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What are the problems and suggestions related to cancer health education in Sichuan, China? A qualitative study of community health workers (CHWs)

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Abstract

Background Health education conducted by community health workers (CHWs) is an evidence-based strategy for promoting cancer prevention, cancer screening, and adherence to medical guidance from doctors. However, CHWs are confronted with some problems related to cancer health education in China. This study aimed to clarify CHWs' awareness of problems in cancer health education in China and the solutions that they were considering to improve the quality and efficiency of cancer health education.

Methods A qualitative descriptive design with purposive sampling was applied in eight primary health care sectors in Guangyuan and Chengdu in Sichuan, China. Face-to-face, in-depth, semistructured interviews were conducted, and a total of 60 CHWs were interviewed. The interviews were transcribed verbatim and imported into Nvivo12.0. Thematic analysis using the constant comparative method was used to analyze the data.

Results Uncooperative inhabitants, poor organization, low-frequency provision, and inadequate training for CHWs were problems related to cancer health education provided by CHWs in China. CHWs proposed some suggestions to improve the accessibility and acceptability of cancer health education, including combining online and offline education, health education after screening, cancer plus others, health education in the workplace, and volunteer recruitment.

Conclusions Both the problems and suggestions described in this study may provide evidence for cancer health education and policy-making related to cancer prevention and control in China.

Keywords Community health workers, Health education, Cancer, Problems, Suggestions, China

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Background

According to estimates from the International Agency for Research on Cancer, 19.3 million new cases of cancer and almost 10 million deaths from cancer occurred worldwide in 2020 [1], 24% of which were newly diagnosed cases and 30% of which were cancer-related deaths in China [2]. The age-standardized incidence and mortality in China are also above the global averages [2]. Additionally, cancers resulted in 67,340,309 disability-adjusted life years (DALYs) in China [3]. With population aging and lifestyle changes, the impact of cancer is likely to increase in China [2].

Cancer-related health education could decrease the impact of cancer at three levels [4]. The first level involves changes in cancer knowledge; attitudes, beliefs or intentions about prevention strategies; early warning signs; early screening; early diagnosis; and appropriate treatment [5, 6]. The second level corresponds to changes in behavior, such as lifestyle and cancer screening, due to first-level changes [7, 8]. The third level involves changes in morbidity, rates of diagnosis, diagnostic stage, and mortality [9].

Community health workers (CHWs) can be categorized into three groups by education and preservice training, including lay health workers (individuals with little or no formal education who underwent a few days to a few weeks of informal training) providing basic health services as unpaid volunteers, level 1 paraprofessionals (individuals with some form of secondary education and subsequent informal training) receiving an allowance, and level 2 salaried paraprofessionals (individuals with some form of secondary education and subsequent formal training lasting a few months to more than a year) [10]. CHWs often have a deep understanding of the community's needs and can provide appropriate health education [11]. Furthermore, CHWs are credible and trusted sources of health information for inhabitants in the community, and health information delivered by CHWs might normalize the information, decrease stigma, improve awareness, and increase consideration of health promotion behaviors [12]. Many studies have shown that health education provieded by CHWs is effective at improving cancer knowledge, attitudes, beliefs, intentions, and screening behavior [13, 14].

In 2009, China launched basic public health services (BPHS) delivered by CHWs, including establishing resident health records, health education for priority diseases, vaccination, health management for priority groups, and communicable disease reports and treatment. In China, CHWs refer to level 2 salaried paraprofessionals who are employed by the government in primary health care sectors, including community health centers (CHCs) and stations in urban areas and township hospital centers (THCs) and village clinics in rural areas [15]. CHWs in China include physicians, nurses, and health technicians (such as pharmacists and imaging and laboratory technicians) with medical practice certificates. In China, a very high proportion of nurses serve as substitutes for physicians to address the shortage of physicians [16]. Priority diseases include hypertension, diabetes, coronary heart disease, asthma, breast cancer, cervical cancer, tuberculosis, hepatitis, and acquired immune deficiency syndrome (AIDS), among others [17]. In 2017, the modified content of BPHS expanded cancer education from breast and cervical cancer to all types of cancer [18].

Some studies have demonstrated that CHWs face many problems with BPHS provision in China, mainly including a lack of support from the public, a shortage of CHWs, a lack of knowledge and skills for CHWs, and inadequate financial incentives, among others [19, 20]. Considering the lower survival rate associated with cancer than with other diseases [21] and the misconception about cancer among a number of people, such as fatalistic beliefs [22], health education related to cancer should also be different from that related to other diseases. To our knowledge, no published studies analyzing the status quo of cancer health education in China from CHWs' perspectives are currently available. This study aimed to clarify CHWs' awareness of problems in cancer health education in China and the solutions that they were considering.

Methods

Design

This was a descriptive qualitative study with a phenomenological approach using semistructured in-depth interviews to clarify CHWs' awareness of problems in cancer health education in China and the solutions that they were considering. The Consolidated Criteria for Reporting Qualitative Studies (COREQ) guided the design and reporting of our study [23] (see the COREQ checklist in supplementary file 1).

