic can present a complex set of care recipient needs and providers' duties in densely-high-rise building based aging community with a high dependency ratio. The study also showed that younger workers with higher education and income had to bear the main burden of care for dependent care recipients during the epidemic but the heaviest routine care burden fell upon those with deficit resource. Governments should consider supplementing service support during large-scale public health emergencies when access to routine health care is disrupted. Policy should focus on continuous support to those informal care providers and their mental health needs during these public health emergencies.

Figures

Figure 1a. Characteristics of care provider-recipient relationship among all care recipients, as reported by informal care providers (N=345)

Figure 1b. Age distribution of dependent care receiver (who cannot live normally without caregivers' help)

Figure 2. The relationship between household income and informal home care duties

Questionnaire

http://www.ccouc.ox.ac.uk/_asset/file/questionnaire-of-home-care.pdf

Funding

This work was supported by CCOUC-Oxford research support fund (#0008).

Competing interests

All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare: no support from any organization for the submitted work; no financial relationships with any organizations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.

Contributors

EYYC, KKCH, ELYW, SYSW, & NG conceived the project. EYYC, ESKL, KKCH, ZH designed the study tool, obtained, validated, and cleaned the data. ESKL, ZH and JHK performed the data analysis. EYYC, ELYW, ESKL, JHK, HH and ZH involved in literature review and write up. All authors contributed to the manuscript drafting, review, revision and approval of the final manuscript. KKCH, ESKL, HH SYSW and ZH provided administrative and operational support. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

Ethical Approval

Verbal consent was obtained from the participant and ethics approval and consent procedure of the study was reviewed and obtained from the Survey and Behavioral Research Ethics Committee at The Chinese University of Hong Kong (SBRE-19-498).

Data sharing statement

No additional data are available.

Word count: 3903

Licence

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Reference

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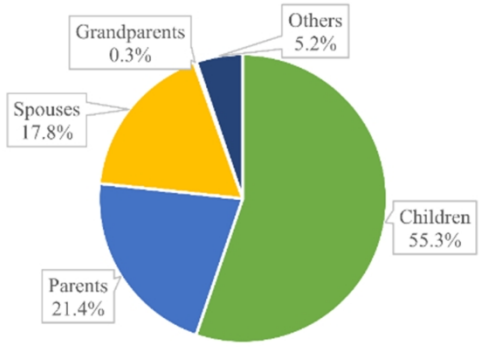

Fig. 1a

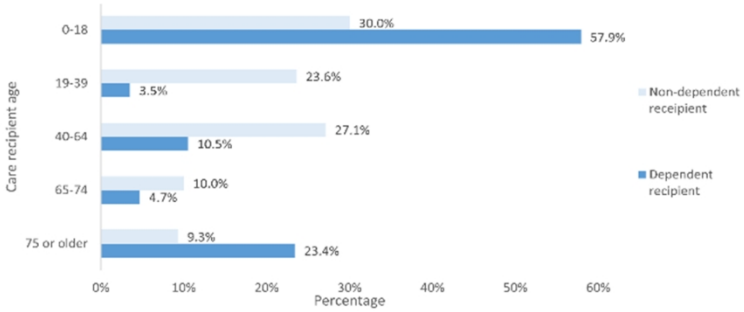

Fig. 1b

Figure 1a. Characteristics of care provider-recipient relationship among all care recipients, as reported by informal care providers (N=345)
Figure 1b. Age distribution of dependent care receiver (who cannot live normally without caregivers' help)

101x76mm (768 x 768 DPI)

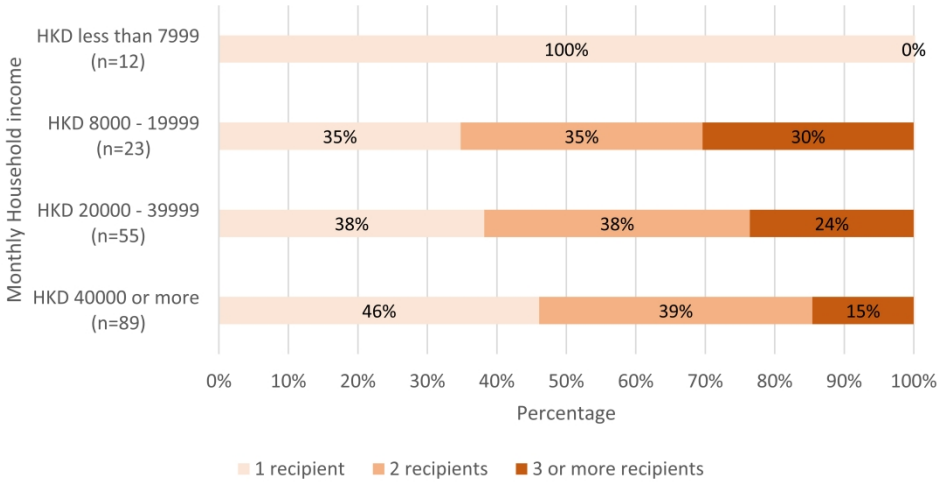

Figure 2. The relationship between household income and informal home care duties

