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With Help from Afar: Cross-Local Communication in an Online COVID-19 Pandemic Community

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Crisis informatics research has examined geographically bounded crises, such as natural or man-made disasters, identifying the critical role of local and hyper-local information focused on one geographic area in crisis communication. The COVID-19 pandemic represents an understudied kind of crisis that simultaneously hits locales across the globe, engendering an emergent form of crisis communication, which we term *cross-local communication*. Cross-local communication is the exchange of crisis information between geographically dispersed locales to facilitate local crisis response. To unpack this notion, we present a qualitative study of an online migrant community of overseas Taiwanese who supported fellow Taiwanese from afar. We detail four distinctive types of cross-local communication: situational updates, risk communication, medical consultation, and coordination. We discuss how the current pandemic situation brings new understandings to crisis informatics and online health community literature, and what role digital technologies could play in supporting cross-local communication.

1   INTRODUCTION

A pandemic is an epidemic occurring on a global scale that crosses national boundaries [44]. Unlike regional crises such as tsunami, wildfires, and hurricanes, which have been well studied in crisis informatics literature, the outbreak of a pandemic usually affects people worldwide. Several pandemics have occurred in the past two decades [28], including the SARS epidemic in 2003, the H1N1 influenza pandemic in 2009, the Ebola virus epidemic in 2013, and the most recent coronavirus disease (COVID-19) pandemic in 2020 [57]. COVID-19, caused by the 2019 novel coronavirus (2019- nCoV), is a highly contagious disease. Having originated in Wuhan, China in December 2019, the disease quickly evolved into a global pandemic [57], with 4,769,177 confirmed cases and 316,898 deaths by May 18, 2020 [53]. As of October 2020, the virus has affected more than 3 million people across the globe and caused more than 1 million deaths [39].

COVID-19 spreads from a region to another [69]. According to the World Health Organization (WHO) [56], the new coronavirus was first identified in early January 2020 shortly after an outbreak in Wuhan, China. It spread to countries throughout the world in February and March. Although hit by the same pandemic, different countries have vastly different public health policies and procedures as well as economic and political factors that affect community transmitting, healthcare system resources, and medical supplies accessibility [69]. Consequently, people from different geographic locations may have starkly different experiences with risk prevention and crisis response. For example, one area might experience a steep growth of cases while another maintains a low infection rate.

The majority of crisis informatics research has focused on informational practices within geo- graphically bounded locales and how local people use information and communication technologies (ICTs), e.g., to seek/share information and prevent risks [80, 87]. However, disease outbreaks, such as the COVID-19 pandemic, are no longer geographically confined. Geographically dispersed places with uneven resources have been simultaneously experiencing and responding to COVID-19's outbreak. The coordination of medical supplies and the exchange of the latest scientific knowledge has needed to happen across multiple locales. Against this backdrop, our research question asks whether and how people from dispersed places can work together in response to global pandemic such as the COVID-19. The concept of *cross-local communication* describes how people from different locales engage in

crisis communication. It denotes a specific type of crisis communication in which communication content is impacted by two or more distinct and geographically dispersed contexts experiencing the same crisis. Thus, the notion of cross-local communication departs from crisis communication that took place in previously studied crisis situations and concerned only one local context. For example, a person in Paris, France might view and respond to tweets about a hurricane in Atlanta, USA. That person's communication only involves the context of Atlanta, where the hurricane is taking place, and not Paris, where the person is located. Thus, this is not considered *cross-local communication*.

In this paper, we aim to answer the main research question "*how has the information about two or more geographically dispersed contexts impacted crisis communication during the COVID-19 pandemic?*" To answer it, we investigated the cross-local communication in an online migrant community. The online migrant community is the *COVID-19 Support Group (CSG)* [1], a community that was created by overseas Taiwanese during the pandemic's outbreak. We chose a migrant community as our study context because online migrant communities are exemplars in which members come from different locales [45]. Migrants often encounter challenges in navigating the health systems of their new national context and thus turn to other migrants of the same origin for support [84, 90]. As a result, exploring *cross-local communication* during a pandemic has the added benefit of helping us unpack the understudied barriers and challenges of such marginalized communities. [73].

We performed an inductive thematic analysis [4] of the group discussions that took place on the message board between the group's creation date and the time of this study. We found that the online migrant community shared similar functions with online health communities in terms of facilitating geographically dispersed Taiwanese to share their local situations and seek informational, emotional, medical, and logistical support. Particularly, the CSG enabled four types of cross-local communication, including situational updates, risk communication, medical consultation, and coordination, which have been understudied in previous crisis informatics and online health community literature. Based on these findings,

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[1]The community name was translated and rephrased to protect user privacy.

we discuss how the COVID-19 pandemic has engendered emergent forms of crisis communication and the role of information and communication technologies (ICTs) in supporting migrants, particularly during public health crises.

Our work has three primary contributions to the HCI and CSCW literature. First, we contribute empirical and conceptual insights into cross-local communication to the crisis informatics and online health community literature. Second, we characterize how pandemics can impact people's informational practices. Third, we reflect upon migrants' interactions with local public health systems, identifying challenges and opportunities for future research.

2   BACKGROUND

COVID-19 can spread human-to-human or through contact with infected surfaces [20]. The virus has various symptoms, such as fever, cough, chills, muscle pain, and shortness of breath [21]. The fatality rate of COVID-19 ranges between 1% and 3%, and increases significantly for older populations and people with diabetes [57]. COVID-19 situations and emergency responses are vastly different across countries. Taiwan, despite its close proximity to China, quickly controlled the situation, thanks to its rapid and transparent response: ten weeks after the announcement of a pandemic, Taiwan had less than 400 cases, in comparison to almost 5,000 in Australia [25]. Almost a year later, the coronavirus cases in Taiwan were under 600, versus the global number of confirmed cases surpassing 30 million, and Taiwan has been seen as successfully containing the virus [31]. According to Wang et al. [89], Taiwan started to assess passengers on flights from Wuhan on as early as December 31st, 2019. Taiwan amassed a considerable amount of response resources, such as masks and isolation rooms, on January 20, 2020 and rapidly produced and implemented 124 action items between January 20th and February 24th (during the outbreak's first-wave). Data analytic exchange technologies were adopted in the border control system, telecommunications systems, and the national health insurance database to trace COVID-19 cases.

Taiwan's national health insurance (NHI) system provides mandatory coverage to all citizens, and has been featured by its good accessibility, broad coverage (99% of the population), low cost, national healthcare ID card, and the centralized medical database [93]. The government commenced a long- term investment in hospital's negative pressure isolation rooms and infectious disease laboratories since the SARA epidemic in 2002 [30]. The robust health system has served

as a solid infrastructure to support these measures to handle the COVID-19 outbreak [30]: The low-cost and high population coverage encourages patients to seek medical service when there are any early symptoms. The NHI database allows medical providers to access patients' travel and symptom history and generate real-time alerts to high-risk cases. The national ID card was used to identified and distributed the face mask to all citizens in thousand of local pharmacies when the supply was a shortage.

