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Internet access, usage and trust among medical professionals in China: A web-based survey

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ABSTRACT

Objectives: Social media has changed methods of communication in the medical profession. As part of a "doctor as communicator" strategy, Chinese medical professionals are actively embracing social media, which may have an impact on tense physician-patient relationships in China. This paper aims to examine a pattern of Internet access, Internet usage, and trust among Chinese medical professionals and further explores the reasons for these relationships on an individual level.

Designs: A web-based questionnaire was designed, based on a media literacy model, and was divided into 3 dimensions: public information, general medical information, and specialty information. After a two-round pilot study, 1001 physicians were included. Additionally, 4 interviewees were chosen to participate in in-depth interviews and content analysis was performed. Data were analyzed using SPSS 25.0.

Results: Findings showed that new media has become a major approach for medical professionals in China to retrieve and get access to various information. However, they still trust traditional media ($n = 1001$, $P < 0.01$) and professional journals more ($n = 1001$, $P < 0.01$). Internet access, usage, and trust were positively correlated ($r = 0.185–0.344$, $P < 0.01$). Regarding usage habits, 47.66% of the participating physicians would practice science popularization through their new media accounts and 71.23% would forward approved health information within their professional realm. A validated instrument can be provided for further related studies.

Conclusions: Science popularization is a specific usage of new media among Chinese medical professionals, through which they have achieved new authority and empowered communication because of self-media. To some extent, physician-patient relationships in China can be improved because this online interaction is conducive to building harmonious and lasting offline physician-patient relationships.

What is known?

- Medical professionals appear to be using the Internet as a library for the purposes of study and improving clinical decision making.
- There is an increasing overlap between Internet and traditional media usage among experienced Internet users, and they perceive the Internet as superior to traditional media.
- Social media use may have both favorable and unfavorable effects on physician-patient relationships.

What is new?

- A diffusion trend, from internal self-improvement to external science popularization, was observed in the pattern of physicians' media usage.
- Medical professionals' access to and trust in Internet-based information tends to be negatively correlated.
- The more they have confidence in new media, the more medical professionals in China are likely to use it to disseminate approved health information.

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- New media can re-empower and re-authorize medical professionals, strengthening their influence with the public. In China, online physician-patient interaction, outside of a clinical setting, is conducive to building better offline relationships with greater longevity and stability.

1. Introduction

A public issue of great concern in recent years, the physician-patient relationship plays a fundamental role in creating a positive healthcare atmosphere. In 2019 there were 18,112 medical conflictions in China [1], even several malicious assaults on doctors happened due to “unsatisfactory treatment” which triggered a long-lasting social discussion. 96% of the physicians involved in these conflictions indicated that they had experience with “medical disputes” in hospital [2]. Social media networks have presented challenges to the healthcare environment, but also offer a glimmer of hope for improving physician-patient relationships [345].

Studies have confirmed the longstanding idea that cultivating media literacy among physicians in China has the potential to bring physicians and patients closer. This can significantly reduce stress in healthcare providers and notably ameliorate tension in physician-patient relationships [678.]. Age-related differences do exist, however [9]. Currently, doctors are embracing social media as part of a “doctor as communicator” [10] strategy. This has opened a space for communication beyond the walls of clinics, so that doctors can leverage the Internet to discuss health topics online or to disseminate health information. The latest data has shown that, in 2018, 97% of doctors used Wechat and 92% followed various public accounts on Wechat. 43.2% of this group had enrolled in microblogs, and 23% had checked in to Toutiao (a specialty information publishing platform for media, national institutions, and enterprises) [11]. This may be a turning point in the tense Chinese physician-patient relationship.

Currently, a body of works focus on social media usage patterns among medical professionals. These cover a wide scope of content. Some work is devoted to uncovering influential factors in medical professionals’ Internet usage habits [121314.]. Another area deals with how the Internet or social media can play a role under special medical circumstances, as a supplement to clinical practice, integrating online and offline care [151617]. The impact of online interaction with patients on physician-patient relationships has also been actively discussed in the literature [18]. Many scholars have also paid heed to the cultivation and application of media literacy in the medical field, owing to the reality that practicing medicine is substantially based on communication. They widely recognized media literacy to be a promising paradigm for the development of educational programs. However, nearly all recent works on this topic have placed their focus on medical students [1920]. Insufficient attention has been paid to the situation of medical professionals, let alone Chinese healthcare workers.

