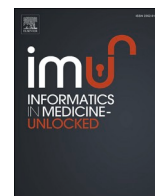




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Establishment of primary health information in the COVID-19 outbreak: A cross-sectional study of population awareness of self-testing

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ABSTRACT

The global pandemic of the Corona Virus Disease 2019 is a severe threat to human health. This paper aims to investigate the status of mass health self-examination awareness and its influencing factors during the COVID-19 epidemic and establish complete health information to intervene in the prevention and control of the COVID-19 epidemic. The study used a simple random sampling method to survey permanent residents (9761 people) aged 15–70 years in a region of Jiangsu Province, China. The survey collected data using a questionnaire with acceptable reliability and validity. The data were entered into SPSS 26, and the data were analyzed using the chi-square test, ANOVA, and logistic regression. The differences in the status of mass health self-examination during COVID-19 were statistically significant ($P < 0.05$) in terms of the literacy level of the grassroots population, ease of access to medical care, primary medical and health conditions, the situation of medical examination programs, and the construction of primary health information technology. The establishment of comprehensive and systematic primary health information can effectively assist in raising people's awareness of health self-examination and promoting health behaviors, which is essential for enhancing COVID-19 prevention and intervention.

1. Introduction

Since December 2019, some hospitals in Wuhan, Hubei Province, have found several unexplained pneumonia cases. Experts found that these cases were acute respiratory infections caused by a new 2019 coronavirus infection [1]. The World Health Organization named this viral infection pneumonia “COVID-19 (Corona Virus Disease 2019)” [2, 3]. According to the assessment, the WHO believes that the current coronavirus pneumonia outbreak has developed into a global pandemic [4,5]. Currently, COVID-19 has caused many deaths worldwide, posing a severe threat to human health and socio-economic well-being [6–8].

Available data suggest that at least one-third of COVID-19 infections are asymptomatic [9,10]. Considering the prevalence and transmission risk of asymptomatic COVID-19, the control strategy of COVID-19 should be changed [11–13]. As an essential foundation of social governance, the grassroots is also the subject with the highest risk of exposure [14]. Grassroots people often ignore the risk of such infections,

thus increasing their own risk of infection [15]. Numerous studies have shown that the most effective measures to prevent epidemic diseases are cultural awareness and expanded consciousness [16]. Social awareness is the primary factor in preventing and containing the spread of disease [17]. Therefore promoting health care and raising primary health awareness becomes one of the essential tools for effective interventions in COVID-19.

At the time of the COVID-19 pandemic, primary health informatization is a critical way to improve the capacity of primary health care services [18]. It can effectively integrate the existing universal health information resources in the region and help to promote the establishment of a new system of high-quality and efficient primary health care services [19]. Improving primary health informatization construction is conducive to building a new ecology of convenient and experiential primary information applications [20,21].

In addition, the establishment of basic health information can help identify problems in primary care, including the state of health

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awareness of the population and the construction of primary medical care, among other dimensions [22,23]. The centralized reflection of individual health status also plays a vital role in excluding suspected cases of COVID-19 among the primary population [24,25]. Therefore, this study aims to investigate the level of people's health self-examination awareness and its influencing factors during the COVID-19 epidemic and establish complete health information to prevent and control the COVID-19 epidemic. The study hopes to improve the health awareness of the primary population through essential steps and help improve the construction of primary health information to promote health care.

2. Methods

2.1. The respondents

Five urban and rural communities Jiangsu Province, China, were selected for the study. A simple random sampling conducted a cross-sectional survey of homebound permanent residents (9761) aged 15–70 years. All protocols met national and international ethical guidelines regarding human subjects' participation in the study and were ethically cleared prior to respondent participation. After the study protocol passed the review process of the institutional research ethics committee, the investigators distributed informed consent forms to obtain their own or guardians' permission before becoming a respondent and completing the questionnaire. The total number of questionnaires returned was 984.

