

## **Using Mobile Phones to Enhance HIV Prevention Knowledge among Village Doctors in Developing Regions: A Study in Guangxi, China**

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**Abstract:** This study examines the effects of using mobile phones to promote the HIV prevention knowledge among the village doctors in Beihai, Guangxi, China. Data was derived from the baseline survey of an mHealth-based HIV prevention and care training project among village doctors. Of the 228 participants who completed the questionnaires, 80.3% were male, 32% received a college or higher education, and 74.4% had a monthly income below 3,000 RMB (~434 USD). Their average HIV prevention knowledge score was  $5.56 \pm 1.84$ . The participants' HIV prevention knowledge was found to be positively associated with the frequency of accessing the Internet using mobile phones, online information searching, and accessing social media using mobile phones. The results indicated that future library services should consider mobile phones as an effective tool for disseminating HIV prevention knowledge via online approaches.

**Keywords:** HIV Prevention Knowledge, Village Doctor, Mobile Phone, mHealth, library services

### **1. Introduction**

HIV has become a global health issue in the past few decades. According to UNAIDS, there were 36.9 million people living with HIV (PLHIV) in 2017 worldwide (UNAIDS, 2018). The disease does not only endanger individual's health and psychological well-being, but also creates social stigma and discrimination (Adams, Zacharia, Masters, Coffey, & Catalan, 2016; Zhang et al., 2016). Therefore, a large number of HIV prevention strategies have been developed and implemented to promote HIV testing, increase treatment adherence, and encourage HIV disclosure (Johnson et al., 2017; Mbuagbaw et al., 2015; Qiao, Li, & Stanton, 2013). Among all these efforts, knowledge has played a critical role in empowering the HIV patients, helping the patients locate and use treatment, understanding medical mechanisms, and reducing the high-

risk behaviors in resources constraint settings (Asante, 2013; Boateng, Kwabong, & Agyei-Baffour, 2013; Nagaraj et al., 2013; Paintsil et al., 2015).

In 2017, it was estimated that 747,000 people are living with HIV (PLHIV) in China (Xinhua, 2017). Guangxi Autonomous Region locates in the southwest of China. It is one of the top HIV epidemic regions in China with a significant number of HIV patients living in rural areas, where the infrastructure is poor and the health care system is underdeveloped (Li et al., 2017). Within this context, village doctors are considered the front line for HIV care and prevention for rural residents. The village doctors, also known as community health workers, usually are farmers who received minimal basic medical and paramedical training in a short period of time to perform one or more essential functions associated with health care without professional certification (Hu et al., 2017). They are responsible for disease prevention and treatment, basic care, and maternal and childcare in rural areas (Zhaoyang, 2008). Their existence as an entry point to the healthcare system for rural residents has greatly compensated the resources-constrained healthcare systems in under developing areas. Serving as the primary healthcare providers, village doctors play an important role in HIV prevention and treatment by providing HIV testing to the local residents and referring newly diagnosed patients to healthcare facilities specialized in HIV care. Therefore, the quality of the primary HIV care and prevention heavily relies on the village doctors' knowledge of HIV prevention. However, a research conducted among healthcare workers of all levels of healthcare facilities showed that their HIV-related knowledge was inadequate (Wu et al., 2016).

Historically, libraries have been supporting their community by providing high quality, trustworthy information services. These services are especially needed in places with a less developed economy, poor infrastructure, and a lack of professionally trained information providers. Libraries have set a goal in helping users with health-related information needs, including providing access to HIV-related information (Case, Howard, & Grant, 2017; Harris, 2013; Nassimbeni & Shabangu, 2015). At the same time, libraries, as innovative information service bodies, consistently seek to evolve their traditional roles and information delivery methods to increase the information accessibility to their users (Duhon & Jameson, 2013).

Studies showed that information communication technology were used by both healthcare professional and informal care givers to gather the latest research and clinical findings to update their knowledge (Bennett, Casebeer, Kristofco, & Strasser, 2004; Fox & Brenner, 2012). The expanded use of mobile phones among the Chinese population has enable the village doctors to access HIV prevention knowledge remotely. Mobile phones, especially, which integrate the internet and network application features, provide a novel approach to online resources for this group. However, little research has been documented on the use of mobile phone in support of HIV prevention knowledge seeking among

village doctors. Therefore, the purpose of this study is to fill the research gap by exploring the potential of implementing a library-supported mobile-phone-based information service for the village doctors. This current study investigates the mobile phone using behavior of the village doctors and how the utilization of mobile phones impacts their HIV prevention knowledge.