Several gaps in the existing research can be observed. For instance, medically-related Internet usage and trust has been a topic of scholarly interest, but only as an extension of the medical setting, such as physician-patient connections and online management of medical working groups. However, the current literature has not placed any emphasis on the status of general Internet information access and trust among Chinese medical professionals in daily life. Thus far, little is known about media literacy in doctors or how they take advantage of the opportunities furnished by social media to ameliorate tension in the complex Chinese healthcare atmosphere.

2. Methods

This study used questionnaires as the main instruments for quantitative research, supplemented with in-depth interviews to enrich the contents of the survey.

2.1. Study design

2.1.1. Research questions

In order to ascertain a more coherent and systematic pattern of Internet use, access, and trust among Chinese medical professionals, concrete and detailed research questions were chosen for in-depth exploration.

RQ1: How do health professionals get access to public information, general medical information, or specialty information through the Internet?

RQ2: How much trust do health professionals feel when they encounter various types of information on the Internet?

RQ3: What are the correlations between Internet access, usage, and trust in Chinese medical professionals?

RQ4: How do Chinese medical professionals perceive the potential impact of online social media usage on physician-patient relationships in the offline social reality?

2.1.2. Instrument

Findings from our literature review demonstrated no single agreed-upon design, format, or methodology for conducting surveys of Internet usage. Because of this research, we elected to create a questionnaire. As data on the status of media literacy can benefit this work by theoretically analyzing doctors’ Internet-related behavior, a decision was made to design the questionnaire based on a specific media literacy model. The first version contained 7 dimensions based on essential elements of media literacy as put forward by Art Silverblatt in 1995 and confirmed by Stanley J. Baran in 2002 [21], including: awareness of the impact of media on individuals and society, understanding the process of mass communication, developing analysis and research of media information strategies, treating media contents as a “text” to gain insight into the culture of the era and ourselves, cultivating the capability to appreciate and understand media content, understanding the ethical and moral obligations of media producers, and developing correct and effective information production skills [22].

The first-round pilot study was conducted at the end of September 2018, with 45 doctors participating. However, many participants responded that the items were not coherent or were weakly logical and that some descriptive questions were somewhat equivocal. Subsequently, the first version of the questionnaire was not deemed suitable. In the context of our research goals, the questionnaire was revised based on the “Global media and information literacy assessment framework” (MIL), released by UNESCO in 2013 [23]. This was developed from the definition of media literacy, which is widely recognized as “the ability to access, analyze, and evaluate media content” [24].The framework comprises 3 factors: information acquisition, evaluation of media content, and effective content production, due to which, we decided to investigate doctors’ Internet behavior from Internet content access, trust(part of the evaluation of media content) and Internet usage (corresponded with effective content production).

Furthermore, for the sake of thoroughly investigating doctors’ Internet behavior related to distinguishing types of information, the following 3 dimensions were developed: public information, general medical information, and specialty information. To make the questionnaire as concise and as detailed as possible, a five-point Likert scale was used to measure the degree of agreement with each item, ranging from 1 (strongly disagree) to 5 (strongly agree).

As a result of a panel discussion composed of medical experts, social media experts, and medical industry professionals, and in the context of the ideal outcomes of the second round of the pilot study, we decided to apply this revised version of the questionnaire on a larger scale.

Public information, for our research purposes, is defined as information relevant to daily life, such as political information, economic information, social messages, and even gossip. Responses to these items were averaged to create composite indices of doctors' unique internet access, usage, and trust patterns as related to public information. (7 items, Cronbach's α coefficient of public information access = 0.643, trust = 0.657, usage = 0.644).

We have defined general medical information as items such as policy modifications, regulatory initiatives, emergencies, and scientific progress in the general field of health. Responses to these items were averaged to create composite indices with unique internet access, usage, and trust patterns regarding general medical information. (14 items, Cronbach's α coefficient of general medical information access = 0.725, trust = 0.662, usage = 0.608).