3 RELATED WORKS

3.1 Local and Hyper-Local Information In Crisis Informatics

Previous crisis informatics research has mostly concerned natural and manmade crises that are geographically bounded, such as floods, earthquakes, bombings, and shootings. In part, as a result, the majority of crisis informatics research has focused on how social media platforms, such as Twitter and Reddit, support the production and dissemination of local and hyper-local information like injury reports and hazard locations within continuous geographic areas (e.g., [41, 47, 62, 75, 80]). Research has shown that physical proximity plays a critical role in social media users' information- sharing and seeking behaviors amidst crises (e.g., [35, 41, 47, 62, 75, 80]). For instance, Starbird and Palen [80] found that during two natural hazards events (i.e., flooding and fires), local people were more likely to retweet information published by local media and organizations when passing on local emergency-related information. Kogan et al. [41] similarly reported that during 2012's Hurricane Sandy, Twitter users who were in the affected areas retweeted quite differently than the global population who was tweeting about the same disaster; those in the affected areas focused on retweets containing locally-useful information. Huang et al.'s study on social media users' experiences after the Boston Marathon Bombings [35] showed that people tended to trust local information from local people who were "*on the ground.*"

Emotional proximity, meaning an emotional connection to the people affected by a crisis or a sentimental association to the area where the crisis is happening, also motivated social media users, including both locals and non-locals (e.g., people who had friends near the affected areas), to share and seek locally relevant information [35]. These informational practices of seeking and curating local and hyper-local information have the ability to enhance people's situational awareness of a crisis. Situational awareness is defined as "*all knowledge that is*

accessible and can be integrated into a coherent picture when required, to assess and cope with a situation" [72], thus helping people make informed decisions.

Social media can help locals and the general public coordinate their efforts in response to crises (e.g., [64, 65, 87]). For instance, after earthquakes, Chinese people have used social media to offer emotional support and coordinate assistance for local people [64, 65]. Citizens living in Iraq during the Gulf War used social media to self-organize communities and resources [50]. Furthermore, emergency response professionals also now actively use social media to share locally-relevant information and coordinate their work [22, 71] as well as communicate with the public about the crisis [36]. The emerging information technologies, such as satellite-supported post-disaster damage assessment [43], are increasingly playing a central role that allows social media users to collectively make sense of and coordinate their response to the crisis [79]. Digital technologies may not have a direct health objective but could indirectly contribute to health empowerment. For example, the geographical information systems (GIS) could be adopted in risk assessment and spatial analysis that predict disease outbreak and spread during epidemic [54].

Local and hyper-local information about one specific geographic area plays an important role in infectious disease crises. Risk communication, a type of crisis communication, refers to how scientists and technical experts spread risk information through designated channels in a top- down way. Broadly speaking, it can reference any public or private communication that informs individuals about the severity or forms of the risks [27]. For instance, during the Zika virus outbreak, people faced extreme uncertainty and ambiguity, as even the public health authorities' scientific knowledge of the virus was limited in the early stage [27, 28]. Consequently, many people sought local and hyper-local information, such as the conditions of the mosquitoes and the specific preventative measures that hotels were taking, from locals and previous travelers to the area to assess the risks of that locale [28].

Collectively, the crisis informatics literature has demonstrated how local and hyper-local information about one geographic area plays an important role in crisis communication, oftentimes because only that particular area is experiencing the crisis or its local contextual information is valuable. However, the literature has not yet examined global pandemics where people from different geographic locales simultaneously experience, more or less, the same crisis. Our study is motivated by this research gap, and aims to understand how, during

the COVID-19 pandemic, information about two or more geographically dispersed areas comes into play in crisis response.

3.2   Online Health Communities and Public Health Crises

Online health communities (OHC) have been well studied in HCI and CSCW, and some previous findings could shed light on how the CSG, our study site, might provide support to Taiwanese migrants. Previous OHC literature has shown that OHCs can provide members with informational, emotional, and instrumental support for health and disease management [48, 86, 95]. In OHCs, individuals can search for health information based on their personal circumstances or symptoms. Advice and information is usually answered by peers with a similar situation or condition, such as cancer, chronic diseases, or another illness [26, 33, 77]. For example, postpartum patients may seek peer support for intimate postpartum challenges, such as parenting, breastfeeding, and postpartum depression [12, 17, 26, 70]. The OHCs users may be motivated to share knowledge with different incentives. The health professionals may be motivated more by self-efficacy and reputation, but the normal users are more willing to be driven by reciprocity, altruism, and empathy [94].

OHCs contain valuable and diverse personal experiences, detailed advice, and support that can complement the assistance of healthcare professionals [32]. In online communities, patients may share their strategies for managing the minutiae of their health conditions, describe their illness trajectories, or develop a collective understanding of disease management [37]. Such online health information can be valuable for many reasons. For example, seeking information and support from online peers, in particular, is an economical solution for when medical experts or resources are costly or not accessible [49, 52]. Seeking social support online can also further help to reduce the impact of negative judgment and relational dependency on a individual's offline social network and allow individuals to get quick support from the greater expertise of the network [34, 88]. These social benefits can help to improve mental health by offering emotional support, or even lead to instrumental support, e.g., managing/coordinating tasks, everyday chores [77, 78] in offline interactions.

However, OHC researchers have also warned of OHCs' limitations. One obvious challenge to these communities is the quality and accuracy of the user-generated online health information. Users need to have sufficient health literacy to differentiate credible

information from information that is of lower-quality, something that is challenging to many lay users [76]. The "network homophily" in social networks could also exacerbate the spread of misinformation as people tend to adopt the advice of people similar to them and trust the information they generate [91]. Previous research has discussed the negative consequences of patients using online health information, which include incorrect self-diagnoses, increased health anxiety, and disrupted patient-doctor relationships [40, 46, 68, 76]. Huh et al. proposed that health professionals could be involved in OHCs to improve the quality of the health information [38]. Besides, the "linguistic accommodation" could also impact the social supports or feedback that the users received from the OHCs, i.e., it may be a burden for the support seeker to align with a certain social norm to attract the group members' responses [74].

Findings from the OHC literature point to OHCs having both advantages and disadvantages that could inform this study. However, the previous literature has not established whether groups that emerge during pandemics, like the CSG, fit into our existing understanding of OHCs. There are at least several ways that the CSG differs from a typical OHC. First, typical OHCs are stable and long-standing since the health conditions or diseases on which they are focused are likely to persist for a long time while the CSG emerged in response to a public health crisis. Second, a typical OHS is designed to focus on health, but the CSG is focused on self-help, which covers issues unrelated to health, such as what entertainment people should seek while at home. Third, when it comes to membership, a typical OHC is for people who have a specific health condition, or care about it for particular reasons, but the CSG membership is predicated on whether the person is related to the country of origin. The CSG is first and foremost an online migrant community. Given the differences between OHCs and the CSG, the study did not start by assuming that the CSG is an OHC, but set out to investigate the mode of cross-local communication in a special type of online group during a pandemic. We argue and accept the OHCs as a concept with fuzzy boundaries [8, 61]. We hope that by investigating this emergent community during the COVID-19 pandemic, we could start to develop a better understanding of the similarities and differences between OHCs and the CSG and communities like it.

