

## **Are People With Chronic Diseases Satisfied With the Online Health Information Related to COVID-19 During the Pandemic?**

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### **Abstract**

**Purpose:** A deluge of fake news and misinformation about the coronavirus disease 2019 (COVID-19) on the Internet poses challenges for the public in their search for reliable and relevant health information for taking protective measures, especially among people with chronic diseases (PWCD). This study aimed to (a) understand the satisfaction level of the online information related to COVID-19 in people with and without chronic diseases; (b) explore information-searching behavior and digital health literacy in PWCD; and (3) identify the possible predictors of information satisfaction among PWCD.

**Methods:** This was a multicity, cross-sectional study using an online survey with a convenience sample of people who (a) were 15 years of age or older and (b) had access to the Internet in mainland China, Hong Kong, and Macau.

**Findings:** Four thousand four hundred and seventy-two subjects completed the survey, of whom less than 50% felt satisfied with the online information. About 20% of respondents ( $n = 882$ ) were diagnosed with at least one chronic disease and reported a lower level of information satisfaction ( $p = .003$ ) than the people without chronic diseases. The majority of the PWCD obtained their online health information from social media. Higher digital health literacy (adjusted odds ratio [ $OR$ ] = 5.07), higher frequency of searches regarding symptoms of COVID-19 (adjusted  $OR = 2.07$ ), higher perceived importance of quickly learning from the information searched (adjusted  $OR = 1.63$ ), and lower frequency of searches on the topic of dealing with psychological stress (adjusted  $OR = 0.54$ ) were found to be predictors of information satisfaction among PWCD.

**Conclusions:** The majority of PWCD sought online information related to COVID-19 from social media, and their level of information satisfaction was significantly lower than among people without chronic diseases. Digital health literacy is a strong and significant predictor of information satisfaction.

**Clinical Relevance:** To support PWCD, we not only have to provide them with clear and accurate information, but also promote their digital health literacy so that they may seek, understand, and appraise health information from the Internet to make appropriate health-related judgments and decisions.

## **Introduction**

The coronavirus disease 2019 (COVID-19) is an infectious viral pneumonia to which the human population has low or no pre-existing immunity. It was first identified in December 2019 in Wuhan, China, and spread across 200 countries, with over 5 million cases identified within 6 months (World Health Organization [WHO], 2020a; ). On March 11, 2020, the WHO declared the COVID-19 outbreak as a pandemic, implying the global spread of the virus. People with chronic diseases (PWCD), such as cardiovascular disease, diabetes, and hypertension, are regarded as a high-risk group that is more vulnerable to infection with COVID19. Epidemiologic evidence has shown that over 94% of hospitalized patients diagnosed with COVID-19 had at least one comorbidity (Richardson et al., 2020). Moreover, PWCD have a higher risk for developing serious complications from COVID-19, such as organ damage, respiratory failure, and cardiac arrest (Guan et al., 2020; Zaim, Chong, Sankaranarayanan, & Harky, 2020). A recent summary report on COVID-19 in China also revealed that the case-fatality rate (CFR) was four times higher than the overall CFR among those  $\geq 70$  years of age, and the CFR was 5% to 10% higher among those with chronic medical conditions (Wu & McGoogan, 2020).

Accessing timely health information plays an important role for the public, particularly for PWCD, to take up measures to protect themselves from the infection and to maintain a healthy lifestyle (e.g., physical activity, healthy eating), even against the background of pandemic-related restrictions. While COVID-19 is highly infectious and spreads fast, the details of its spread and transmission are still unclear and under investigation (Anderson, Heesterbeek, Klinkenberg, & Hollingsworth, 2020). The majority of people have to seek and obtain updated information on COVID-19 in a timely manner to protect themselves. Traditionally, people have obtained health

information through pamphlets or health education from health professionals. Due to digital transformation, the rapid development of smartphones, and increasing accessibility to the Internet, nowadays most people access and search for health information through the Internet and by using different devices and apps (Chen, Li, Liang, & Tsai, 2018). Although people may easily obtain information about COVID-19 from the Internet, a global epidemic of information has spread rapidly through online platforms and digital media. The WHO labeled this situation as an “infodemic” (short for information epidemic), resulting from the large amount of true, false, and mixed information circulating through digital communication channels in relation to COVID-19 (Zarocostas, 2020).

Online health information-seeking behavior is affected by various sociodemographic factors, and previous studies have indicated that adults with a lower socioeconomic status, male status, older age, lower education level, and poor Internet connectivity were less likely to seek online health information (Hallyburton & Evarts, 2014; Kontos, Blake, Chou, & Prestin, 2014; McCloud, Okechukwu, Sorensen, & Viswanath, 2016). Online health information seeking is also affected by personal health status. PWCD tended to use the Internet more frequently for seeking online health information and had a higher risk for obtaining misinformation, compared with people in good health (Houston & Allison, 2002; Sadasivam et al., 2013). The more frequent online information seeking among PWCD implies that they may have more health-related concerns, especially during a pandemic (Wong & Cheung, 2019). Compared with healthy adults, the health information needs of PWCD are more complex, and insufficient information or misinformation always leads to information dissatisfaction (Tustin, 2010). Under the current situation of the infodemic, in which a large amount of true, false, and mixed information is circulating on the Internet, it is

crucial to understand and promote the capacity of PWCD to seek, understand, and apply appropriate digital health information, as well as to identify disinformation and misinformation, to address their health information needs.