Specialty information has been defined as any relevant progress or clinical trial information within a doctors' specialty field. Responses to these items were averaged to create composite indices with internet access, usage, and trust patterns, or so-called self-studying or self-actualizing behaviors in the doctor's professional realm (15 items, Cronbach's α coefficient of specialty information access = 0.793, trust = 0.811, usage = 0.768).

Besides these factors, the questionnaire acquired demographic particulars about the participants. These include sex, age in years, professional background, and hospital grades (Appendix A).

2.2. Setting and data collection

The questionnaire form was prepared by applying the web-based WJX® platform. The study was recommended to medical professional users on both the website's home page and the Dingxiangyuan (DXY) [25] application from October 16, 2018 to October 20, 2018. A brief introduction to the study was provided, and if the respondent was interested, they could access more detailed study information and be directed to the questionnaire by clicking a hyperlink at the bottom of the reading materials. Every participant was rewarded with 5 online credits, which could be applied to their own account and exchanged for online courses or gifts.

Once a participant entered the questionnaire, their actions were automatically and anonymously recorded, but a successful submission of answers could only be received if all items had been completed so that missing data would not be a possibility. In addition, for the sake of better quality control, IP addresses were reviewed to exclude duplicates.

After the quantitative data results were produced, a semi-structured in-depth interview was conducted on the 25th of January 2019, with 4 medical professionals (P1–4) who had had outstanding achievements in social media, to provide a supplementary corpus for further analysis. The interviewees were working in various departments of clinics and had become thought leaders on new media, having a large number of fans on the Internet. More detailed information is provided in Appendix B.

After transcribing the interview content above, a researcher double-checked it in pairs to ensure that critical information was not missed. After this, theme words and concepts were extracted. To verify correct comprehension of interview, the results of this analysis were provided to the interviewee and double checked.

The results of this research were released to participants through online articles on the DXY platform for feedback and a seminar was held in Tsinghua University, to which many reporters, medical professionals, and professors of communication were invited to disseminate and discuss the results.

2.3. Participants

Non-probability convenience sampling on the DXY platform was deemed to be appropriate to target doctors who already had online accounts and were willing to use the Internet or social media. DXY is the largest professional social network for healthcare providers, medical institutions, clinical practitioners, and professionals in the field of life science in China. All users of the DXY platform are certified doctors and have the tendency of frequently using new media, which matches the target population for this research. In order to dovetail with the extant literature on the relevant methodology, this research project endeavored to recruit a wide range of medical professionals without any geographic or other exclusion criteria. In this study, a total of 1001 valid responses were recorded.

Since the sample group originates from the DXY network, their response to new media is likely to be more positive than that of those who do not participate in this network. This might introduce a degree of bias to a study of Internet usage among doctors. However, considering that our focus was the pattern of doctors' Internet access, usage, and trust, the inclusion criteria did not require adjustment.

2.4. Ethical considerations

Participants were informed of the study's data security procedures to protect confidential participant information. All participants volunteered to be involved in this study. An informed consent letter and a brief introduction including research purpose, methods, benefits, and limitation were provided to each participant before involvement in the study. To ensure confidentiality and anonymity regarding questionnaire responses, all actions of participants were anonymously recorded using a code rather than participants' real names. If a participant was unwilling to finish the survey, he/she had the option to withdraw from the study at any time, and any data received and collected from the participant was excluded from the study. For semi-structured interviews, verbal informed consent was given by every interviewee. Each interviewee was informed that the interview would be recorded and were given the opportunity to review the transcribed interview. All interviewees could voluntarily withdraw from the project at any time.

2.5. Statistical analysis

Data from the survey package were first exported to excel spreadsheets and then imported to SPSS version 25.0 (SPSS, Inc, Chicago, IL, USA) for statistical analysis. Frequency distribution was used in describing demographic traits or calculating means, standard deviation was used for continuous variables. Reliability tests and internal validity tests were conducted to examine the consistency of subgroups in the second-round pilot study.

A paired *t*-test was used for validating some statistical differences among attitudes toward internet access, usage, and trust within the same group of participants on the following 3 dimensions: public information, general medical information, and specialty information. A chi-square text was conducted to compare the composition of users in certain applications (RQ1, RQ2) and nonparametric methods were applied to compare positions with the baseline of the society. Significance levels were set at $P = 0.05$.