3.3 Migrants and ICTs

In this paper, we adopt the International Organization for Migration (IOM)'s inclusive [9]

definition of "*migrant*" which refers to any individual who "*is moving or has moved across an international border or within a State away from his or her habitual place of residence; regardless of the person's legal status; whether the movement is voluntary or involuntary; whatever the causes for the movement are; or whatever the length of the stay is*" [51]. Refugees, people seeking asylum, foreign-born individuals residing in a country on any visa type (e.g., international students and immigrants) are all referred to as migrants here.

Migrants are vulnerable when seeking health information and accessing health services in an unfamiliar national context. Healthcare systems in different countries vary greatly in terms of financial models, service design, and access regulations [2, 92]; thus, migrants oftentimes have to navigate and adapt to a healthcare system different from the one in their home country [83]. In addition, there are frequently various barriers hindering migrants from effectively using the health services in their host countries. Migrants' health beliefs are often shaped by their deep- rooted cultural practices and values, impacting their health-related decision-making and service- seeking practices [10, 82, 83]. Health-related culture and values clashes could prevent them from accessing health information and services. For instance, Tang et al. [83] found that international students in the United States continued to use the medicine and remedies they brought from their home countries because they have more trust in the medicines and remedies that match their ethnic beliefs and traditions. In addition, when accessing health-related services, migrants may also face environmental barriers (e.g., high cost of fresh food), communication barriers with healthcare providers, and systemic barriers (e.g., the complexity of the healthcare system) [55]. For instance, immigrant women from the Caribbean living in the U.S. were unable to receive needed health services because of the challenges they faced, including barriers to accessing insurance and unsatisfactory patient-doctor relationships [5].

HCI and CSCW researchers have started to pay attention to migrants' health-related issues. Brown et al. [6] discovered that immigrant women from the Caribbean living in the U.S. faced barriers when managing their health, such as stress, domestic abuse, dietary challenges, and mental wellness, and that it was important to help them build a support structure, reduce stressors, and promote positive lifestyle changes. Talhouk et al. [82] studied Syrian refugees in rural Lebanon and identified a number of factors that should be considered in antenatal care for refugees, such as health beliefs, perceptions of negative attitudes of healthcare

providers, and health literacy level. Tachtler et al. [81] focused on promoting psychological resilience among unaccompanied migrant youths in different countries; they revealed challenges that the mentors of the youth faced and emphasized several ways to support the mentors.

While previous research has recognized the importance of migrants' health, it did not investigate how migrants navigate public health crises. Our study seeks to understand migrants' practices of seeking and sharing health-related information during a pandemic.

4   METHOD

4.1   Study Site

The online migrant community we chose to focus on is the COVID-19 Support Group (CSG). The community was created by a self-described Taiwanese migrant living abroad. In the community, the administrators called on medical staff to provide online consultations and advice to overseas

Table 1. Descriptive statistics of the CSG dataset (N=956).

	Max	Min	Average	Median	SD
Number of Likes	77,000	0	1907.45	125	6644.95
Number of Comments	4,700	0	57.74	20	180.70
Length of Post (Words)	3567	15	311.91	209	373.49
Length of Comment (Words)	393	1	28.94	17	35.97

Taiwanese who found it difficult to seek medical information or treatment. According to the community's description, CSG was meant to support overseas Taiwanese in response to the COVID- 19 pandemic, providing temporary and preliminary medical advice, COVID-19-related discussion, news and information sharing, and other forms of emergency assistance. At the time of this study, the community had nearly 80,000 members and included thousands of medical staff and experts [11]. None of the authors have a relationship with the community owners or administrators or post any message in the community. The main language of the CSG is Taiwanese Mandarin.

We selected CSG as our study platform because 1) its members originated in

geographically dispersed locales; 2) it is a non-profit group coordinating medical professionals and people in response to the COVID-19 pandemic; and 3) unlike Twitter, the CSG is managed by medical professionals and is a closed online community that enforces membership approval. Thus, the CSG does not face as many of the challenges common on Twitter, such as rampant misinformation and harassment. These three characteristics helped us to understand how cross-local communication can facilitate local crisis response. After searching on multiple social media platforms, we were unable to find another online community that fulfilled all the characteristics of cross-local communication so early on in the COVID-19 pandemic.

4.2   Data Collection and Analysis

On April 22, 2020, we used a PHP script to parse and collect threads from the CSG through the platform's application programming interface (API). Our final dataset included 956 posts and 52,833 associated comments. Table 1 shows the descriptive statistics of our dataset. The dataset covers threads created by CSG members from March 16, 2020 to April 22, 2020.

To address the research question, we performed an inductive thematic analysis [4] on the dataset. Three researchers participated in this process. Upon the completion of data collection, each of us read the dataset to obtain an initial understanding of its content. We held frequent meetings during the first two weeks (once per three or four days) to discuss our impressions of the dataset as well as the general question of what role the CSG was playing during the ongoing pandemic. What struck us the most was that the overseas Taiwanese in the online community drew on knowledge and experiences from two or more globally distributed locales to support each other, doing what we call *cross-local communication*. Thus, we agreed to narrow our general question to the more refined one of how *cross-local communication* supported in crisis response to the COVID-19 pandemic.

With this idea in mind, each of us then returned to the dataset to develop initial codes for all the 956 threads. Our unit of analysis was a thread including a post and its subsequent comments. First, each of us separately generated a list of basic codes. An example of basic code was "*A London resident sought information about home medication used in Taiwan.*" Each data point was related to a basic code. Some data were removed at this step if they were irrelevant, such as cat pictures or music recommendations. Second, we met again to discuss our lists of codes. While the exact wordings of our basic codes were not the same,

they were generally in harmony in terms of how we interpreted the data. As we went over and compared our lists of basic codes, we identified differences where one coder might have a code not identified by other coders. In such situation, we would discuss whether the code was semantically distinctive enough, or it could be incorporated into common codes. Through this process, we were able to agree upon a unified list of basic codes. Third, we aggregated and refined our codes based on their similarities and differences, generating larger themes. This was an iterative process during which we held frequent discussions and went back and forth between our codes and data until we reached a satisfactory thematic scheme.

Our final thematic scheme included four primary types of cross-local communication: 1) **Cross- local situational updates,** included sharing and comparing public awareness, preparation, and local policies responding to the pandemic. 2) **Cross-local risk communication,** included sharing and comparing local information regarding preservative measures, supplies, caring, and cultural dif- ferences. 3) **Cross-Local medical consultation,** included seeking and sharing general or COVID- related medical advice, diagnoses, and care information. 4) **Cross-Local coordination,** included seeking and providing medical care support, supplies for local people, and front-line workers. After the data analysis, we selected the representative quotes to be used in our findings section. We then translated the quotes into English.