Digital health literacy is defined as the “ability to seek, find, understand, and appraise health information from electronic sources and apply the knowledge gained to addressing or solving a health problem” (Norman & Skinner, 2006). Digital health literacy may empower the public to acquire and apply the latest recommendations and advice on protective measures such as washing hands and maintaining physical distance (Castro-Sánchez, Chang, Vila-Candel, Escobedo, & Holmes, 2016). Previous studies have also indicated that lower digital health literacy is associated with poor health behavior and worse selfperceived understanding of health status, symptoms, and optional treatments (van der Vaart & Drossaert, 2017). However, the overabundance of misinformation on COVID-19 poses a challenge for people seeking health information (Okan, Sørensen & Messer, 2020; Sentell, Vamos, & Okan, 2020). Compared with the healthy population, PWCD engage in more online health information seeking and have many more health concerns and information needs (Wong & Cheung, 2019). Regrettably, there is limited information about public online information-seeking behavior on COVID-19 and the related information satisfaction under the situation of an infodemic, especially among PWCD. To fill this gap, this study aimed to (a) understand the level of satisfaction about online information related to COVID-19 in PWCD in mainland China, Hong Kong, and Macau; (b) explore the information-seeking behavior and digital health literacy in PWCD; and (c) identify possible predictors of information satisfaction among PWCD.

## **Methods**

### *Design, Data Collection, and Participants*

This study was part of a large-scale international collaborative research network that was launched in mid-March 2020 in more than 40 countries ([www.covid-hl.org](http://www.covid-hl.org)). The network aimed to investigate health literacy, digital health literacy, health informationseeking behavior, and psychological well-being during the COVID-19 pandemic (Dadaczynski, Okan, & Rathmann, 2020). As part of this global network, a multicity, cross-sectional study using an online survey was adopted with a convenience sample of 4,472 people living in mainland China, Hong Kong, and Macau. People were invited to participate if they met the following inclusion criteria: (a) 15 years of age or older and (b) have access to the Internet. PWCD were defined as those having medical conditions of at least 6 months' duration that required ongoing medical attention or limited activities of daily living or both (Megari, 2013). To reach as many people as possible, we included different sources to deploy the online survey, including e-mail lists of (a) students, staff, and alumni of various universities; (b) members of various nongovernmental organizations; (c) different labor unions; and (d) social media platforms (e.g., Facebook, WeChat). The invitation e-mail contained an information sheet describing the study, a consent form, and a link to the online survey. The results of this study are reported in accordance with the "good practice in the conduct and reporting of survey research" guideline (Kelley, Clark, Brown, & Sitzia, 2003).

### *Variables and Instruments*

The survey was divided into five parts: (1) demographic data, (2) sources of information seeking and COVID-related topics searched, (3) perceived information



importance and satisfaction, (4) digital health literacy, and (5) psychological well-being (Dadaczynski et al., 2020).

The English-language survey was translated into traditional and simplified Chinese versions, adopting the WHO's process of translation and adaptation of instruments (WHO, 2020c). Conceptual, cultural, and linguistic equivalence was observed. Pretesting of the translated versions was conducted with 10 people, and comments from the sample participants were obtained. Discrepancies were discussed with three project team members, and amendments were carried out until a satisfactory version was reached.

#### *Sources of Information Seeking and COVID-Related Topics Searched*

Sources for online health information seeking were assessed through multiple-choice questions with reference to the list of sources proposed by Marstedt (2018) and adapted to examples of local media in mainland China, Hong Kong, and Macau. COVID-related topics searched were also assessed through multiple-choice questions with reference to the commonly searched key words of different search engines and the key words of health education materials on COVID-19 (WHO, 2020b). This survey component demonstrated acceptable internal consistency ( $\alpha = 0.77$ ) and internal reliability ( $\alpha = 0.81$ ).

#### *Perceived Information Importance and Satisfaction*

Perceived information importance was assessed by the six items developed by Gebel et al. (2014) on how important the respondents felt the online information was, such as whether the information was up to date and whether the information was verified. Satisfaction with information was measured using a 5-point Likert scale ranging from "very dissatisfied" to "very satisfied." In this study, we defined the people

with a high level of information satisfaction as those rating the information as satisfied or very satisfied; the rest were regarded as having a low level of information satisfaction. The scale demonstrated acceptable internal consistency ( $\alpha = 0.79$ ).

### *Digital Health Literacy*

The Digital Health Literacy Instrument (DHLI) was used to assess digital health literacy (van der Vaart & Drossaert, 2017). The DHLI comprised different domains of digital health literacy, including information-seeking behavior, evaluating the reliability of online information, relevance of information to COVID-19, and sense of privacy protection in social media, using a 4-point Likert scale ranging from “*very difficult*” to “*very easy*.” Some generic questions in the DHLI were rephrased with regard to the current COVID-19 situation (e.g., “how easy or difficult is it for you to seek health information” was rephrased to “how easy or difficult is it for you to seek health information related to COVID-19”). The higher the score, the higher the level of digital health literacy. The scale had good content and construct validity (van der Vaart & Drossaert, 2017). For the current study, internal consistencies of the total scale ( $\alpha = 0.86$ ) and subscales ( $\alpha$  range = 0.77–0.88) were satisfactory.

### *Psychological Well-Being Index*

Psychological well-being was assessed using the World Health Organization-Five Well-Being Index (WHO-5; WHO, 1998). The WHO-5 consisted of 5 positively phrased items on a 6-point Likert scale that were scored from 0 (*at no time*) to 6 (*all the time*). The raw score ranged from 0 to 25. The final score was obtained by multiplying the raw score by 4. A score of 0 represented the worst imaginable well-being, whereas 100 represented the best well-being (Topp, Østergaard, Søndergaard, & Bech, 2015). The WHO-5 has good construct validity as a unidimensional scale in

evaluating subjective wellbeing for both younger and older persons. It was also noted to have very high clinical validity, and it can be used regardless of underlying conditions and across various settings (Topp, Østergaard, Søndergaard, & Bech, 2015). For the current study, the WHO-5 further showed excellent internal reliability ( $\alpha = 0.94$ ).