Two-tailed Pearson correlation coefficients were performed to explore the relationships between Internet access, usage, and trust. (RQ3) Age was perceived as a continuous variable. This study

examined the relationship between age and Internet usage through Pearson tests as well.

After transcribing and sorting out the in-depth interview data, researchers performed content analysis on the interview corpus to determine how medical professionals view the impact of social media on the extension of and changes in medical practice. (RQ4).

3. Results

3.1. Sample characteristics

A total of 1001 medical professionals submitted the questionnaire in this study. Because this study used a specially-designed online survey, there was no need to handle missing items (since it was not possible to submit an incomplete questionnaire). The sample characteristics of this study were distributed widely enough, as evidenced by the recorded age distribution; the oldest participant was 80 years old and the youngest was 22 years old. The majority of the population was male, and 331 respondents (33.1%) were female, which is comparable to the overall demographic ratio of doctors in Chinese society. No statistically significant difference was found (female doctors in Chinese society account for 28% of the population [26], $P > 0.05$). The general profiles of respondents in this study are presented in Table 1.

3.2. Analysis of internet access

In terms of public information, results suggested that only 32.77% of the medical professionals mainly obtained this sort of information through mass media (newspaper, broadcast, and TV). 85.51% received this type of information through various new media (Wechat, microblog, and various news applications). The results were statistically significant and clearly showed that new media had become the principal way for medical professionals to access public information.

Regarding general medical information acquisition, this study examined means for three channels of information dissemination: traditional medical media, new medical media, and opinion leaders in new media. Statistical differences clearly manifested. The results illustrate that medical new media is a major channel used by medical professionals to gain general medical information. Moreover, they were also willing to access such information through the new media accounts of opinion leaders in the medical field.

A similar approach was applied to specialty information. This time traditional medical media was restricted to professional journals. The results indicated, with statistical significance, that medical new media and opinion leaders in new media were far ahead in this area. All detailed Paired T-test results of the findings mentioned above are exhibited in Table 2.

Table 1
Basic characteristics of respondents ($n = 1001$).

Characteristics	*n* (%)
Age (year)	
Range	22–80
≤29	123 (12.3)
30–39	514 (51.3)
40–49	293 (29.3)
50–59	60 (6.0)
≥60	11 (1.1)
Sex	
Male	670 (66.9)
Female	331 (33.1)
Region	
Eastern	447 (55.4)
Western	147 (18.2)
Central	179 (22.2)
Northeast	34 (4.2)
Education level	
Vocational school	55 (5.5)
Bachelor	539 (52.8)
Master	315 (31.5)
Doctor	92 (9.2)
Hospital Grade	
Tertiary	563 (56.2)
Secondary	295 (29.5)
Primary	109 (10.9)
Other (CDC, Research Center et al.)	34 (3.4)

3.3. Analysis of internet usage

The chief results in this area were the descriptive analysis of the purpose and form of Internet usage among medical professionals. In this survey, 88.8% of this special group chose to utilize the Internet to encounter and update their professional fields, 37.96% of the doctors indicated explicitly that they would express their views on hot social events through their new media accounts. Also, 47.66% of them answered that they would perform science popularization in their professional realm through their new media accounts, and 50.45% of them made it clear that they would take the initiative to refute health rumors in their professional fields. Besides this, 71.23% of this group would forward and share approved health information, which was conducive to health information dissemination.

3.4. Analysis of internet trust

In the three main dimensions that were consistent with Internet access, a Paired T-test was applied to non-medical traditional media, medical traditional media, professional journals, medical new media, and opinion leaders in new media, for the sake of contrasting levels of trust. The analysis presented positive results. Regarding public information, medical professionals had more confidence in information provided by traditional media. On the topic of general medical information, they put more stock in traditional medical media and opinion leaders in new media, rather than medical new media. For specialty information, they trusted information obtained from professional journals most and were least trusting of information received through new media. All detailed Paired T-test results pertaining to these aspects mentioned above are presented in Table 3.