## **2. Methods**

Data in the current study were derived from a cross-sectional baseline survey for an mHealth HIV prevention and care training project among village doctors in Guangxi Autonomous Region (Guangxi), China. We attempted to recruit village doctors who meet the following criteria: 1) are at least 18 years old; 2) are currently working as a village doctor; 3) plan to work in the local area in the next 12 months; and 4) did not involve in other mobile device-based training programs for HIV prevention. With the support from the Beihai Centers for Disease Control (CDC), we recruited 230 village doctors, among which, 228 completed the survey. We collected data on demographic characteristics, medical experience, mobile phone ownership, using behavior of mobile phones, as well as the HIV prevention knowledge level of the participants. The medical experience included having direct contact with high-risk groups of HIV (e.g., female sex workers, men who have sex with men, drug users, and spouse or sex partners of HIV patients, etc.) and receiving HIV prevention training in the past 12 months. The use behavior of mobile phones included the frequency of using mobile phones to access the Internet (never, a few times in a week, and everyday) and the major online activities conducted via mobile phone, such as searching online formation and accessing social media. The HIV prevention knowledge level was evaluated by 20 questions regarding the mechanism, transmission, and diagnosis of HIV. Cronbach alpha for the HIV prevention knowledge scale is 0.70.

The data was analyzed using SPSS, Version 25. Descriptive statistics were used to demonstrate the demographic features of the participants. Independent T-test and one-way ANOVA were conducted to investigate the mobile phone ownership and the association between mobile phone use behavior and HIV prevention knowledge level. To identify the impact of the ownership and use of mobile phones on HIV prevention knowledge level, variables that were found significantly associated with HIV prevention knowledge ( $p < 0.05$ ) were selected and entered into the multiple regression model using a stepwise analysis method. The research protocol was approved by the Institutional Review Boards at Wayne State University in the United States and the Beihai CDC in China.

## **3. Results**

Table 1 presents the characteristics of the participants and their use of mobile phone. More than 80% of the participants were male, 46.3% were under 45 years old, 32% received a college level or higher education, and 74.4% earned a monthly income below 3,000 yuan ( $\approx$  440 dollar). About two thirds of the

participants had direct contact with the patients who were at higher risk of HIV and 90.3% received HIV prevention training in the past 12 months. Of all the participants, 79.6% reported owning a mobile phone, 46.2% reported using mobile phones at least once a day to access the Internet, 61.8% conducted online searching via mobile phones, and 57.9% accessed social media via mobile phones.

**Table 1. Factors associated with HIV prevention knowledge**

N (%)	Overall (100)	228 HIV prevention Knowledge	P value
<b>Gender</b>			
Male	183 (80.3)	17.65 ± 1.86	0.817
Female	45 (19.7)	17.58 ± 1.96	
<b>Age (year)</b>			
< 45	105 (46.3)	17.92 ± 1.66	0.034*
≥ 45	122 (53.7)	17.39 ± 2.02	
<b>Education</b>			
Middle school	51 (23)	17.45 ± 2.00	0.306
High school/polytechnic school	100 (45)	17.56 ± 1.91	
College and above	71 (32)	17.93 ± 1.73	
<b>Monthly household income (yuan)</b>			
<3000	166 (74.4)	17.55 ± 1.84	0.180
≥3000	57 (25.6)	17.93 ± 1.86	
<b>Have direct contacts with high-risk group of HIV</b>			
Yes	148 (66.7)	17.99 ± 1.60	0.000***
No	74 (33.3)	17.00 ± 2.17	
<b>Received HIV prevention training in the past 12 months</b>			
Yes	205 (90.3)	17.68 ± 1.87	0.235
No	22 (9.7)	17.18 ± 1.89	
<b>Owning a mobile phone</b>			
Yes	179 (79.6)	17.85 ± 1.66	0.001***
No	46 (20.4)	16.85 ± 2.41	
<b>Frequency of accessing the Internet via a mobile phone</b>			
Never	59 (28.1)	17.25 ± 2.16	0.020*
A few times in a week	54 (25.7)	17.72 ± 1.63	
Everyday	97 (46.2)	18.08 ± 1.59	
<b>Searching information via a mobile phone</b>			
Yes	141 (61.8)	17.91 ± 1.62	0.004**
No	87 (38.2)	17.18 ± 2.15	
<b>Access social media via a mobile phone</b>			
Yes	132 (57.9)	17.97 ± 1.59	0.001***
No	96 (42.1)	17.18 ± 2.13	

\*p &lt; 0.05, \*\*p &lt; 0.01, \*\*\*p &lt; 0.001.