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Table S1. Factors associated with self-perceived increased difficulty in daily living

	No	Yes	p	AOR (LB-UB)	p
N	120	71			
Socio-demographic					
Age[a]			0.306		
18-44	34.2%	43.7%			
45-64	49.2%	38.0%			
65 or more	16.7%	18.3%			
Gender			0.441		
Male	35.0%	29.6%			
Female	65.0%	70.4%			
Education attainment			0.356		
Primary level or below	10.0%	4.2%			
Secondary level	48.3%	52.1%			
Tertiary level	41.7%	43.7%			
Occupation			0.903		
White collar	44.8%	44.3%			
Blue collar (including services and sales)	19.0%	17.1%			
Housewives	21.6%	25.7%			
Students	0.9%	0.0%			
Unemployed or retired	13.8%	12.9%			
Housing			0.703		
Public housing	25.8%	21.1%			
Subsidized housing	13.3%	9.9%			
Private housing (including independent villa)	60.0%	67.6%			
Others	0.8%	1.4%			
Household income			0.422		
<7999	4.5%	10.6%			
8000 – 19999	14.3%	10.6%			
20000 – 39999	30.4%	30.3%			
40000 or more	50.9%	48.5%			
Housing size			0.397		
Small (350ft or below)	16.2%	22.4%			
Medium (351 ft- 800ft)	67.6%	67.2%			
Large (801 ft. or above)	16.2%	10.4%			
Chronic disease condition			0.616		
No	79.2%	76.1%			
Yes	20.8%	23.9%			
Marital status			0.001		
Unmarried (including divorced or widow)	32.5%	11.3%		Ref.	
Married	67.5%	88.7%		2.81 (0.98 – 8.09)	0.055

Having sufficient knowledge to take care their family members			0.463		
Not sure or No	9.6%	13.0%			
Yes	90.4%	87.0%			
Characteristics of the care recipient					
Number of care recipient			0.797		
1 recipient	47.5%	43.7%			
2 recipients	35.0%	35.2%			
3 or more recipients	17.5%	21.1%			
Family member as fragile elderly or disabilities			0.958		
No	68.6%	69.0%			
Yes (with either one)	31.4%	31.0%			
Children were the care recipients			0.075		
No	42.5%	29.6%		Ref.	
Yes	57.5%	70.4%		0.83 (0.34 – 2.05)	0.688
Spouse was the care recipient			0.148		
No	73.3%	63.4%			
Yes	26.7%	36.6%			
Parents or parents-in-law were the care recipients*			0.033		
No	65.8%	80.3%		Ref.	
Yes	34.2%	19.7%		0.23 (0.08- 0.70)	0.009
Family member who were dependent recipients *			<0.001		
No	49.1%	13.0%		Ref.	
Yes	50.9%	87.0%		6.38 (2.69 – 15.14)	<0.001
Family member received care due to staying at home during COVID-19 outbreak ^			0.053		
No	81.9%	69.6%		Ref.	
Yes	18.1%	30.4%		1.70 (0.70 – 4.13)	0.238
Family member who receive care mainly due to their chronic condition			0.709		
No	88.8%	87.0%			
Yes	11.2%	13.0%			
The effect brought by COVID-19					
Stopped or decrease the use of community services during COVID-19 outbreak+			0.007		
No	95.8%	84.5%		Ref.	

Yes	4.2%	15.5%		3.22 (0.73 – 14.19)	0.122
Need to take personal leave for caregiving responsibility*			<0.001		
No	92.4%	63.4%		Ref.	
Yes	7.6%	36.6%		7.15 (2.44 – 20.91)	<0.001

+Using Fisher's exact test, ^p<0.10, * p<0.05,

[a]The age group "18-24" and "25-44" were collapsed

In the multivariable logistic regression, there were 7 missing values in variable *family member who were dependent recipients*, 2 missing values in s*topped or decrease the use of community services during COVID-19 outbreak*, 2 missing values in *need to take personal leave for caregiving responsibility*, 7 missing values in *stay at home during COVID-19 outbreak*, and 1 missing value in *perceived increased difficulty in daily live*

Table S2. Sociodemographic predictors for care providers who believed to have adequate knowledge for routine care and COVID infection control