2.2. Questionnaire

The study used a self-designed questionnaire to collect relevant information from the respondents. The survey included general characteristics (3 entries), availability of basic medical facilities at the primary level (6 entries), health self-examination status of the primary (11 entries), and knowledge and suggestions on health informatics construction (10 entries). Professional staff translated, produced, and tested the questionnaire for validation. The researchers conducted reliability and validity analysis of the questionnaire to verify the reliability and validity of the questionnaire data. According to the reliability analysis, the alpha value (reliability coefficient) was 0.87 (greater than 0.80), indicating that the results of each item response were reliable. The alpha value of each deleted item was less than the standardized alpha value, which indicated that the questions were reasonable and the overall reliability of the questionnaire was high. In order to ensure the systematicity and completeness of the study, the study developed different dimensions of interview content for each subject. The subjects included the community people, community health clinic medical staff, and local hospital leaders.

2.3. Statistical analyses

The study used SPSS 26.0 statistical software to analyze the data. Frequencies (N) and percentages (%) represent the count data, and the study used the χ^2 test to compare groups. The study performed ANOVA on the item groups for comparison between groups. In addition, analysis of covariance controlled for the effect of covariates in the ANOVA, combined with logistic regression analysis, to investigate the current situation and factors influencing the awareness of primary health self-examination during the COVID-19 epidemic. Differences were considered statistically significant at $P < 0.05$.

3. Results

3.1. General information

A total of 1093 questionnaires were collected, and 984 were valid.

468 (47.60%) were male, and 516 (52.40%) were female. In addition, the basic information includes the distribution of respondents' age and highest education (including current study) (Fig. 1).

3.2. Provision of primary care infrastructure

Respondents rated the condition of medical facilities as average. This section includes the availability of community hospitals or health stations in the respondent's community or village, the ease of access to health care, and the medical facilities in the community hospital or health station (Fig. 2).

One-way ANOVA showed that the convenience of access to health care ($p < 0.001$), the availability of primary health care facilities ($p = 0.043 < 0.05$), and the availability of medical checkup programs ($p < 0.001$) all had significant effects on the awareness of health self-examination among the population. There was no statistically significant difference between the availability of community hospitals or health stations in the respondent's community or village ($p = 0.827$) and the awareness of health self-examination among the masses.

3.3. Health self-examination status of the grassroots

By one-way ANOVA, the educational and age factors of the respondents significantly influenced their knowledge of commonly used drugs and their efficacy ($p < 0.001$, $P = 0.002$), their initiative to browse the Internet about COVID-19 prevention and treatment ($p < 0.001$, $p < 0.001$), and their behavior is to take fundamental body indicators such as temperature at home ($P = 0.002$, $P = 0.020$). Analysis of variance between groups for this item showed statistically significant differences ($P < 0.05$). Most people during COVID-19 can measure fundamental physical indicators on their own, and these people tend to have a better understanding of commonly used medications. The reasons for not having the first checkup were both subjective and objective and were slightly more subjective, with the two aspects of "felt no harm" (59.10%) and "too many unnecessary tests in the hospital" (48.80%) being the main factors. The study used logistic regression analysis to process data on the "feeling fine" population and the selection of areas to visit for minor illnesses. The significance was more significant than 0.05, indicating that the difference was insignificant, except for those who chose the city hospital. This result may be related to the medical condition of the respondent's place of residence, while those who chose the city hospital paid more attention to their medical condition (Fig. 3). The results of the situation of awareness of regular medical checkups differed among people with different educational levels (Table 1), and the

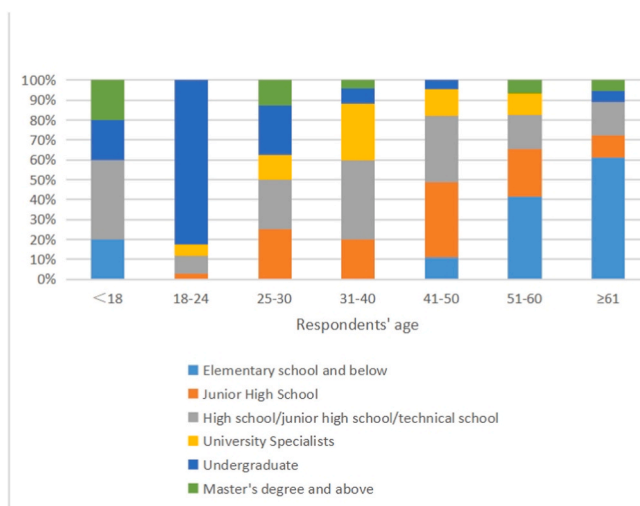


Fig. 1. Distribution of respondents' age and highest education (including current study).