### *Ethical Statement*

Written consent was obtained from all eligible respondents before the survey started. To give consent, the respondents had to press the button “I agree” after reading the online information sheet. Ethical approval was obtained from the Human Subject Ethics Subcommittee of the Hong Kong Polytechnic University (HSEARS20200407001). To maintain data security and privacy, the survey was conducted anonymously through a secure database management system.

### *Data Analysis*

Statistical analysis was performed using IBM SPSS version 25.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to characterize the respondents, including their demographic data and information-seeking behavior. The *t* test for continuous variables and chi-square test for categorical variables were applied to compare the difference in the information-seeking behavior between PWCD with higher and lower levels of information satisfaction. Pearson’s correlation matrices were generated between each potential predictor (e.g., education level, source of information, topic of information seeking, and perceived importance of the information) and the respondents’ level of information satisfaction. Stepwise binary logistic regression analyses were computed to determine the strengths of predictors of information

satisfaction. All statistical tests were two tailed, and a significant alpha value was set at  $p < .05$ .

**Table 1.** Demographics and Health Information-Seeking Behavior on COVID-19

Sociodemographic variable	All N = 4,472 n (%)	With chronic disease n = 882	No chronic disease n = 3,576	Chi-square	p value
Sex	4,465 (100.0)	882 (19.8) <sup>a</sup>	3,570 (80.2) <sup>a</sup>	2.016	.156
Male	3,481 (77.8)	210 (23.8)	771 (21.6)		
Female	984 (22.0)	672 (76.2)	2,799 (78.4)		
Age, years (M = 31.42; SD = 12.56)	4,472 (100.0)	882 (19.8) <sup>a</sup>	3,576 (80.2) <sup>a</sup>	68.259	<.001
Young adults (<39)	3,351 (74.9)	573 (65.0)	2,772 (77.5)		
Middle-aged (40-59)	884 (19.8)	228 (25.9)	651 (18.2)		
Older adults (≥60)	237 (5.3)	81 (9.2)	153 (4.3)		
Country of birth	4,460 (100.0)	879 (19.8) <sup>a</sup>	3,567 (80.2) <sup>a</sup>	2.970	.227
China and its regions	4,361 (97.8)	866 (98.5)	3,481 (97.6)		
Other Asian countries	44 (1.0)	5 (0.6)	39 (1.1)		
Other countries	55 (1.2)	8 (0.9)	47 (1.3)		
Region	4,272 (100.0)	847 (19.9) <sup>a</sup>	3,412 (80.1) <sup>a</sup>	7.628	.022
Mainland China	2,094 (49.0)	396 (46.8)	1,698 (49.8)		
Hong Kong	1,227 (28.7)	233 (27.5)	986 (28.9)		
Macau	951 (21.3)	218 (25.7)	728 (21.3)		
Status	4,472 (100.0)	882 (19.8) <sup>a</sup>	3,576 (80.2) <sup>a</sup>	24.270	<.001
Students	2,184 (48.8)	366 (41.5)	1,815 (50.8)		
Non-Students	2,288 (51.2)	516 (58.5)	1,761 (49.2)		
Educational level	4,472 (100.0)	882 (19.8) <sup>a</sup>	3,572 (80.2) <sup>a</sup>	7.963	.093
Primary education	18 (0.4)	4 (0.5)	13 (0.4)		
Secondary education	378 (8.5)	94 (10.7)	279 (7.8)		
Bachelor's degree	2,716 (60.8)	517 (58.6)	2,194 (61.4)		
Master's degree or above	1,253 (28.1)	246 (27.9)	1,005 (28.1)		
Other	102 (2.3)	21 (2.4)	81 (2.3)		
WHO-5 Well-Being Index score	58.56 (21.43)	55.89 (22.04)	59.22 (21.23)	4.139	<.001
Experience of health information seeking on COVID-19		882 (19.8) <sup>a</sup>	3,576 (80.2) <sup>a</sup>	6.566	.087
Yes, only information for me	1,195 (26.7)	244 (27.7)	946 (26.5) <sup>a</sup>		
Yes, only information for other people	148 (3.3)	30 (3.4)	116 (3.2)		
Yes, information for me and other people	2,616 (58.5)	488 (55.3)	2,121 (59.3)		
No, I haven't searched for information in the past 4 weeks	513 (11.5)	120 (13.6)	393 (11.0)		
Languages used in information seeking (multiple response) <sup>b</sup>					
Chinese	3,780 (75.9)	731 (76.4)	3,043 (75.8)	0.093	.760
English	1,163 (23.4)	217 (22.7)	944 (23.5)	0.437	.508
Other	35 (0.7)	9 (0.9)	26 (0.6)	0.923	.337
COVID-related topics searched (multiple response) <sup>b</sup>					
Current spread of the coronavirus	3,548 (89.9)	665 (87.4)	2,878 (90.6)	6.982	.008
Symptoms of the disease COVID-19	3,230 (81.9)	609 (80.0)	2,619 (82.4)	2.413	.120
Transmission routes of the coronavirus	3,177 (80.5)	617 (81.1)	2,557 (80.5)	0.138	.710
Individual measures to protect against infection	2,832 (71.8)	534 (70.2)	2,293 (72.2)	1.218	.270
Hygiene regulations	2,401 (60.9)	472 (62.0)	1,925 (60.6)	0.515	.473
Current situation assessments and recommendations	2,062 (52.3)	404 (53.1)	1,657 (52.2)	0.214	.644
Restrictions	2,853 (72.3)	567 (74.5)	2,283 (71.9)	2.115	.146
Economic and social consequences of the coronavirus	2,100 (53.2)	421 (55.3)	1,677 (52.8)	1.566	.211
Dealing with psychological stress caused by the coronavirus	1,372 (34.8)	281 (37.0)	1,090 (34.3)	1.871	.171
Information satisfaction about COVID-19 <sup>b</sup>				10.475	.033
Very dissatisfied	73 (1.9)	18 (2.4)	54 (1.7)		