The association between demographic variables, medical experience and mobile phone use of the participants and their HIV prevention knowledge were also demonstrated in Table 1. Participants who were under 45 years reported higher HIV prevention knowledge than their elder counterparts ( $p = 0.034$ ). The group which had direct contact with high-risk group of HIV were more likely to have better HIV prevention knowledge ( $p < 0.001$ ). The results also showed that the participants who owned mobile phones and used mobile phones to access the Internet had a higher probability to score higher in HIV prevention knowledge than those who did not. Those who searched information and accessed social media via mobile phones reported better knowledge than their counterparts. A positive association was also found between the knowledge level and the frequency of accessing the internet via mobile phones. However, there was no significant difference found between the group that received HIV prevention training in the past 12 months and those who did not regarding the knowledge level.

The results of stepwise multiple regression analysis was demonstrated in Table 2. The HIV prevention knowledge was significantly associated with having direct contact with high-risk groups of HIV ( $p < 0.001$ ) and using mobile phones to search information online ( $p = 0.031$ ). The independent variables explained 9.2% of the overall variation of the HIV prevention knowledge score.

Table 2. Multiple regressions on factors associated with HIV prevention knowledge

	B	P value
Constant	17.73	0.000***
Have direct contacts with high-risk group of HIV (Yes)	0.965	0.000***
Have direct contacts with high-risk group of HIV (No)	Reference	Reference
Searching information via a mobile phone (Yes)	0.554	0.031*
Searching information via a mobile phone (No)	Reference	Reference
$R^2 = 0.092$		

\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

#### 4. Discussion

This study was the first study to examine the relationship between HIV prevention knowledge and mobile phone use among village doctors in China. Strong associations between the participants' HIV prevention knowledge and their mobile phone use behavior were revealed in this study. The participants' level of HIV prevention knowledge was also associated with age and previous direct contact with the high-risk group of HIV.

The results indicated that mobile phones were an effective tool of attaining HIV prevention knowledge from the Internet while multiple information resources

were available. The positive impact of online searching via mobile phones on increasing HIV prevention knowledge was consistent with previous studies demonstrating that Internet-based information was effective in improving HIV prevention knowledge among various audiences (Kasatpibal et al., 2014; Young & Rice, 2011). The fact that 61.8% of the participants had searched information online also demonstrated that the village doctors were able to conduct active information seeking behavior to fulfill their information needs. Therefore, in addition to face-to-face training, the HIV prevention campaign and municipal health services should consider providing the village doctors with mobile access to online resources, such as lectures, seminars, as well as medical databases through mobile phones to help them improve and update their HIV prevention knowledge. It will also extend the coverage of training to the village doctors living in remote areas with poor infrastructure. Also, mobile phone applications focusing on disseminating and exchanging HIV-related information should be created and launched to support disease specific communication and knowledge sharing.

We also found that although mobile phones were adopted by most of the participants, the internet function was not fully utilized for information seeking or communication purposes. Two reasons could possibly contribute to the absence of such online activities. First, some of the village doctors had been working in less developed regions and were rarely exposed to mobile phones before, so that they needed time and instructions to use these functions. Second, considering most of the participants earning a salary below 3,000 RMB, they may have a concern for the cost of accessing the Internet. Therefore, future HIV prevention campaigns and healthcare services should integrate information technology training into their regular training programs to help the village doctors get familiar with the eHealth tools. Stipend or pre-paid mobile phone sim cards could also be provided to the village doctors to encourage professional communication.

## **5. Limitations**

There are several limitations that should be acknowledged when interpreting the findings from this study. First, the participants were village doctors from Guangxi autonomous region, the extent to which these findings can be applied to formally disciplined medical professionals in other regions or countries is unknown. Second, self-reported data were used to assess mobile phone use, negative responses may have been under-reported. Third, the mobile phone use and knowledge assimilation were subject to individual eHealth literacy, but the data on eHealth literacy was absent in this study.

## **6. Conclusion**

This study provides empirical evidence revealing the association between HIV prevention knowledge and use of mobile phones among village doctors in China. This study has important implications for promoting HIV prevention knowledge among healthcare professionals with informal medical training and

working in a resource-constrained environment. Findings from this study can be used to inform future HIV prevention efforts to take advantage of mobile phone technology and mobile applications to enhance the knowledge accumulation and sharing among the village doctors. Moreover, the findings also suggest that libraries should be prepared to fulfill potential needs for delivering training programs to the village doctors in order to increase their awareness of online resources, strengthen their searching capability, and encourage online communication.

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