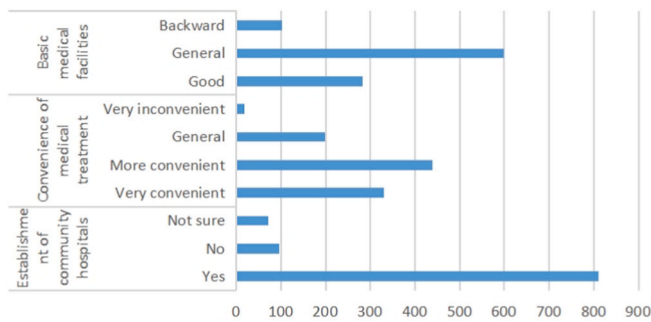


Fig. 2. Primary medical infrastructure equipped.

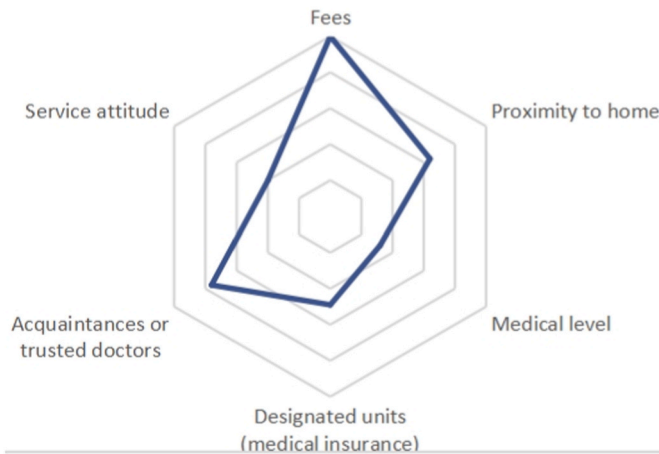


Fig. 3. Considerations for the public's choice of medical care.

difference between the level of education of the respondents and the presence of awareness of regular medical checkups was statistically significant ($\chi^2 = 23.627, p < 0.001$). The difference in percentage comparison shows that the percentage of master's degree and above with awareness of regular medical checkups was 83.33%, which would be significantly higher than the average of 61.59%. The percentage of undergraduates with awareness of regular medical checkups was 75.00%, significantly higher than the average level of 61.59%. The proportion of elementary school and below without awareness of regular medical checkups is 75.86%, significantly higher than the average level of 38.41%. Their literacy level influences people's health self-examination awareness [26].

According to chi-square analysis, fundamental physical indicators such as people's knowledge of commonly used drugs and their efficacy ($p < 0.001$), whether they browse the Internet for content related to COVID-19 prevention and treatment ($p < 0.001$) and taking their temperature at home ($P = 0.007$) were statistically significant in relation to the respondents' literacy level (Table 2). The literacy level of the grassroots people influenced their health concerns and health

monitoring behaviors [27]. The higher the level of literacy, the higher the level of knowledge of this group about commonly used drugs and their efficacy, actively browsing content related to COVID-19 prevention and treatment, and taking temperature measurements autonomously and regularly.

Awareness of regular self-examination influences the population's health behavior. According to the chi-square analysis, the differences between fundamental physical indicators such as the population's knowledge of commonly used drugs and their efficacy ($p < 0.001$), whether they browse the Internet in relation to COVID-19 prevention and treatment ($P = 0.002$) and taking their temperature at home ($P = 0.035 < 0.05$) and the population's awareness of regular medical checkups were statistically significant. This result confirms the above relationship.