**Table 1.** (Continued)

Sociodemographic variable	All N = 4,472 n (%)	With chronic disease n = 882	No chronic disease n = 3,576	Chi-square	p value
Dissatisfied	134 (3.4)	35 (4.6)	99 (3.1)		
Partly satisfied	1,733 (44.0)	354 (46.5)	1,377 (43.4)		
Satisfied	1,841 (46.7)	323 (42.4)	1,515 (47.7)		
Very satisfied	161 (4.1)	31 (4.1)	130 (4.1)		

<sup>a</sup>Missing values: sex (0.4%, n = 20); age (0.3%, n = 14); country (0.6%, n = 26); region (4.8%, n = 213); status (0.3%, n = 14); study program (0.2%, n = 5); educational level (0.5%, n = 13); experience of health information seeking (0.3%, n = 14).

<sup>b</sup>Excluded patients who answered "no" in health information seeking (11%, n = 513).

## Results

### *Demographic Health Information-Seeking Behavior on COVID-19*

The majority of the respondents were younger adults (mean age 31.42 years,  $SD = 12.56$ ), of whom 20% were diagnosed with one or more chronic diseases ( $n = 882$ ; Table 1). Their topic searches during information seeking were mostly related to the current spread of the coronavirus (89.9%), followed by symptoms of COVID-19 (81.9%) and transmission routes of COVID19 (80.5%). Only 46.7% and 4.1% of respondents felt satisfied or very satisfied with online information about COVID-19, respectively, and PWCD reported a lower level of information satisfaction than people without chronic diseases ( $p = .003$ ).

## Source of Information on COVID-19 and Related Topics Searched

**Table 2.** Sources of Information on COVID-19 Obtained by People With Chronic Diseases and With Different Levels of Information Satisfaction

Source of information	High information satisfaction	Low information satisfaction	Chi-square	p value
	n (%)	n (%)		
Search engines			2.948	.086
High utilization <sup>a</sup>	305 (86.4)	333 (81.8)		
Low utilization	48 (13.6)	74 (18.2)		
Websites of public bodies			3.371	.066
High utilization	255 (72.0)	268 (65.8)		
Low utilization	99 (28.0)	139 (34.2)		
Wikipedia and other online encyclopedias			2.187	.139
High utilization	228 (64.6)	241 (59.4)		
Low utilization	125 (35.4)	165 (40.6)		
Social media			3.485	.062
High utilization	311 (87.9)	338 (83.0)		
Low utilization	43 (12.1)	69 (17.0)		
YouTube			2.541	.111
High utilization	243 (68.6)	257 (63.1)		
Low utilization	111 (31.4)	150 (36.9)		
Blogs on health topics			1.298	.255
High utilization	158 (44.6)	165 (55.4)		
Low utilization	196 (55.4)	242 (44.7)		
Online communities (e.g., WhatsApp; Viber chat)			1.574	.210
High utilization	163 (46.0)	169 (41.5)		
Low utilization	191 (54.0)	238 (58.5)		
Health portals			0.911	.340
High utilization	153 (43.2)	162 (39.8)		
Low utilization	201 (56.8)	245 (60.2)		

<sup>a</sup>High utilization: often and sometimes; low utilization: rarely and never.

**Table 3.** COVID-Related Topics Searched by People With Chronic Diseases and With Different Levels of Information Satisfaction

Topic searched (multiple response)	High information satisfaction	Low information satisfaction	Chi-square	p value
	n (%)	n (%)		
Current spread of the coronavirus	322 (91.0)	343 (84.3)	7.676	.006
Transmission routes of the coronavirus	307 (86.7)	310 (76.2)	13.751	<.001
Symptoms of the disease COVID-19	305 (86.2)	304 (74.7)	15.570	<.001
Individual measures to protect against infection	268 (75.7)	266 (65.4)	9.689	.002
Hygiene regulations	243 (68.6)	229 (56.3)	12.317	<.001
Current situation assessments and recommendations	200 (56.5)	204 (50.1)	3.089	.079
Restrictions	280 (79.1)	287 (70.5)	7.338	<.001
Economic and social consequences of the coronavirus	208 (58.8)	213 (52.3)	3.160	.075
Dealing with psychological stress caused by the coronavirus	140 (39.7)	141 (34.6)	2.041	.175
Other	11 (3.1)	14 (3.4)	0.066	.797

As shown in Table 2, most of the PWCD respondents obtained information on COVID-19 from social media, followed by the use of search engines. Similar to people

without chronic diseases, their most commonly searched topic was about the current spread of the coronavirus, followed by the symptoms of COVID-19 and its transmission routes (Table 3). PWCD with a higher level of information satisfaction performed more searches on the current spread of the coronavirus ( $p = .006$ ), transmission routes of the coronavirus ( $p < .001$ ), symptoms of COVID-19 ( $p < .001$ ), individual measures to protect against infection ( $p = .002$ ), and hygiene regulations ( $p < .001$ ) and restrictions ( $p = .007$ ) compared with those with a lower level of information satisfaction.