Privacy, Ethics and Disclosure. We were mindful of the ethical sensitivity when using online data in social computing research while preparing and conducting the study. Given the lack of consensus on universal standards and ethical approaches, researchers should ponder best practices in their particular study context [19]. For this study, we took several measures into consideration: First, we had obtained approval for the study procedure from our university's IRB office prior to the study. Second, to protect the stakeholders' privacy, we have adopted several cautionary steps: 1) All quotes are originally in Taiwanese Mandarin (a variety of Mandarin Chinese), and we translated and rephrased them into English, which provides a natural level of disguise to prevent the sections from being verbatim searched or identified. All translated quotes were reviewed by a third-party translator to prevent subconscious bias. 2) The "Post ID" is not associated with the posting time or order, so it will not identify the original post. 3) We removed all the identifiable personal information, e.g., user identifier, the name of working place, towns, personal health diary, symptoms, and made sure the quotes will

not directly violate users' privacy. 4) Our data use aligns with the community's explicitly stated policy and the requirement on the pseudonymization of the group name and the anonymization of community members.

The leading author of this study is Taiwanese. Three authors are Chinese language native speakers. None of the authors served an administrator role for the community. Therefore, the leading author possesses essential insider knowledge to understand the Taiwanese culture and values celebrated within the community. Such knowledge played a key role in our data analysis.

5   FINDINGS

The COVID-19 Support Group (CSG) has been mediating cross-local communication between Taiwanese from different locales across the globe since the day of its creation. Against the backdrop of the global pandemic and vastly different local circumstances, the CSG has served as a central hub for COVID-19 related knowledge and experiences to be shared across geographical boundaries. Next, we detail how cross-local communication has played out in this online migrant community.

5.1   Cross-Local Situational Update

Cross-local situational update refers to how people from one specific region share information about their local situation, such as statistics, trends, predictions, local authorities' policies, and responses, and the general public's practices. Such situational updates allow people from other regions to compare the reported information from another location with their own local context.

For instance, a front-line health worker from Taiwan shared their local conditions in late March, 2020:

> **Post 427:** "*Hello everyone, I am a firefighter in Taiwan, and I am also a dedicated ambulance staff in this epidemic. I am responsible for carrying cases to the hospital for quarantine or returning home from the hospital. (...) The number of imported cases has skyrocketed recently, and our dedicated ambulances in Kaohsiung have been over-loaded. Here I'd like to share some personal experiences*

and preventive measures. Please feel free to ask me anything."

Comment: "*I would like to share this post to let the UK people know how they should protect themselves.*"

In this example, an emergency responder from Taiwan shared their local situation and experiences and invited questions from the community. March 22, 2020, the posted date of the comment, was a time during which the numbers of confirmed cases had just started to climb in some countries like the U.K. and the U.S. People from those countries had neither paid sufficient attention to COVID-19 nor taken serious preventive measures, but this online community allowed overseas Taiwanese in those countries to gain early insights into COVID-19 by learning from the front-line workers and people based in Taiwan. More importantly, the comment that expressed criticism of the U.K.'s then lack of action was enabled by cross-local communication in which people could compare information about two different locales.

Due to variations in the timing of outbreaks, the migrants from Taiwan were able to develop an awareness of the virus before the local communities, medical professionals, and even authorities in their host countries did. The cross-local situational update prompted a *cross-comparison* of different publics' awareness, medical professionals' preparedness, and local policies. For instance, one front-line medical worker posted on March 16, 2020, sharing her concerns about the public's awareness in the U.K.:

Post 157: "*I am a medical staffer working in the NHS. Local people lack the awareness of wearing masks and other preventive measures in public places; The official recommendations are very different from what I hear from Taiwan's Minister of Health and Welfare Chen Shizhong. My close friends and colleagues here do not have a sense of crisis. Some people here do not believe the preventive effect of masks, but I wear masks every day. My job has close contact with patients, while my hospital is unprepared for the asymptomatic COVID-19 cases. It's terrifying for me to go to work every day, worrying about the possibility of being infected and bringing the virus to my family.*"

The poster compared the UK and Taiwan's preventive measures, took the preventive measures recommended by Taiwan, and worried that the local general public and authorities in the UK were not properly prepared for the pandemic. This post was also enabled by the availability of information about two locales.

Situational updates regarding changes in local public health policies were common. The conflict between the migrants' local policies and the policy in Taiwan, which required people to wear masks, caused major concern in this online community. Some migrants advocated locally and shared their success online. For example, a physician from Maryland posted in late March, 2020, about how he or she, as a front-line health professional, communicated with their higher-ups to change the policy of wearing a mask in the workplace:

>**Post 487:**"*My hospital's policy prohibited us from wearing masks outside the wards. I emailed the senior officials based on empirical evidence. After the communication, they changed the policy and now allow us to wear masks. The policy was extended to all hospitals in the region now...*"
>
>**Comment:**"*My hospital in New York has also changed their mask policy recently. They thought wearing a mask was just Asian culture, but now require all the doctors and patients entering the delivery room to wear a mask. Speak out! Make changes!*"

Such cross-local situational updates and advocacy evoked support and resonance from many members in the online community. This was only possible because information about the policies in different locales was shared through the CSG.

5.2   Cross-Local Risk Communication

In cross-local risk communication, CSG members shared resources for others to assess the risks associated with COVID-19 as well as measures for risk prevention and the reasoning processes behind preventative measures.

5.2.1   *Cross-Local Risk Assessment.* Some CSG members had to make high-stakes decisions by assessing the degree of risk associated with different locales. Thus, it was important for them to seek information about more than one place. One of these types of decisions involved travel. For instance, in late March, one poster from California sought advice to help assess the risk of their parents' travel plan back to Taiwan:

>**Post 554:**"*I live in California. So far, the case number isn't that crazy. My parents (63 years old) have been visiting since February, and their return flight is scheduled at the end of March. My mother feels that staying in the United States may cause*

more uncertainty... but I think that flying back to Taiwan is more risky, especially since older people are more vulnerable, plus now is the peak time when a lot of people go back to Taiwan... Do you think they should go back to Taiwan as scheduled or just stay at my place?"

Comment:"*It is better to stay and you can take care of them. In the recent few weeks, many international students have being rushing back to Taiwan, including those who may have been infected. Your parents will have a higher chance of contacting infected people if they fly.*"

In this example, the poster and the commenter engaged in cross-local risk assessment where they shared information about the risks associated with two places, California and Taiwan. The poster was worried about the potential increase of cases in their county, while the commenter pointed out how Taiwan's risk had also recently increased. This provision of risk information about two locales in cross-local communication supported the collective process of risk assessment where community members worked together for high-stakes decision-making.

Cross-local risk assessment also happened among front-line health professionals from different places. For instance, a nurse practitioner posted:

Post 456:"*I am serving as an ARNP (Advanced Registered Nurse Practitioner) in Washing- ton. My medical assistant lives with her son, and her son was diagnosed with COVID-19 last Sunday. She was tested the day after. The result just came back and it's negative. Now it's only been 5 days since her son was diagnosed, but our hospital already asked her to come back to work. It's against the recommendations of the Washington State Department of Health... I've complained to the employee health office but my words don't carry much weight... I think she should self-quarantine for 14 days before coming back...I think it's very risky especially considering we are still seeing many patients. Am I overreacting? Testing negative doesn't guarantee that she is not in the incubation period, right?*"

This poster faced a conflict between the policy at their hospital, and their own beliefs and the recommendations at the state level. After failed advocacy, they started doubting whether their risk assessment made sense. In the comments the poster received, health

professionals from other places complained about their hospitals' similar policies and reassured the poster that they were not overreacting. They also recommended preventative measures and advocacy strategies. This case demonstrates that the COVID-19 pandemic not only brought uncertainty and anxiety to the general public, but also to health professionals. The cross-local risk assessment among front-line health professionals with the same health beliefs helped them gain support from each other when facing conflict about those beliefs.