3.5. Correlations

To validate the research questions, correlations were performed to explore possible relationships between Internet access, Internet trust, Internet usage and demographics. The positive results demonstrated that: 1) Younger medical professionals were more inclined to get information from new media sources ($r = -0.119$, $P < 0.01$). 2) Senior medical professionals were apt to obtain information from traditional media sources ($r = 0.082$, $P = 0.01$). 3) Trust of medical professionals was positively correlated with their acquisition habits. That is, the higher the rate of new media access, the more trust they would place in new media and vice versa ($r = 0.318$, $P < 0.01$). (4) The greater the confidence the respondent had in new media, the higher their probability of publishing their perspective on social events or hot topics was ($r = 0.185$, $P < 0.01$). Some other specifics are displayed in Table 4.

3.6. Content analysis of in-depth interviews

After transcribing the interview recordings, their contents were

Table 2
Internet access in medical professionals ($n = 1001$, *Mean±SD*).

Information	Traditional media	New media	Opinion leader in new media	t_1	P_1	t_2	P_2	t_3	P_3
Public info	2.78 ± 1.29	4.26 ± 0.87		−30.06	<0.001	–	–	–	–
General medical info	3.57 ± 1.11	4.05 ± 0.88	3.71 ± 1.04	−11.51	<0.001	−3.34	0.001	9.67	<0.001
Specialty info	3.51 ± 1.09[a]	4.00 ± 0.80	3.73 ± 0.95	−11.80	<0.001	−5.42	<0.001	9.53	<0.001

Note; t_1: comparation between traditional media and new media; t_2: comparation between traditional media and opinion leader in new media; t_3: comparation between new media and opinion leader in new media; a: from professional journals.

Table 3
Internet trust in medical professionals ($n = 1001$, *Mean±SD*).

Information	Traditional media	New media	Opinion leader in new media	t_1	P_1	t_2	P_2	t_3	P_3
Public info	3.47 ± 1.09	3.35 ± 0.87		3.60	<0.001	–	–	–	–
General medical info	3.93 ± 0.88	3.84 ± 0.88	3.87 ± 0.88	3.44	0.006	2.11	0.035	9.67	<0.001
Specialty info	4.04 ± 0.92[a]	3.84 ± 0.81	3.8 ± 0.86	6.86	<0.001	7.59	<0.001	1.62	0.106

Note: t_1: comparation between traditional media and new media; t_2: comparation between traditional media and opinion leader in new media; t_3: comparation between new media and opinion leader in new media; a: from professional journals.

Table 4
The relationship between internet access, usage and trust ($n = 1001$, r).

Items	Internet access	Internet trust	Internet usage
Internet access	1	–	–
Internet trust	0.32*	1	–
Internet usage	0.34*	0.19*	1

Note: *$P < 0.001$.

coded by 2 of our researchers. The most salient and frequently referred to theme words are listed in Table 5.

The results of the qualitative interviews corroborated the above-mentioned statistical results from the individual questionnaires, and offered further supplementary explanations for them. Even though Internet usage style is diverse, science popularization has become a fashionable topic to use social media for when it comes to medical professionals. Social media has shaped a new communication style which can bring with it potential impacts on the social roles of medical professionals (through communication empowerment and reengineering of authority). A strong effect can also be observed related to the physician-patient relationship. Similar results to those of the quantitative data will not be repeated in this discussion.

4. Discussion

New media has become a major avenue for medical professionals in China to access diverse information. They use the Internet mainly to study and enhance themselves. The latest data have upheld this belief. This is in line with the results of an investigation from DXY, which said medical professionals spent 29.2 h per week using the Internet in 2018 [[26]], among which 16.2 h were related to medicine. This is a higher rate of Internet use than that of ordinary netizens (Average netizens typically spend 27.6 h on the Internet) [27]. Some scholars insist that this is a virtue of generally higher education levels among medical professionals than in the general population [28]. A diffusion trend of physicians' media usage style was observed by our study, from inward benefits for themselves to outward benefits in their ability to popularize science. This observation can partially be explained by communication empowerment, which was a key term extracted from interviewees. All of them expressed a positive attitude towards the power to communicate which has been given to them by new media platforms in China.

Table 5
Top 5 conceptions mentioned in interview.