### *Perceived Information Importance and Digital Health Literacy in PWCD*

**Table 4.** Digital Health Literacy Scores in People With Chronic Diseases and With Different Levels of Information Satisfaction

	High information satisfaction	Low information satisfaction	t-test	p value
	Mean (SD)	Mean (SD)		
Overall digital health literacy scores	3.01 (0.40)	2.73 (0.42)	9.411	<.001
Subscale scores				
Information seeking	3.21 (0.49)	2.92 (0.51)	8.072	<.001
Adding self-generated content	2.96 (0.58)	2.67 (0.61)	6.546	<.001
Evaluating reliability	2.78 (0.53)	2.52 (0.53)	6.874	<.001
Determining relevance	3.10 (0.43)	2.83 (0.47)	8.348	<.001

**Table 5.** Perceived Information Importance Scores in People With Chronic Diseases and With Different Levels of Information Satisfaction

Perceived Information Importance Scale	High information satisfaction	Low information satisfaction	t test	p value
	Mean (SD)	Mean (SD)		
The information is up to date	3.61 (0.52)	3.40 (0.62)	4.958	<.001
The information is verified	3.75 (0.47)	3.57 (0.60)	4.555	<.001
The information comes from official sources	3.53 (0.68)	3.33 (0.74)	4.008	<.001
Reader could quickly learn the most important things	3.40 (0.62)	3.14 (0.63)	5.678	<.001
Different opinions are represented	3.18 (0.66)	3.09 (0.68)	1.830	.068
The subject is dealt with comprehensively	3.38 (0.62)	3.24 (0.69)	3.019	<.001

PWCD who had a higher level of information satisfaction reported a higher level of digital health literacy ( $p < .01$ ; Table 4). Among PWCD, those with higher levels of information satisfaction also reported having higher levels of perceived information importance on whether the information was up to date ( $p < .001$ ), whether

the information was verified ( $p < .001$ ), whether the information came from official sources ( $p < .001$ ), whether the reader could quickly learn the most important things ( $p < .001$ ), and whether the content was dealt with comprehensively ( $p = .003$ ; Table 5).

### *Predictors of Information Satisfaction Among PWCD*

After adjusting for age, gender, and regions, the results of binary regression showed that higher digital health literacy (adjusted odds ratio [OR] = 5.07,  $p < .001$ ), higher frequency of searches regarding symptoms of COVID-19 (adjusted OR = 2.07,  $p = 0.01$ ), higher perceived importance of quickly learning from the information searched (adjusted OR = 1.63,  $p = 0.01$ ), and lower frequency of searches on the topic of dealing with psychological stress (adjusted OR = 0.54,  $p = .001$ ) served as significant predictors of information satisfaction on COVID-19.

### **Discussion**

Nowadays, people can easily obtain health information from the Internet and everyone can share and post different information online without verification or support by scientific evidence, leading to an overwhelming amount of true, false, and mixed information in the digital communication channels. The bombardment of mixed health information such as false preventive measures on COVID-19 (e.g., drinking warm water with lemon slices or adulterated alcohol) confuses people and affects their strategies regarding preventive measures. A previous study indicated that a high frequency of media exposure during the COVID19 outbreak was found to be associated with different mental health problems such as depression (Gao et al., 2020). Compared with the general population, our findings also found that PWCD had a lower level of psychological well-being. Under the situation of an infodemic, this is the first study investigating the satisfaction level on information related to COVID-19 in China.



Less than 50% of respondents were satisfied with information during the infodemic, and the satisfaction level was much lower in PWCD. PWCD usually pay much more attention to information about COVID-19 because of their higher risks for morbidity, mortality, and severe COVID-19-associated complications (Onder, Rezza, & Brusaferro, 2020). Since most community facilities (e.g., community centers, health clinics) were suspended or their service duration shortened due to the restriction on social activities in mainland China, Macau, and Hong Kong, the majority of PWCD encountered difficulties in their routine medical treatments and faced various health problems that triggered the online information seeking (Kang, Yang, Yuan, Xu, Zhao, & Yang, 2020). However, most of the online health information on COVID-19 was not specifically developed for the PWCD due to the limited knowledge available on the particularities of COVID-19 in relation to chronic diseases. According to the latest information from the U.S. Centers for Disease Control and Prevention, the current information on COVID-19 is still inadequate and insufficient to determine the level of risk for each underlying medical condition (Centers for Disease Control and Prevention, 2020). Even though

PWCD spend a lot of time searching health information, they may not be able to obtain the relevant information they need. The insufficiency of specific information shaped to the needs of PWCD could be a possible factor contributing to lower information satisfaction among PWCD.

A higher level of digital health literacy was found to be a significant predictor of information satisfaction in PWCD. Similar findings were also reported in a previous study in which the higher the health literacy, the higher the satisfaction in using electronic platforms for information seeking (Wong, Steitz, & Rosenbloom, 2019). The COVID-19 infodemic has highlighted that poor health literacy is an underestimated

public health problem worldwide (Paakkari & Okan, 2020). People with poor digital health literacy encountered difficulties in understanding health information and taking inappropriate protective measures without fact checking, consequently making them more vulnerable to COVID19 infection (Huang & Zhao, 2020). Previous studies also demonstrated that a lower level of health literacy was associated with less compliance with protective behaviors (e.g., vaccination and hand hygiene) for controlling the outbreak of infectious diseases (Castro-Sánchez et al., 2016). Although eliminating all the disinformation, misinformation, and malinformation is almost impossible, enhancing the public's digital health literacy is one of the effective ways to fight the infodemic by increasing people's capacity to seek appropriate health information from electronic sources (Paakkari & Okan, 2020; Traver, Basagoiti, MartinezMillana, Fernández-Llatas, & Traver, 2016).