5.2.2   *Cross-Local Communication of Risk Prevention Measures.* Risk prevention measures refer to individual-level preventive measures in response to a crisis, such as stocking supplies and following official guidelines. We observed that people posted on the online community to 1) ask for other places' officially recommended preventive measures when their own local measures were unclear or did not exist, 2) compare different, local official, or individual preventive measures to decide what measures to take. For instance, in the early days when local public health policies were not yet developed to cover young children, several posters asked their peers to share what their local recommendations were, whether their locale had pediatric cases, and what preventive measures others were personally taking. Here is one example:

> **Post 536:** "*I am in London and my due date is next month. Because of the current situation, plus the fact that medical staff are still not wearing masks, I am very worried. After taking the baby home, we adults can take a bath and disinfect ourselves, what should we do about the baby ? We plan to cover the baby as often as possible and take a shower immediately when we arrive home. But the remaining question is: Is there a bathing method that can remove the virus without irritating the baby's skin, considering that baby skin is so fragile? Thank you!?*"
>
> **Comment1:** "*Don't use the Vital Baby acquaint sanitizing water it may cause skin irritation...you can use cotton wool and wipe gently change the baby blankets and clothes frequently. And make sure you stay clean.* "
>
> **Comment2:** "*FYI, here are some tips from a pediatrician in Taiwan (URL). you can use raincover to cover the baby carrier* "

This post received dozens of suggestions, including suggestions based on personal experience and tips from health professionals in Taiwan. The poster later replied, stating that she

"*felt at ease*" after receiving so much helpful advice. This cross-local sharing of preventive measures helped individuals like the poster make informed decisions about risk prevention amidst the uncertainty and the unknown of the virus.

In some cases, the information the posters received conflicted, such as different countries or hospitals' official guidelines; however, the personal suggestions from peers regarding preventive measures were consistent. For instance,

> **Post 617:** "*I work in a kindergarten in Connecticut. it's still open. I have taken two weeks of unpaid leave. I am extremely worried about the risks of getting infected once I go back to work, especially considering that I have a 6-year-old son and 80-year-old mother-in-law living with us. Has anyone heard of any pediatric cases of COVID-19? Could you please provide information and advice regarding the cases and preventive measures for young children?*"
>
> **Comment1:** "*A study in Singapore indicates that although infected children are asymptomatic, they can still spread a large amount of virus. It is risky for senior people* "
>
> **Comment2:** "*The UK government thinks that infants and children are not high-risk groups. my husband and I also work in hospital settings, but I'm not sure whether we should follow the government's guidelines...*"
>
> **Comment3:** "*Japan has already reported a number of pediatric cases. Some got infected by teachers, some by family members...19 cases were children under 10 years, five of whom are asymptomatic...*"

In the comments to the poster's question, several people shared relevant, published studies with URLs and guidelines from multiple countries, including Singapore, China, Canada, and the UK. Some people also shared specific information regarding their local pediatric cases. Although the official guidelines of different countries conflicted, as demonstrated by the selected comments regarding Singapore and the UK, the majority of users suggested that the poster should wear masks and keep a distance from her child and mother-in-law after going back to work. In this case, the online community allowed cross-local sharing and the collective sensemaking of risk prevention.

5.3   Cross-Local Medical Consultations

During the COVID-19 outbreak, it was recommended to the general public that they avoid visiting healthcare facilities unless necessary, considering that the facilities were a *hot zone*. However, this situation was vague and challenging for many individuals, such as pregnant women and chronically ill patients, as they were uncertain whether their conditions were non-urgent or not, with some simply choosing not to visit a doctor offline to mitigate the risks of being infected. In the online community, we observed that people frequently conducted online medical consultations because of their restricted access (voluntary or not) to regular, offline health services. Such online medical consultations allowed people to seek a health professional's advice on a range of issues and receive a possible diagnosis or personal care advice. Unlike the typical one-on-one clinical consultations with local doctors, in the online community, the medical consultation happened cross-locally. Health professionals from all over the world provided free consultation services to the migrants during the COVID-19 pandemic.

To ensure that posters provide sufficient information for the consultation, the moderator created a *template* for the posters who needed to fill it in in order to consult the health professionals in the community. The template included age, gender, weight, height, location, travel history, pre-existing conditions, objective symptoms, subjective symptoms, actions (e.g., treatments, offline visits) that had been taken, and plan. The posts that followed the template were tagged "*symptom diagnosis*" so that the healthcare professionals could filter out those posts and reply. A health professional repeatedly posted a disclaimer to remind the posters who sought medical advice to treat the received advice with cautious: "*Health professionals should try their best to use clinical evidence, clinical knowledge, experiences to meet posters' needs, help them evaluate the risks and make better decisions. However, this community is not a licensed online medical consultation platform. We don't have the detailed medical records of the posters or follow official regulations. Any comment provided by us is only for your consideration. Posters or patients themselves are the decision-makers and responsible for their decisions.*"

COVID-19 has a wide range of symptoms, rendering the diagnosis difficult without a test.
Because in many areas, there was a shortage of testing kits or a strict clinical criteria for getting one, many posters chose to consult health professionals in the online community. For instance, one international student posted:

Post 741: "*...I live in Texas, and have not traveled abroad for the past month. I had dinner with friends last Thursday. My friend and I started developing sore throats the following day. I had a mild fever (37.6C) and chills on Saturday. I contacted the local government several times and they said I did not qualify for COVID-19 testing, so I could only receive a flu test at urgent care and the result was negative   On Monday I started having the symptoms of dizziness (I have a history of migraine-type dizziness),my tonsils were inflamed and coughing persisted, and I have been rinsing my mouth with salt water frequently, trying to relieve the symptoms.   Do I have COVID-19?*"

Not meeting the local testing criteria and not being able to receive a diagnosis offline, the poster chose to consult the health professionals in the CSG. The student received not only a health professional's feedback, but also personal experiences shared by other peers.

Others sought medical consultations because they found their offline treatments unsatisfactory. For instance, a migrant in Turkey posted:

Post 694: "*I really appreciate that we have this online community to help each other. I live in Turkey...(symptom description omitted).   the doctor only said that this may be gastrointestinal problems. My body temperature has been high for seven or eight days. Are these COVID-19 symptoms? I have taken the medication prescribed by the doctor, but my conditions haven't improved. *"

The post shows the individual's anxiety caused by the pandemic. Although their offline doctor had offered a diagnosis, the poster was still concerned about whether they actually had COVID-19.