Conceptions	Frequency	Percentage (%)
Internet usage	8	29.6
Science Popularization	7	25.9
Authority Reengineering	5	18.5
Physician–patient Relationship	4	14.8
Communication Empowerment	3	11.1

The emergence of new media or self-media has endowed medical professionals with the ability to "bypass" the traditional media filter [29]. Besides expressing their attitudes or viewpoints directly and coherently, they can also turn their self-media accounts into a type of media, to counteract a disadvantage felt by medical professionals in the process of negative image-building by the more established media (Media sporadically provides amplified negative reports and can demonize medical professionals [3031]). It can also enable the public to view medical disputes more rationally and objectively. In turn, new media can enable the public to have a more scientific understanding of medicine. Our research indicates that more than half of the medical professionals would take the initiative to curtail health rumors in their professional area and rectify health misconceptions in the pubic via social media as well. This is because the prevalence of health rumors continues to grow and there is a need to deter these, which can be achieved by medical professionals with the rise of doctors' narratives.

Interestingly, medical professionals' access to and trust in Internet information tended to be inverted. Namely, information acquisition primarily depended on new media, however, more trust was placed in traditional media, including professional journals. This may be attributed to the current Internet environment, where the veracity of information is not assured for users [32]. In China, there are few studies on the potential relationship between Internet usage and Internet trust, however, some results related to our above conclusions have been articulated. Li & Zhang conducted a RCT in Chinese Weibo users and concluded that they believed in traditional media far more than social media [33]. Simultaneously, a preference for Internet usage among this population positively impacted their degree of trust in new media, which shows that, the more they were inclined to access information from new media, the more likely they were to have confidence in new media than those who were not accustomed to use new media. Switching to the circumstance of using traditional media we see the same explanation. This result is consistent with existing conclusions. For instance, Johnson & Kaye [34] found, through research of media

credibility perceptions, that Internet users who prefer a specific network are more inclined to trust that network's media, and subjective media preference has a significant impact on the degree of trust in the medium reported by respondents [35].

It is noteworthy that our research highlights a specific way of using the Internet among Chinese medical professionals, namely science popularization. Self-media has extended the medical setting, to a large extent. In our study, nearly half of the participants performed science popularization in their professional realm through their new media accounts, and this behavior was positively correlated with Internet trust. Nonetheless, tracking back to 2002, when the Internet hadn't reached its current level of maturity, research has shown that the traditional media was the main source of health information. Statistics showed that more than 80% of the public received health information from TV, magazines, newspapers, and other traditional media, which is much higher than the portion of this information received from their medical professionals [36]. Regarding the question of why the activity of science popularization among medical professionals is emerging in the new media era, this study speculates that there are two reasons. One is that, despite a high demand for health information in China, the health literacy level of Chinese citizens remains low. Shen & Chen conducted a convenience sampling survey to understand the health knowledge demands of the population in Guangdong province in 2014, which showed that 86.6% of the public displayed a strong demand for health information [37]. Corresponding to this conclusion is an asymmetry in health literacy levels, which are only 11.58% according to statistics published in 2016 [38]. On the other hand, authoritative voices are more persuasive to the public, especially in a sophisticated Internet environment. A basic consensus has been recognized that health information acquired through self-media lacks scientificity and accuracy [39]. Some scholars [40] have pointed out that the quality of health information obtained through the internet contains a mixture of true and false information and needs to be dealt with urgently. A crucial intervention is needed to ensure the professionalism and authority of information sources and medical staff are high-quality health information sources [41].

Owing to this, authority reengineering in medical professionals has become prominent based on the information extracted from our interview corpus. The emergence of new media or self-media makes it possible for young medical professionals to establish their own brand and rebuild their authority. This certain reconstructed authority cannot only make medical professionals become "opinion leaders" of the public, but also help their professional development. Just as one interviewee said "In consideration of my outstanding performance on the platform, our hospital has opened a women's outpatient center for me. Female fans come to see me specifically from far away," (P2) and "New media can help young medical professionals to expand their influence, as well as attracting patients from experienced (usually older) doctors." (P3).