	Knowledge for routine care			**Knowledge of COVID-19 risk mitigation**		
N	20 (10.9%)	164 (89.1%)		95 (49.5%)	97 (50.5%)	
	Not enough knowledge	Enough knowledge	p	Not enough knowledge	Enough knowledge	p
Socio-demographic details						
Age[ab]			0.036*			0.349
18-44	25.0%	39.6%		43.2%	33.0%	
45-64	35.0%	45.1%		41.1%	48.5%	
65 or more	40.0%	15.2%		15.8%	18.6%	
Gender			0.455			0.958
Male	40.0%	31.7%		32.6%	33.0%	
Female	60.0%	68.3%		67.4%	67.0%	
Education attainment			<0.001*			0.160
Primary or below	30.0%	4.3%		10.5%	5.2%	
Secondary	45.0%	49.4%		52.6%	46.4%	
Tertiary	25.0%	46.3%		36.8%	48.5%	
Marital status[a]			0.786			0.453
Non-married	20.0%	25.0%		27.4%	22.7%	
Married	80.0%	75.0%		72.6%	77.3%	
Housing[a]			0.236			0.897
Public housing	40.0%	22.0%		23.2%	25.8%	
Subsidized housing	15.0%	12.2%		13.7%	10.3%	
Private housing (including independent villa)	45.0%	65.2%		62.1%	62.9%	
Others	0.0%	0.6%		1.1%	1.0%	
Living density (household size / number of people)[a]			0.900			0.428
<200 ft per ppl	62.5%	60.9%		65.5%	59.8%	
200 ft or more per ppl	37.5%	39.1%		34.5%	40.2%	
Main information channel[a]			0.653			0.249
Television	50.0%	34.1%		38.9%	34.0%	
Internet or smartphone app	45.0%	57.9%		56.8%	55.7%	

Others (newspaper, radio)	5.0%	7.9%		4.2%	10.3%	
Housing size[a]			0.104			0.547
Small (350ft or below)	31.3%	16.7%		20.7%	16.3%	
Medium (351 ft-800ft)	68.8%	67.3%		67.8%	67.4%	
Large (801 ft. or above)	0.0%	16.0%		11.5%	16.3%	
Family income group[a]			<0.001*			0.323
<7999	27.8%	4.5%		5.8%	7.5%	
8000 – 19999	11.1%	13.5%		12.8%	12.9%	
20000 – 39999	50.0%	27.6%		37.2%	24.7%	
40000 or more	11.1%	54.5%		44.2%	54.8%	
Employment[a]			0.010*			0.699
White collar	15.0%	49.1%		44.6%	44.2%	
Blue collar (including services and sales)	20.0%	17.6%		18.5%	18.9%	
Students	0.0%	0.0%		25.0%	21.1%	
Housewives	45.0%	20.1%		1.1%	0.0%	
Unemployment and retired	20.0%	13.2%		10.9%	15.8%	
Care recipient characteristics						
Children were the care recipients			0.059			0.528
No	55.0%	33.5%		35.8%	40.2%	
Yes	45.0%	66.5%		64.2%	59.8%	
Spouse was the care recipient			0.723			0.594
No	65.0%	68.9%		71.6%	68.0%	
Yes	35.0%	31.1%		28.4%	32.0%	
Parents or parents-in-law were the care recipients			0.597			0.480
No	65.0%	70.7%		73.7%	69.1%	
Yes	35.0%	29.3%		26.3%	30.9%	
Family members were dependent recipients			0.044*			0.817
No	15.0%	37.8%		34.8%	36.5%	

Yes	85.0%	62.2%		65.2%	63.5%	
Members were fragile elderly or disabilities			0.040*			0.709
No	47.4%	70.6%		70.2%	67.7%	
Yes	52.6%	29.4%		29.8%	32.3%	

[a]Fisher's exact test was performed for analysis about "knowledge for routine care"
[b]The age group "18-24" and "25-44" were combined as the age group "18-24" only have 2 subjects
*p<0.05

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	1
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	4
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	4
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	4
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*4*
Bias	9	Describe any efforts to address potential sources of bias	5
Study size	10	Explain how the study size was arrived at	4
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	4
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	5
		(*b*) Describe any methods used to examine subgroups and interactions	5
		(*c*) Explain how missing data were addressed	5
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	5
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5,7
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	5
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	5,7
		(b) Indicate number of participants with missing data for each variable of interest	8
Outcome data	15*	Report numbers of outcome events or summary measures	6-11
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	6-11

		(*b*) Report category boundaries when continuous variables were categorized	6-11
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	12
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	11-12
Generalisability	21	Discuss the generalisability (external validity) of the study results	12-13
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	14

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.