3.4. Cognition and attitude of the masses towards health informatization

Respondents were not sure if they had electronic health records 444 (45.10%): 300 (30.50%), no 240 (24.40%), regarding the necessity of establishing electronic health records, electronic medical records, and healthcare-specific networks: necessary 894 (90.90%), unnecessary 90 (9.10%). Respondents were generally satisfied with the construction of information technology in primary health care 492 (50.00%), delighted 102 (10.40%), relatively satisfied 330 (33.50%), and not very satisfied 60 (6.10%). The masses' awareness of regular medical checkups showed a statistically significant difference in primary health care informatics ($F = 10.697, p = 0.002$). The differences between respondents' knowledge of primary health care informatization construction ($p = 0.094$), the presence or absence of electronic health records ($p = 0.115$), and attitudes regarding the necessity of establishing electronic health records, electronic medical records, and healthcare-specific networks ($p = 0.086$) and awareness of regular medical checkups were not statistically significant. The difference between the respondents' satisfaction with the information technology construction of primary health care and their awareness of regular medical checkups was statistically significant ($\chi^2 = 19.114, p < 0.001$). The difference in percentages showed that the percentage of those with awareness of regular medical checkups who chose "more satisfied" was 38.61%, significantly higher than those without awareness of regular medical checkups who chose 25.40%.

4. Discussion

The findings showed that after adjusting for potential covariates, mass health self-examination during COVID-19 was related to literacy, ease of access to medical care, primary medical and health conditions, the status of medical examination programs, and the construction of information technology in primary health. Therefore, it is essential to establish comprehensive and systematic primary health information in the primary community to give full play to its crucial guiding role in raising the public's awareness for COVID-19 self-testing and providing a reference for good primary COVID-19 prevention and surveillance, and to provide a reference for good prevention and surveillance of COVID-19 at the primary level.

Table 1 Results of cross-tabulation (chi-square) analysis between literacy and awareness of regular medical checkups.

Title	Name	Highest degree (including current enrollment)						Total	χ^2	p
		Elementary school and below	Junior High School	High school/junior high school/technical school	University Specialists	Undergraduate	Master's degree and above			
Awareness of regular medical checkups	Yes	24.14%	58.82%	72.50%	68.42%	75.00%	83.33%	61.59%	23.627	0.000**
	No	75.86%	41.18%	27.50%	31.58%	25.00%	16.67%			
Total		174	204	240	114	216	36	984		

* $p < 0.05$ ** $p < 0.01$.

Table 2
Results of cross-sectional (chi-square) analysis of literacy and health cognitive behaviors during the COVID-19 pandemic.

Title	Name	Highest degree (including current enrollment)						Total	χ^2	P
		Elementary school and below	Junior High School	High school/ junior high school/ technical school	University Specialists	Undergraduate	Master's degree and above			
Knowledge of commonly used drugs and their efficacy	Very well understood	6.90%	14.71%	25.00%	26.32%	19.44%	50.00%	19.51%	45.419	0.000**
	Basic	20.69%	55.88%	60.00%	42.11%	72.22%	50.00%	52.44%		
	Understanding	72.41%	29.41%	15.00%	31.58%	8.33%	0.00%	28.05%		
	No knowledge	174	204	240	114	216	36	984		
Browse the web for COVID-19 prevention and treatment-related content	Proactive Search	10.34%	26.47%	52.50%	42.11%	52.78%	66.67%	39.02%	42.293	0.000**
	Will notice it when it happens to browse	27.59%	44.12%	30.00%	42.11%	44.44%	33.33%	37.20%		
	Will not browse	62.07%	29.41%	17.50%	15.79%	2.78%	0.00%	23.78%		
	Total	174	204	240	114	216	36	984		
Take temperature and other essential body indicators at home	Able to perform regularly	6.90%	26.47%	15.00%	21.05%	19.44%	83.33%	20.12%	24.186	0.007**
	Occasionally performed	34.48%	41.18%	52.50%	42.11%	41.67%	16.67%	42.07%		
	Not to be performed	58.62%	32.35%	32.50%	36.84%	38.89%	0.00%	37.80%		
	Total	174	204	240	114	216	36	984		
Knowledge of information technology construction in primary health care	Never knew	79.31%	55.88%	35.00%	42.11%	19.44%	50.00%	45.12%	30.431	0.001**
	Basic	17.24%	41.18%	60.00%	57.89%	75.00%	33.33%	50.61%		
	Understanding	3.45%	2.94%	5.00%	0.00%	5.56%	16.67%	4.27%		
	Total	174	204	240	114	216	36	984		

* $p < 0.05$ ** $p < 0.01$.