Finally, when it came to physician-patient relationships, the interviewees all observed that a physician's use of social media through direct communication with patients can perceptibly affect the patients' trust in medical professionals in real life. This promotes improvement of the physician-patient relationship in offline healthcare settings. For patients, "Interaction online is a great way to cultivate trust with your doctor." (P4) The emergence of new media or self-media expands the time and space of physician-patient communication. Rather than being confined to scheduled visits in hospital settings, physician-patient communication can be instantaneous and borderless. Also, through the use of social media, some medical professionals have achieved a transformation from "doing science popularization as a part-time job" to "making content creation a full-time job" followed by millions of admirers online after resignation from the hospital where they formerly worked. For medical professionals still working in the hospital, the use of social media can improve their personal reputation and influence. "I think I am an inconspicuous physician, but many fans will ask for my suggestions even though they had decided to visit some famous doctors. They said they still believe in me." (P4) Stated thusly, interaction online cannot merely be seen as the prolongation of physician-patient communication. It creates a new healthcare venue for both physicians and patients. Further, it can strengthen the trust between physicians and patients and also can bolster a physicians' personal development, which may be a silver lining for the strained physician-patient relationship in China [42]. When Geisler discussed the use of technology in 1991, technology was perceived as a tool of management and information. Its feature was saving time and improving the efficiency of operations. It follows that it should help improve communication and create new methods of interacting [43].

5. Strengths and limitations

This paper is believed to be the first one to explore Internet literacy among Chinese medical professionals, including their Internet access, usage, and trust. As such, it provides vital baseline data for future studies and the building blocks for more studies in this area. Medical professionals are a particular population who are difficult to bring into contact with researchers. Web-based surveys are able to assist in this work, actualizing an empirical study with a large sample size within this special group. Additionally, this study offers a validated instrument for further studies.

This is an exploration in descriptive research, so this paper cannot explain any causal relationship between our various variables. This type of research ascertains the pattern of Internet access, usage, and trust among medical professionals in China, identifies the correlations among these 3 concepts, and explores the influencing factors of trust and use of the Internet. The methodology for this work provides an understanding of the issues pertaining to medical professionals using the Internet and the essential empowerment by new media for medical professionals seeking to popularize science in their field.

Nonprobability convenience sampling was used in this study, so the results are not fully representative or generally applicable. However, by using a social network, it was possible to target a large number of medical professionals. Because of the high homogeneity of the sample, although the generalization is curtailed, our data has strong explanatory power to illustrate the phenomena of this cross-sectional survey. We would suggest a randomized controlled trial to be applied in further studies to confirm these conclusions. Apart from this, a larger sample size or a wider range of websites is recommended, to minimize nonresponse error.

6. Conclusions

Our empirical study on 1001 medical professionals in China has examined their access to, usage of, and trust in the Internet based on a web survey. This paper has found that new media has become a major outlet used by medical professionals in China to access various information. Even so, they still trust traditional media and professional journals more. Differing from the doctors described in western studies, where medical professionals are mainly integrating new media into their process of making better clinical decisions, medical professionals in China prefer to use new media for science popularization as well. This may be a unique behavior specific to China. The more the doctors in our study had confidence in new media, the more they used it to disseminate approved health information. According to qualitative interviews with some

medical professionals, communication beyond traditional medical settings can partially ease the strained physician-patient relationship in China through establishing stronger trust connections. Online physician-patient interaction beyond a traditional medical setting is a new avenue for interaction and is conducive to building a more harmonious offline physician-patient relationship that is more stable and longer-lasting than before, due to new trust connections. In addition, new media can re-empower and re-authorize medical professionals, so as to strengthen their influence. Moving forward, this study also provides a stable instrument that can be used to examine media literacy among medical professionals. Besides the items mentioned in this reported research, more influencing factors of medical professionals' Internet usage and of media participation processes should be included in the future. Additionally, deeper qualitative research and larger sample size RCTs are recommended for further understanding in this area.

Data sharing statement

We received permission to access questionnaire data based on the Dingxiangyuan platform from 16th, Oct 2018 to 20th, Oct 2018. To access this data, please contact zhangjing242526@126.com to receive permission.

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CRediT authorship contribution statement

Hairuo Zhou: Data curation, Formal analysis, Writing - original draft, Writing - review & editing. **Jing Zhang:** Investigation, Resources. **Jing Su:** Supervision, Methodology, Conceptualization, Project administration.

Declaration of competing interest

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Appendices. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijnss.2020.07.003.

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