These help-seeking posts were generally met with opinions and suggestions from self-identified medical professionals, in which the medical professionals carefully cited their own conditions when providing medical advice. Here is an example:

Post 532: "*I live in Canada. I started coughing last Saturday, dry cough. (symptom descriptions)... Do I need to get tested? Canada has a shortage of testing kits. Could any healthcare professional here offer me some advice?*"
Comment: "*I am a physician in the UK. Based on your descriptions, there's no need for testing! It is not just because of the shortage of testing kits, the treatment is the same for all mild symptom patients anyway: home isolation, over-the-*

counter medication for symptom relief, and more rest to recuperate. The severe
cases will be sent to the hospital for supportive invasive treatment (intubation,
respirator, inotropic agents, etc.). If you still have concerns, please feel free to
message me."

The poster in Canada and the physician in the UK had several more rounds of follow-up comments. The poster listed the medications they had at hand, including medication they had brought from Taiwan. The physician drew from their experiences in the UK to offer suggestions regarding what OTC (Over the Counter) medication the poster should take.

CSG members additionally sought medication recommendations and routine care suggestions for suspected and confirmed cases from health professionals in the online community. They chose to use the group's online medical consultation because they faced various offline barriers, such as a lack of access to testing, a lack of access to other offline medical services, and conflicts between their health beliefs regarding medication and the beliefs local providers held. For example, on March 19, 2020, a poster asked whether she could use influenza medicine to treat COVID-19:

Post 793: "*There is no COVID-19 testing available for me, and I do not have any*
access to offline medical services, based on the Australian government's policy Can
I use Tamiflu to treat the possible COVID-19 infection? I have read online that
hospitals in Taiwan used antibiotics and the doctor used Tamiflu plus AIDS drugs to
treat coronavirus in Thailand I *know this is probably a futile attempt. I know I'm*
*trying to save a dead horse as if it is alive   *"

Comment: "*Based on the latest research report, the AIDS drug is not effective;*
Tamiflu has not been confirmed. There is still no effective treatment for
coronavirus. "

The poster saw treatment information from countries with early outbreaks and wondered if she could use a similar medicine. A physician from Taiwan replied to the post and shared that there was no reliable treatment thus far. Since the start of the COVID-19 pandemic, health professionals around the world have tried a lot of different treatment plans. Correspondingly, there is much information online about unverified treatments without solid clinical evidence. This kind of information could easily mislead individuals and could cause severe health outcomes. By answering the poster's question, the health professional from Taiwan helped clarify the

poster's understanding of a possible treatment and potentially prevented the poster from taking a medication without official approval. However, it is also understandable why the poster wanted to try a medication without getting a prescription as the poster was unable to get tested while suffering from possible symptoms. Their words "*I know I'm trying to save a dead horse as if it is alive...*" indicate the frustration they were experiencing.

Some posters did not seek specific medication recommendations. Instead, they wanted to know

routine care measures that could help mitigate symptoms. For example, a poster sought care advice for her father-in-law who had tested positive for COVID-19:

Post 607: "*My father-in-law has been diagnosed with the coronavirus. He has had a dry cough for a while (about a week or two), a mild fever, and no other symptoms. My parents-in-law live in Idaho and there are not many local cases but parent-in-law still got infected. He hasn't been hospitalized and the doctor only asked him to self-quarantine.... My father-in-law is 80-year-old with hypertension... My mother-in-law is 78-year-old... I am very anxious and don't know what I can do. Could healthcare professionals here provide me with any relevant homecare advice?*"

Comment (from a doctor in Washington State, US): "*Watch out for fever >100.4 and shortness of breath, monitor BP, otherwise symptomatic management. Hydration, Vit C, Zinc, +/- Melatonin, turmeric*"

Comment: "*Call their primary doctor for any medications refills as well as upper resiratory infection medicine. My clinic has been doing that since last week*."

This poster asked for care advice from health professionals from different countries for her senior family members and received multiple health professionals' advice. With public health practices uneven across the world, CSG members sought to know more about other places' practices in order to figure out optimal solutions. When offline medical guidelines were missing, the health professionals and other peers in the online community helped fill in the gap.

Notably, in many cases, when the posters were specifically seeking advice regarding treatment and care from health professionals, peers who were not healthcare professionals also shared their personal experiences and tips. For instance, among the comments the above

post received, non- professional peers shared their personal tips for everyday life, such as having nutritious meals, washing the father-in-law's clothes separately, taking certain Taiwanese home remedies, and using the Nextdoor app's medication delivery service for older adults. A common phenomenon was that many of the migrants and those who still lived in Taiwan actively shared popular home remedies and recipes that they believed to be effective, such as hot Honey Lemon Tea.

5.4   Cross-Local Coordination

Local coordination is common in previously studied crises, such as earthquakes and hurricanes, where local authorities, volunteers, and residents in one area work together in on-the-ground crisis response [63]. What we found in the CSG is a form of cross-local coordination where people from different places could coordinate on-the-ground crisis response. Here is an example:

> **Post 380:** "*I am a Taiwanese cardiologist my training mainly focuses on critical patients. I am currently studying in London. Although I am not an infection specialist or an epidemiologist, I can provide you with correct COVID-19 information and psychological support. If you are in home quarantine, I can offer you advice on home care and other local support, e.g., grocery shopping, etc.*"

Many community members replied to show their appreciation. Some comments were about seeking medical advice online from the poster. The poster presented how the migrant community could offer emotional and in-person local help to each other during the pandemic. Unlike the formal (professional) and informal (citizen-based) response communities of other crisis events or natural disasters [59], this help was enabled by the online migrant community and coordinated through cross-local communication.

Another common type of cross-local coordination was the offer of local grocery or supply delivery. For instance, a Taiwanese restaurant owner in the Netherlands posted on March 23, 2020, offering food to front-line healthcare workers, in particular, those who had migrated from Taiwan. He wrote:

> **Post 561:** "*Are there any Taiwanese working in the front line in or near Amsterdam? I own a restaurant in Amsterdam. Although I am not a medical staff, I want to offer my help. If you are a frontline healthcare worker, you can contact me*"

and I will prepare your lunch box and send it to you. I have a few partners in Hague and Rotterdam as well; I can ask them to help too."

The online migrant community also supported cross-local coordination between multiple locales. Here is an example through a request for medical supplies:

Post 619: "*My cousin works at a New York hospital. Her hospital announced that they can only distributed one mask for each doctor per week, and there will be no additional support if they want to change the masks daily. So we would like to ask if a friend who lives in the United States is willing to donate surgical masks and N95 to New York hospitals? I hope not only to help my cousin but also to show more love and donate materials to the frontline doctors. N95 and surgical masks are currently needed. Please help!*"

Many people commented that they were willing to help, including some in Taiwan and some in other cities in the United States. In Taiwan, the face mask supply was sufficient due to the government's control of the distribution. All citizens were able to get a few masks per week. Many who did not need their face mask quota expressed a willingness to donate their masks to the people in need. It was a warm example of cross-local coordination, showing how the online migrant community could facilitate the coordination of a cross-local delivery of medical supplies. The finding can be referring to instrumental support that the cross-local communication pushed the tangible assistance during the pandemic [77, 78]. Although people were quarantined in their local areas, they could still exchange critical information about medical supplies, such as what was still available at which locale, and take advantage of the global shipping services that were still available.