The survey showed that the awareness of health self-examination among rural grassroots people was weak during COVID-19, and this finding was related to the literacy level of the respondents. The highly literate group had a strong awareness of health self-examination than the low literate group (19.63% higher). As a result, the highly literate group had a relative advantage in the knowledge and mastery of home backup medication and COVID-9 symptom management behaviors (71.90%), were more likely to browse actively and study online content related to COVID-19 prevention and treatment (76.22%) and had a more robust COVID-19 prevention and judgment awareness. The low literacy group was relatively lacking in the above aspects. The survey inferred that strong self-health awareness motivated people to cooperate with local epidemic prevention and control efforts actively, provide accurate and effective health and health information, achieving effective monitoring of the epidemic at the primary level [28,29]. As part of the primary health system, rural health care plays a vital role in primary health care. Rural communities should be actively involved in improving local health care [30]. Facing the whole community population, especially the low literacy group, the community health centers implement health education activities. For example, activities such as COVID-19 related health information dissemination, professional health counseling, and guidance on initial COVID-19 health care measures help the population improve health awareness and concepts. Community service workers are also encouraged to participate in primary health-related activities because of efficient cross-organizational cooperation mechanisms between them and primary health [31]. The rapid coordinated response of community participation, adequate human resources, and medical equipment are also favorable factors for efficient COVID-19 prevention and control in rural areas [32].

In addition, 39.02% of the population actively browsed online content related to COVID-19 prevention and treatment. This indicates that most people want to obtain additional health information. As reported in many studies, the population's behavior toward receiving health information about COVID-19 through the Internet was correlated with poor

mental health during COVID-19 [33]. During COVID-19, unemployment, community isolation, and fear of being infected caused poor mental health such as PTSD symptoms, anxiety, depression, or stress [34]. These adverse psychological emotions led them to seek additional health information to protect mental health parameters actively [35]. Further health information includes local COVID-19 updates, basic COVID-19 precautions, and the experiences shared by others. The population can gain knowledge of COVID-19 health care and guidance on healthy behaviors from this information. This will increase confidence in health care and alleviate anxiety, fear, and depression in the face of COVID-19 infection. This leads to the adoption of proactive COVID-19 preventive care measures such as more frequent health counseling, COVID-19 surveillance, and more extended home care [36]. In contrast, people choose to access health information through web browsing. This may be influenced by cultural differences, dissatisfaction with health information, and low confidence in physicians. What also needs to be considered is the riskiness of false medical health information on the Internet [37]. Therefore, there is a need for local health care systems to enhance web-based knowledge. The aim is to provide accurate and reliable web-based information to avoid misinformation guidance causing adverse health outcomes.

61.60% of the people indicated that they were aware of independent health checkups. Only 34.80% of the group maintained the frequency of regular checkups at once a year, and 20.10% of the group regularly took their temperature at home. This data indicates that the implementation of self-health monitoring behavior of grassroots people during epidemics is not in place, reflecting the imperfect monitoring of epidemics at the primary level. In addition, vulnerable groups such as empty-nest elderly and mobility-impaired people in rural areas are likely to be missed in rural epidemic surveillance due to their lack of relevant health prevention guidelines [38,39]. This will make it more difficult to control the epidemic at the grassroots level. Given the transmission characteristics and infectivity of COVID-19, the nationwide implementation of non-medical interventions such as lockdown and home isolation have

restricted primary activities' scope, which may be one of the fundamental reasons for the failure to implement mass self-examination behaviors [40–42]. The primary manifestation of New crown pneumonia infection may be fever, so temperature measurement is currently a straightforward and vital method by which the primary population can self-monitor and screen for novel coronavirus infection. In any case, strengthening the health surveillance of the primary population during COVID-19 is a priority in the prevention and control of the epidemic at the primary level. Especially for the low-education groups and vulnerable groups, we need to conduct essential surveillance, and the dominant groups should help guide the implementation of basic surveillance measures such as temperature monitoring and trip recording to reflect and report the health status of the primary population promptly.

The study also found that in terms of the availability of basic medical facilities at the primary level, there was a correlation between the health self-examination of the grassroots population and the ease of access to medical care, primary medical and health conditions, and the status of medical examination programs. They are considering the establishment of health service stations by village or community according to the national health care reform plan [43]. However, it still influences people's health self-examination at the convenience of access to medical care. Specific influencing factors include the distance from home, traffic situation, visit flow, and other objective factors.