Over 80% of respondents sought and obtained health information about COVID-19 from social media. Similar findings were also reported by Gupta et al. (2020) in which social media was found to be the most common source for information seeking during the COVID19 pandemic. The use of social media (e.g., WeChat, Facebook) is increasing rapidly across the world. A national survey in China indicated that over 93% of the population logs in to social media platforms every day and over 98% had used it to seek health information (Zhang, Wen, Liang, & Lei, 2017). Health information on the social media platform is usually less lengthy and supplemented with pictures or videos so people may quickly learn from the information. This attribute was regarded as an important element during information seeking by our respondents and was also found to be a predictor of their information satisfaction. However, the major concern about health information on social media is the lack of quality and reliability (Ventola, 2014). The overwhelming amount of misinformation on social media was

regarded as the major cause of the infodemic (Cinelli et al., 2020). Since the use of social media for information seeking is increasing rapidly and has been reported as being the major sources (Gupta et al., 2020; Singh et al., 2020), some criteria should be proposed to guide the use of social media for information dissemination during the pandemic (Chan, Nickson, Rudolph, Lee, & Joynt, 2020).

A higher frequency of searches regarding symptoms of COVID-19 was also found to be a predictor of satisfaction with information. The outbreak of COVID-19 was first identified in China with a cluster of viral pneumonia cases. At the early stage of the outbreak, many things about COVID-19 were unknown except the symptoms, including fever, cough, and shortness of breath, which could be the reason why the people performing higher frequencies of searches regarding symptoms of COVID-19 had a higher level of satisfaction with information (Grech, 2020). In fact, various misinformation and false news on social media is mainly related to the topics about transmission mode, protective measures, treatment, and the spread of the disease (Orso, Federici, Copetti, Vetrugno, & Bove, 2020). Although the symptoms of COVID-19 are one of the common search topics, the majority of Chinese people and the respondents were also looking for information about the current spread of COVID-19, its transmission routes, and protective measures (Zhao, Cheng, Yu, & Xu, 2020). Over a year has passed since the first case of COVID-19 was discovered in China, and it is common knowledge that the infodemic is almost as great a threat as the virus itself. A few organizations (e.g., U.S. National Institutes of Health) have also made recommendations for the public to obtain reliable online information by (a) using a trustworthy source of online information (e.g., the website of a federal agency, medical school, or large professional or nonprofit organization); (b) checking the author's credibility (e.g., health professionals); and (c) ensuring that the information and

webpage are up to date (National Institutes of Health, 2018). To improve the level of information satisfaction and address the health-related concerns of PWCD, enhancing digital health literacy and providing timely, verified, and reliable online health information are needed in the fight against COVID-19.

### **Implications**

This article provided evidence and information about digital health literacy, health information-seeking behaviors, and information satisfaction during the outbreak of COVID-19. From a clinical viewpoint, the findings generated insights on the importance of digital health literacy for supporting the public, particularly PWCD, during a pandemic. Future research should develop appropriate interventions and investigate their effectiveness in enhancing public digital health literacy in order to strengthen the public capacity of health information seeking and decision making. Government policy interventions may help to tackle the infodemic and to implore technology giants and social media to act responsibly to counteract the distribution of disinformation and misinformation.

### **Limitations**

Some potential limitations should be noted in this study. Due to the limitations of the tools, some information about the respondents' health background (e.g., presence and severity of chronic disease) was selfreported, and the reasons for their information satisfaction were not collected in the survey. Therefore, the causal relationship between information satisfaction and information-seeking behavior is difficult to elucidate. Also, this was a voluntary online survey distributed through a network of universities, nongovernmental organizations, and professional bodies, so the population may be under-represented.

## **Conclusions**

The majority of PWCD in mainland China, Hong Kong, and Macau have accessed social media to seek health information about COVID-19. In the infodemic, their satisfaction level on health information was significantly lower than that of people without chronic diseases. Digital health literacy is a strong and significant predictor of information satisfaction. To support PWCD, we not only have to provide them with clear and true information, but also promote their psychological well-being and digital health literacy so that they may seek, understand, and appraise health information from electronic sources and make appropriate health-related judgments and decisions.

## References

- Anderson, R. M., Heesterbeek, H., Klinkenberg, D., & Hollingsworth, T. D. (2020). How will countrybased mitigation measures influence the course of the COVID-19 epidemic? *Lancet*, *395*(10228), 931–934.
- Castro-Sánchez, E., Chang, P. W. S., Vila-Candel, R., Escobedo, A. A., & Holmes, A. H. (2016). Health literacy and infectious diseases: Why does it matter? *International Journal of Infectious Diseases*, *43*, 103–110.  
<https://doi.org/10.1016/j.ijid.2015.12.019>
- Centers for Disease Control and Prevention. (2020). *Clinical questions about COVID-19: Questions and answers*. Retrieved from <https://www.cdc.gov/coronavirus/2019-ncov/hcp/faq.html>
- Chan, A. K. M., Nickson, C. P., Rudolph, J. W., Lee, A., & Joynt, G. M. (2020). Social media for rapid knowledge dissemination: Early experience from the COVID-19 pandemic. *Anaesthesia*, *75*, 1579–1582. <https://doi.org/10.1111/anae.15057>
- Chen, Y.-Y., Li, C.-M., Liang, J.-C., & Tsai, C.-C. (2018). Health information obtained from the Internet and changes in medical decision making: Questionnaire development and cross-sectional survey. *Journal of Medical Internet Research*, *20*(2), e47.
- Cinelli, M., Quattrocioni, W., Galeazzi, A., Valensise, C. M., Brugnoti, E., Schmidt, A. L., ... Scala, A. (2020). The COVID-19 social media infodemic. *Scientific Reports*, *10*, article 16598.
- Dadaczynski, K., Okan, O., & Rathmann, K. (2020). *COVID-19 Health Literacy Survey: University students (COVID-HL Survey). Questionnaire and scale documentation*. Bielefeld, Germany: Public Health Centre Fulda (PHZF) at the Fulda University of