6 DISCUSSION

In this paper, we reported on a qualitative study of how an overseas Taiwanese migrant community conducted *cross-local communication* during the COVID-19 pandemic. We identified four types of cross-local communication: situational updates, risk communication, medical consultations, and assistance coordination. Next, we discuss in detail the role of cross-local communication during the COVID-19 pandemic and migrants' struggles with local public health systems. We articulate the practical implications for crisis informatics and public health research and practices.

6.1   Cross-Local Communication in Pandemic Response

Public health crises, such as the COVID-19 pandemic, are distinct from regional crises like hurricanes and floods, which have been well -studied in crisis informatics [41, 47, 62, 75, 80]. In regional crises, local and hyper-local information (e.g., injury reports, hazard locations, and local media reports) about one place is important [35, 41, 80], but during the COVID-19 pandemic in our study, local and hyper-local information about two or more places was utilized in crisis communication. CSG members already had access to their local information, but still sought information about other places, in order to navigate their local public health crisis situation. The group formation provided us a unique perspective to unpack crisis communication patterns by mediating the members tied by country of origin instead of residence.

Cross-local communication involves a complex cross-comparison of information from more than one locale. For example, a risk assessment of travel is done by cross-comparing the local conditions of different locales. However, the risk assessment is not like that of other epidemic crises (e.g., Zika) during which people would consult on just one hyper-local situation for travel or virus exposure [27]. The travel risk assessment in COVID-19 is much more complex. For instance, one poster mentioned assessing the risk between staying house or flying back to their home country on behalf of their parents. The information needed is not only local or hyper-local [28, 42]; the poster also needed help comparing the medical resources, economic burdens, preventive measures, and the long haul flight risks, etc.

Cross-local communication enabled by social media adds a new element to what we understand as crisis communication. In regional crises, emergency response is led by local authorities, and affected locals do not have other locales to use to cross-compare and check on the effectiveness and validity of their local authorities (e.g., [41, 47, 62, 75, 80]). In this pandemic, however, cross- local communication allowed people to compare different locales' authorities. By cross-comparing situations and measures from different locales, the community's members gained access to more information and could develop a more comprehensive view of the severity of the crisis and viable countermeasures, and become better equipped to assess and critique their local authorities.

Cross-local communication occurs as individual citizens find the need to assimilate experiences and lessons from other places. It exhibits citizens' rapid adaptation to a crisis

situation. When Taiwan enforced the use of face masks very early on, their experiences and strategies were not well received in countries such as the U.S. at the very beginning. In fact, most states in the U.S. only started to mandate face coverings in July 2020 [24]. Acknowledging the distinctive local conditions that might shape public health responses and policies, our evidence suggested that cross-local communication in our study could be considered as helpful to individual members.

Cross-local communication in the CSG reflects the uneven distribution of public health practices and resources across the world. This unevenness exists at multiple levels. We have numerous instances where different countries have had different public health policies and measures. The conversation following Post 692 indicated an unevenness even within the state of California. As a result, CSG members had needs that were unmet by their local context, and turned to the online community for help meeting them. In this regard, the CSG functioned as an emergent form of an OHC, connecting people with similar concerns or conditions and facilitating social support [26, 33, 77]. However, it is important to note that CSG members differed from typical OHC members, such as chronic health patients: only a small portion of the posts reported infected cases. Most posts were used to consult the online peers on pandemic-related information. CSG also had the benefit of having medical professionals as administrators, which was found to be useful when dealing with misinformation and low health literacy in online health communities [38]. In addition, the medical consultation template was a useful method to elicit a member's condition and concerns and help the medical professionals give advice. The practices of cross-local communication showed how collective efforts can help prevent the virus from spreading, reduce individual uncertainty and doubts, provide emotional support, and clarify misinformation [18, 34].

Cross-local communication entails social support. Cutrona and Suhr detailed five types of social support: informational (knowledge, resources, etc.), instrumental (practical or material aid), esteem (compliment, validation, etc.), network (presence, companions, etc.), and emotional (relationship, physical affection, etc.) [13]. Through the exchange of local and hyper-local information about two or more places through cross-local communication, multiple types of support were provided. First, cross-local communication is inherently informational support because, by definition, it relies upon supplying information about local conditions, either explicitly in situational updates and risk communication or implicitly in medical consultations

and coordination. Second, cross-local communication allowed for emotional support when CSG members empathized with each other's frustrations, most evident in the tensions around mask-wearing in the early days of the pandemic. Third, cross-local coordination entails instrumental support, a less studied form of social support in the OHC literature [78]. Smith et al. noted that instrumental support is of important value to people facing life-threatening health conditions and identified key types of instrumental support, such as chores, food, transport, exercise, financial assistance, and personal care [78]. In our study, we found the major types of instrumental support to be grocery shopping and medical supplies, corresponding to the unique characteristics of COVID-19, such as quarantine and a lack of medical resources.

Cross-local communication could bring unique misinformation risks in pandemic response.

Plenty of research has demonstrated how online communities can become a hotbed of misinformation and conspiracy theory [3, 96]. Our study did not find evidence of the propagation of misinformation, perhaps resulting from the medical professionals who worked diligently as moderators and administrators, and the ethnic-based membership. However, proper oversight is critical for cross-local communication to be instrumental in pandemic response.

Design Implications: Social media can be used as crisis platform or online support groups [23, 52] of collective actions from multiple locales. For instance, the cross-local situational updates in the online social media group could contain situational information and preventive measures from different regions or countries and even across languages. The design would help local communities access cross-local information from overseas early outbreak countries. The collective data collocation and contribution on social media could be used to help local people to prepare for the pandemic's spread and help local authorities be better prepared [14]. The informational practices of seeking and curating cross-local information could further enhance people's situational awareness of the global pandemic, while also reflecting the rapidly changing situation for the local authorities, i.e., the integration of citizen-generated content which the authorities can use to react to the pandemic [67].

Health information-seeking behaviors are varied in different channels, e.g., supportive information on social media and reliable data sources on search engines [15]. We argue it is crucial to provide online services that fuse multiple information sources, especially those that mix social media, with official sources and reliable professionals. One appealing use case is

the risk assessment of traveling from one country to another [66] involves a series of complex information comparisons, including the screening process, a quarantine period, and preventive measures during the trip. For example, if a user wants to travel from the US to Taiwan, they may want to identify the official screening process and prevention measures in both countries, the accessing medical resources, and then seek informational support on social media for their doubts and any personal matters, such as flying with an infant. Traveling is now a challenging task due to the uncertainly, rapidly changing updates, and culture/language barriers. It would be helpful to have such a service to help people make an informed decision during the pandemic.

Social media could be a new form of an online health or support community during a pandemic. Due to the pandemic characteristics and limitation of medical treatment access, many users sought medical consultations online. However, this brings to the fore, the challenges of health literacy and the spreading of misinformation. These issues can be addressed by engaging a healthcare professional in the conversations. Social media can be part of the local or cross-local sociotechnical system that coordinates with the experts or authorities in the organization as a whole [60]. The system could help people in the same or diffident locals have better crisis communication and find a better way to educate people about the pandemic's recent developments [47]. The *social norm*, such as symptom template, could be effective to improve the communication efficiency and accuracy of situational updates and social supports [74]. Our study results also indicated the online social media groups in the crisis event are no longer geographically confined. The group could be formed by the user with similar origins, such as suffering in the same pandemic or other shared difficulties. These findings shed light on the social media strategies of mediating the geography dispersion users in crisis events, e.g., how to coordinate the users from different regions with the different cultural norm, language, and infrastructure.