The survey indicated that people close to health service stations or primary hospitals during COVID-19, with convenient transportation and uncrowded access, were more inclined to self-directed health monitoring and preventive care consultation for pneumoconiosis. In addition, the study used logistic regression to analyze the factors influencing the choice of area of visit. Furthermore, the results showed that, excluding the influence of their subjective factors and other factors, people were more inclined to choose the consultation are based on the judgment of health care conditions than choosing the consultation are based on the severity of their illness ($P = 0.000 < 0.05$). The survey built hypotheses around health care conditions, and 89.52% of the population chose health institutions with better health care conditions under the same conditions. The health self-examination of the population is related to the situation of the medical examination program, with specific factors such as the cost (49.70%), quality (68.48%), and length (56.97%) of the examination. Before implementing health self-monitoring behaviors, people would consider a combination of less expensive, better quality, and less time-consuming medical checkups. Therefore, it is necessary to improve the primary health care infrastructure to solve the problems of "expensive" and "difficult" access to health care, Especially during the COVID-19 pandemic, adequate health resources, and good medical conditions played an important role in guiding the population towards autonomous disease prevention counseling and health consultation [44].

In addition, primary health care informatization construction, such as the application of electronic health records, electronic medical records and health care private networks, was related to the population's health self-examination. People's awareness of regular self-examination was positively related to their satisfaction with primary health care informatization. The study inferred that the efficient and convenient health care services brought by the information technology construction contributed to improving people's awareness of health self-examination. Considering the importance of a complete information system to improve the efficiency of medical workers and achieve real-time and effective health monitoring of the population during COVID-19 [45,46]. Therefore, 90.90% of the population affirms the necessity of establishing electronic health records, electronic medical records, and a dedicated network for health care. At the same time, the survey showed that the respondents have concerns about the construction of health information technology, such as the risk of information leakage (76.97%), inaccurate health information (60.00%), easy system failure (51.52%), and troublesome operation (36.36%). This can provide informative opinions to further improve health information and the information system. This

result indirectly indicated that there are still many problems with the existing primary health information technology construction [47]. These problems bring significant troubles in people's physical examination and consultation. They are likely to lead people to reduce the frequency of health self-examination and consultation to avoid these problems. This initiative is bound to bring more severe consequences during the COVID-19 pandemic, such as difficulty in implementing health information monitoring, people not knowing that they are infected with the new coronavirus, and the disease is detected too late and difficult to control. Therefore, it is necessary to make targeted improvements in the process of primary health information technology construction to indirectly raise awareness of health self-examination among the grassroots population during COVID-19 and to do an excellent job of preventing and monitoring COVID-19 at the primary level [48].

5. Limitations

The population studied was mainly in communities within Nantong, Jiangsu, and there may be other issues to be discussed for the areas with the most severe outbreaks of COVID-19. Our data need to be investigated and confirmed in future broader population studies, and we look forward to related studies by other research groups.

6. Conclusion

The results of the study suggest that the primary health information creation intervention helped identify problems in primary health care. Initiatives such as strengthening literacy, basic health care conditions, and primary health information technology can help raise awareness of health self-examination among the community population and ultimately lead to health self-examination behaviors. Applying this study to a similar population may lead to COVID-19 prevention in any community. Therefore, authorities and public health experts should prioritize strengthening community-based primary health care measures. In addition, education related to COVID-19 should continue to be provided to all community residents to increase health awareness and proactively prevent COVID-19.

Ethics approval and consent to participate

The participants were duly informed about the purpose of the study. Moreover, the researchers assured them that the information collected would remain confidential and be used only for the study. By answering the questions in the questionnaire, the respondents indicated their agreement to participate. Informed consent was obtained from all subjects involved in the study. The study was approved by the Ethics Committee of the First People's Hospital of Yancheng City [2020]-(K-062).

Availability of data and materials

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

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Authors' contributions

W J: Conceptualization, Methodology, Writing- Original draft preparation. **W S:** Formal analysis, Writing- Original draft preparation.

X L: Visualization, Investigation. **J X:** Supervision. **J Z:** Investigation, Validation. **F Q:** Writing- Reviewing and Editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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