Applied Sciences & Interdisciplinary Centre for Health Literacy Research at Bielefeld University. <https://doi.org/10.4119/unibi/2942920>

Gao, J., Zheng, P., Jia, Y., Chen, H., Mao, Y., Chen, S., ... Dai, J. (2020). Mental health problems and social media exposure during COVID-19 outbreak. *PLoS One*, *15*(4), e0231924. <https://doi.org/10.1371/journal.pone.0231924>

Gebel, C., Juenger, N., Wagner, U., & (2014). Informations- und engagementsbezogenes Medienhandeln von Jugendlichen [Information and engagement related media activities of young people]. *Jugendliche und die Aneignung politischer Informationen in Online-Medien [Young people and the acquisition of political information in online media]*, (53–136). Wiesbaden: Springer.

Grech, V. (2020). Unknown unknowns—COVID-19 and potential global mortality. *Early Human Development*, *14*, 105026.

Guan, W.-J., Liang, W.-H., Zhao, Y., Liang, H.-R., Chen, Z.-S., Li, Y.-M., ... China Medical Treatment Expert Group for COVID-19. (2020). Comorbidity and its impact on 1590 patients with COVID-19 in China: A nationwide analysis. *European Respiratory Journal*, *55*(5), 2000547. <https://doi.org/10.1183/13993003.00547-2020>

Gupta, L., Gasparyan, A. Y., Misra, D. P., Agarwal, V., Zimba, O., & Yessirkepov, M. (2020). Information and misinformation on COVID-19: A cross-sectional survey study. *Journal of Korean Medical Science*, *35*(27), e256.

Hallyburton, A., & Evarts, L. A. (2014). Gender and online health information seeking: A five survey meta-analysis. *Journal of Consumer Health on the Internet*, *18*(2), 128–142.

Houston, T. K., & Allison, J. J. (2002). Users of Internet health information: Differences by health status. *Journal of Medical Internet Research*, *4*(2), e7.

- Huang, Y., & Zhao, N. (2020). Generalized anxiety disorder, depressive symptoms and sleep quality during COVID-19 outbreak in China: A web-based cross-sectional survey. *Psychiatry Research*, 288, 112954. <https://doi.org/10.1016/j.psych res.2020.112954>
- Kang C.Y., Yang S., Yuan J., Xu Li., Zhao X., Yang J. (2020). Patients with chronic illness urgently need integrated physical and psychological care during the COVID-19 outbreak. *Asian Journal of Psychiatry*, 51, 102081. <http://doi.org/10.1016/j.ajp.2020.102081>.
- Kelley, K., Clark, B., Brown, V., & Sitzia, J. (2003). Good practice in the conduct and reporting of survey research. *International Journal for Quality in Health Care*, 15(3), 261–266. <https://doi.org/10.1093/ intqh c/mzg031>
- Kontos, E., Blake, K. D., Chou, W. Y., & Prestin, A. (2014). Predictors of eHealth usage: Insights on the digital divide from the Health Information National Trends Survey 2012. *Journal of Medical Internet Research*, 16(7), e172. <https://doi.org/10.2196/ jmir.3117>
- Marstedt, G. (2018). *Das Internet: Auch Ihr Ratgeber für Gesundheitsfragen? Bevölkerungsumfrage zur Suche von Gesundheitsinformationen im Internet und zur Reaktion der Ärzte (The Internet: Also your guide to health issues? Population survey on the search for health information on the Internet and the reaction of doctors)*. Gütersloh, Germany: Bertelsmann Stiftung.
- McCloud, R. F., Okechukwu, C. A., Sorensen, G., & Viswanath, K. (2016). Beyond access: Barriers to internet health information seeking among the urban poor. *Journal of the American Medical Informatics Association*, 23(6), 1053–1059.
- Megari, K. (2013). Quality of life in chronic disease patients. *Health Psychology Research*, 1(3), e27–e27. <https://doi.org/10.4081/hpr.2013.e27>



- National Institutes of Health. (2018). *Online health information: Is it reliable?* Retrieved from <https://www.nia.nih.gov/health/online-health-information-it-reliable>
- Norman, C. D., & Skinner, H. A. (2006). eHealth literacy: Essential skills for consumer health in a networked world. *Journal of Medical Internet Research*, 8(2), e9.
- Okan, O., Sørensen, K., & Messer, M. (2020, March 19). COVID-19: A guide to good practice on keeping people well informed. *The Conversation*. <https://theconversation.com/covid-19-a-guide-to-good-practice-on-keeping-people-well-informed-134046>.
- Onder, G., Rezza, G., & Brusaferro, S. (2020). Case-fatality rate and characteristics of patients dying in relation to COVID-19 in Italy. *Journal of the American Medical Association*, 323(18), 1775–1776.
- Orso, D., Federici, N., Copetti, R., Vetrugno, L., & Bove, T. (2020). Infodemic and the spread of fake news in the COVID-19-era. *European Journal of Emergency Medicine*, 27(5), 327–328.
- Paakkari, L., & Okan, O. (2020). COVID-19: Health literacy is an underestimated problem. *Lancet Public Health*, 5(5), e249–e250. [https://doi.org/10.1016/S2468-2667\(20\)30086-4](https://doi.org/10.1016/S2468-2667(20)30086-4)
- Richardson, S., Hirsch, J. S., Narasimhan, M., Crawford, J. M., McGinn, T., Davidson, K. W., ... Zanos, T. P. (2020). Presenting characteristics, comorbidities, and outcomes among 5700 patients hospitalized with COVID-19 in the New York City area. *Journal of the American Medical Association*, 323(20), 2052–2059. <https://doi.org/10.1001/jama.2020.6775>
- Sadasivam R. S., Kinney R. L., Lemon S. C., Shimada S. L., Allison J. J., Houston T. K. (2013). Internet health information seeking is a team sport: Analysis of the Pew