6.2   Challenges to Migrants During the COVID-19 Pandemic

Our study of the CSG revealed two unique challenges that the Taiwanese migrants faced during the COVID-19 pandemic. First, overseas Taiwanese struggled with local practices and norms that contradicted their personal beliefs. Migrants' health beliefs are shaped by their cultural values and practices [10, 82, 83]. Taiwanese were accustomed to wearing a mask. Many Taiwanese migrants experienced SARS in 2003, so they had a higher awareness of preventive

measures and a willingness to cooperate with them to prevent the virus from spreading. However, during the early days of the pandemic, many public health authorities in Western countries (e.g., the CDC in the U.S.) recommended against wearing a mask in public. Wearing a mask was linked to illness and even negative Asian stereotypes (e.g., the symbol of a face mask in America versus Asia). Cultural differences like this induced anxiety among the Taiwanese migrant communities.

Second, overseas Taiwanese were resourceless in navigating their local contexts. The conversation started by Post 607, for example, suggested that the poster had no knowledge of helpful home care methods for their infected family members, when their local doctor was not helpful. Migrants are vulnerable in navigating healthcare systems in unfamiliar contexts [83]. Such a situation could only be exacerbated when local public health authorities themselves are also at a loss while navigating a rapidly developing pandemic.

The online community under study seems to have mitigated these challenges to certain extent. We discussed how it provided various forms of support to its members, like those offered by OHCs. In addition, the online migrant community became a nexus of cultural affinity for overseas Taiwanese. As people migrate to a new locale, they do not merely, or easily, pick up the new social and cultural practices. Rather, they maintain the existing social and cultural connections to their homeland [1]. The online migrant community mediated such connections, resonating with Brubaker's point about how a homeland-oriented venue could be "*an authoritative source of value, identity, and loyalty*" [7]. In this study, the CSG allowed migrants to share their local tensions and sustain their existing social and cultural beliefs. Taiwanese migrants also derived pride from the Taiwan government's effective public health measures, and shared with each other culturally-situated home remedies and Taiwan's guidelines. These point to the potential of ICTs to help migrants cope with public health challenges as well as compliment the concept of motivating the online health community user to share knowledge though the same cultural beliefs [93].

Design Implication: There is a need to design sociotechnical systems to support migrants' challenges during a pandemic. The topic is currently underexplored in the research of Crisis Informatics. We recommend considering social norms and cultural values in the design of preventive measures and policy, e.g., integrate cultural capital to disease preventive measures [16]. A large-scale, worldwide pandemic outbreak requires local, hyper-local, and

cross-local input to respond to the challenges of local and migrant communities. Migrant communities can be seen as a new way of producing and reproducing cultural capital that provides new ideas and input to local crisis control and prevention.

Social support mediated by social media need to be multidimensional. For example, the information needs of the migrant who is an international student are different from the ones of an individual in an intercultural marriage, which are different from the ones of foreign workers, undocumented workers, and permanent immigrants, etc. All of these migrant sub-groups may need different support, e.g., the international students may face financial burdens and difficulties understanding health services information [27]; the intercultural marriage family may require different health advice based on their cultural background; undocumented workers may lack a primary medical provider and rely more on urgent care [58]. The variance sheds light on the design space of providing a better social support platform to the marginalized groups during the pandemic.

Our findings could also be used to complement the role of public official response management during the pandemic, either local or cross-local communities. The people would compare the situation and policy across diffing locals (such as the masking policy), which could cause confusion and frustration if the people received inconsistent or even conflicting information. We argue the authority must clarify or explain these cross-local comparisons, e.g., to point out the legal issue or the cultural norms difference, etc. Our data analysis supports the strong needs of the risk assessment, prevention measures, and coordination across different locals, e.g., to travel across states or countries, protect family members or themself at the workplace/home, and get the on- the-ground supply for crisis response. Our study shed light on how to improve the current public
official response management systems.

6.3　　　The Temporality of Studying a Rapidly Evolving Pandemic Situation

Studying the ongoing COVID-19 pandemic also differs significantly from crisis informatics research in terms of temporality. For regional crises, crisis informatics researchers usually carry out post- hoc studies when the crises have ceased [35, 80]. However, the pandemic has an extended time frame due to its extreme scientific uncertainty leading to tremendous

difficulties in aspects such as understanding pathology and transmission patterns, and creating treatments. As a result, empirical research conducted at certain point may not reflect what happens after. This does not invalidate our research, as our empirical findings still truthfully reflect the experiences during a specific period of time. However, it does invite us to reflect upon our study context and findings.

Local public health authorities' attitudes, practices, and policies could have changed significantly. Our data reflect the time period between March 16, 2020, and April 22, 2020, during which local authorities across the world were relatively slow at acknowledging the crisis situation and adopting necessary preventive measures. People in the CSG stressed the severity of COVID-19 and were frustrated by their local contexts. In October 2020, most places' local authorities had developed much understanding of COVID-19, as well as countermeasures. personal protective equipment such as face masks were no longer in shortage. We conjecture that this would alleviate people's anxiety and frustration, and moderate their needs to coordinate instrumental support, such as shipping face masks to another place. However, the need for cross-local coordination of grocery shopping for vulnerable populations could remain.

Importantly, cross-local communication is likely to remain even when local authorities have established regular procedures for monitoring and containing cases across the world. Previous research has shown that due to many causes such as lack of social media expertise and recognition of interacting with the public, public health authorities do not always produce accurate, relevant, or interesting information [29, 85]. Even if public health authorities have developed their responses and policies, much uncertainty still remains at multiple organizational and scientific levels [28]. As a result, alternative information sources such as cross-local communication afforded by the CSG are still irreplaceable.

Lastly, cultural coping strategies could differ in different organizations. Our study selected a Taiwanese migrant group as our study site, but the findings may not apply to all migrant groups or other local community groups. For example, the cross-local medical consultations may not be obvious if the migrant groups have less confident in their home countries' healthcare system. The cross-local coordination may be less likely to happen if the migrant population size is very small in the local. All these cultural factors should be considered when adopting or interpreting the findings in this paper.

7   CONCLUSION

In this paper, we presented a qualitative analysis of cross-local communication during the COVID-19 pandemic. Cross-local communication is the exchange of crisis information between geographically dispersed locales to facilitate local crisis response. Against the backdrop of a global pandemic and uneven local situations and responses, cross-local communication helps geographically dispersed people support each other. The online migrant community has provided fertile ground for cross- local communication to happen. Cross-local communication is conspicuous in a pandemic because more or less the same situation happens to locales worldwide and crisis response could benefit from triangulating, cross-comparing, and unifying information from different locales. Moving forward, crisis informatics research could pay more attention to this mode of crisis communication as well as the design of information infrastructure supporting it.

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