- Internet Survey. *International Journal of Medical Informatics*, 82(3), 193–200.  
<http://doi.org/10.1016/j.ijmed inf.2012.09.008>.
- Sentell, T., Vamos, S., & Okan, O. (2020). Interdisciplinary perspectives on health literacy research around the world: More important than ever in a time of COVID-19. *International Journal of Environmental Research and Public Health*, 17(9), 3010.
- Singh, L., Bansal, S., Bode, L., Budak, C., Chi, G., Kawintiranon, K., Wang, Y. (2020). A first look at COVID-19 information and misinformation sharing on Twitter. arXiv preprint arXiv:2003.13907. <https://arxiv.org/abs/2003.13907v1>
- Topp, C. W., Østergaard, S. D., Søndergaard, S., & Bech, P. (2015). The WHO-5 Well-Being Index: A systematic review of the literature. *Psychotherapy and Psychosomatics*, 84(3), 167–176. <https://doi.org/10.1159/000376585>
- Traver, M., Basagoiti, I., Martinez-Millana, A., Fernández-Llatas, C., & Traver, V. (2016, August 16–20). *Experiences of a general practitioner in the daily practice about digital health literacy. The real needs*. Paper presented at the 38th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Orlando, Florida, August 16–20, 2016.
- Tustin, N. (2010). The role of patient satisfaction in online health information seeking. *Journal of Health Communication*, 15(1), 3–17.
- van der Vaart, R., & Drossaert, C. (2017). Development of the Digital Health Literacy Instrument: Measuring a broad spectrum of health 1.0 and health 2.0 skills. *Journal of Medical Internet Research*, 19(1), e27–e27. <https://doi.org/10.2196/jmir.6709>
- Ventola, C. L. (2014). Social media and health care professionals: Benefits, risks, and best practices. *P & T: A Peer-Reviewed Journal for Formulary Management*, 39(7), 491–520.

- Wong, D. K. K., & Cheung, M. K. (2019). Online health information seeking and ehealth literacy among patients attending a primary care clinic in Hong Kong: A cross-sectional survey. *Journal of Medical Internet Research*, *21*(3), e10831.
- Wong, J. I. S., Steitz, B. D., & Rosenbloom, S. T. (2019). Characterizing the impact of health literacy, computer ability, patient demographics, and portal usage on patient satisfaction with a patient portal. *JAMIA Open*, *2*(4), 456–464.
- World Health Organization. (1998). Wellbeing Measures in Primary Health Care/The DEPCARE Project: Report on a WHO meeting, Stockholm, Sweden 12–13 February 1998. Paper presented at the Wellbeing Measures in Primary Health Care/ The DEPCARE Project: Report on a WHO Meeting, Stockholm, Sweden, February 12–13, 1998. Retrieved from [https://www.euro.who.int/\\_data/assets/pdf\\_file/0016/130750/E60246.pdf](https://www.euro.who.int/_data/assets/pdf_file/0016/130750/E60246.pdf)
- World Health Organization. (2020a). *Coronavirus disease 2019 (COVID-19): Situation report*, 72. Geneva, Switzerland: Author.
- World Health Organization. (2020b). *Coronavirus disease 2019 (COVID-19): Situation report*, 73. Geneva, Switzerland: Author.
- World Health Organization. (2020c). Process of translation and adaptation of instruments. Retrieved from [https://www.who.int/substance\\_abuse/research\\_tools/translation/en/](https://www.who.int/substance_abuse/research_tools/translation/en/).
- Wu, Z., & McGoogan, J. M. (2020). Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: Summary of a report of 72,314 cases from the Chinese Center for Disease Control and Prevention. *Journal of the American Medical Association*, *323*(13), 1239–1242.  
<https://doi.org/10.1001/jama.2020.2648>

- Zaim, S., Chong, J. H., Sankaranarayanan, V., & Harky, A. (2020). COVID-19 and multiorgan response. *Current Problems in Cardiology*, 45(8), 100618. <https://doi.org/10.1016/j.cpcar.2020.100618>
- Zarocostas, J. (2020). How to fight an infodemic. *Lancet*, 395(10225), 676. [https://doi.org/10.1016/S0140-6736\(20\)30461-X](https://doi.org/10.1016/S0140-6736(20)30461-X)
- Zhang, X., Wen, D., Liang, J., & Lei, J. (2017). How the public uses social media WeChat to obtain health information in China: A survey study. *BMC Medical Informatics and Decision Making*, 17(Suppl. 2), 66. <https://doi.org/10.1186/s12911-017-0470-0>
- Zhao Y., Cheng S., Yu X., Xu H. (2020). Chinese Public's Attention to the COVID-19 Epidemic on Social Media: Observational Descriptive Study. *Journal of Medical Internet Research*, 22(5), e18825. <http://doi.org/10.2196/18825>