Setting

This study was conducted in Sichuan Province, which is located in southwestern China and is the fifth largest province by population and the sixth largest province by economy among 31 provinces in the Chinese mainland [24, 25]. We purposively selected Guangyuan (an undeveloped city with a gross domestic product (GDP) of 94.2 billion RMB and a per capita GDP of 35.3 thousand RMB) and Chengdu (a developed city with a GDP of 1701.3 billion RMB and a per capita GDP of 103.4 thousand RMB) [26] as the study areas. Then, one county/district was chosen within each city to represent the socioeconomic development of Guangyuan and Chengdu. Finally, four primary health care sectors were

selected within each county/district, including two in rural areas and two in urban areas. In total, eight primary health care sectors were chosen as the final study settings.

Research team

The research team consisted of seven members—1 male and 6 females. None of these members had any prior relationships with the participants. Four members (YZ, WQ, YF, and WS) were cancer health education experts with more than four years of experience in qualitative study, and the other three (ZL, LY, and RL) were master's degree candidates who had completed systematic training in qualitative study and had participated in qualitative studies in the past. Data collection was conducted by YF and LY, who were both trained in qualitative data collection techniques, the study protocol and tools. They were all familiar with primary health sectors due to their previous internship experience, and they familiarized themselves with the interview guide and the context before commencing data collection.

Participants

We used purposive sampling to identify participants of different ages, sexes, educational backgrounds and working years. The inclusion criteria for CHWs were as follows: (I) had worked in cancer health education, (II) had worked as a CHW for more than 1 year, and (III) were willing to participate in qualitative interviews. The directors of the eight primary health care sectors assisted the interviewer in verbally inviting potential participants in their sectors. After receiving a verbal explanation of the study accompanied by written materials, potential participants interested in the study were able to schedule an appointment to discuss participation in more depth before making a final decision at their discretion. This also provided them with an opportunity to review the written materials prior to the informed consent process at the time of the interview. Potential participants were also informed of the right to withdraw from the study at any time for any reason, the confidentiality of their participation, and the deidentification of data for reporting.

Data collection

Face-to-face in-depth interviews were conducted from July 7 to 15, 2021, in a secure private location of the primary health care sector. At the beginning of each interview, the interviewer introduced herself, provided the participant with detailed information about the study, such as the motivation and objectives, and answered questions prior to obtaining written informed consent.

After completing the informed consent process using a standard script, a one-to-one interview was conducted based on the interview guide (see the interview guide in supplementary file 2). The interview guide was revised after six interviews were conducted as a pilot test. Data from pilot interviews were not included in the analysis. The interview guide started with the collection of demographic information, followed by semistructured in-depth interviews about health education related to cancer. Semistructured interviews allowed participants to freely share their thoughts and perceptions while allowing the researchers to retain some control over the direction of the study. No one else was present apart from the participant or the interviewer during the interviews. If a participant was observed to prefer the local Sichuan dialect, the interviewers used it to complete the interview, allowing participants to speak freely and comfortably.

The interviews lasted 15 to 35 min. All the interviews were audio recorded with permission from the participants, while field notes were taken to capture nonverbal communication and other relevant information. No participants refused to provide consent or dropped out during the interviews. The interviews proceeded in tandem with the coding and interpretation processes. The interviews were conducted until theoretical saturation was reached and confirmed by an additional five interviews, totaling 60 participants [27]. No interviews were repeated.

Data analysis

The interviews were transcribed verbatim within 24 h after the end of each interview, and the corresponding field notes were sorted in a Word document for consultation and discussion by the research team. All the transcripts were checked against the original records by authors YZ and WQ and then returned to the participants for feedback. None of the participants provided any adjustments. The coding process was initiated during data collection using the qualitative analysis computer program Nvivo12.0 (QSR International, Melbourne, Australia). The transcripts were analyzed inductively via thematic analysis using the constant comparative method [28], where coded categories were derived directly from the transcripts. Researchers strictly followed the analysis steps to ensure consistency [29].

First, YZ and WQ independently read each transcript several times, and meaningful fragments were identified and coded. They met regularly (after approximately every 4–5 interviews) to discuss and validate the codes. Any inconsistencies in coding assignments were resolved in discussions. The second step of the data analysis mainly focused on the deduction and induction of codes by comparison and

Table 1 Trustworthiness criteria

Criteria	Performed techniques and application procedures
Credibility	Researcher triangulation: each interview was analyzed by 2 researchers. Team meetings were held in which the analyses were compared, and subthemes and themes were identified. Triangulation of data collection methods: semi-structured interviews were conducted, and field notes were kept by the researchers. Participant verification: all transcripts were returned to participants for feedback. None of the participants made any additional adjustments.
Transferability	Detailed descriptions of the study conducted included the characteristics of the research team and the participants, sampling strategies, and the data collection and analysis process.
Reliability	External researcher audit: an external researcher evaluated the research protocol, focusing on aspects related to the study methods and design. In addition, the external researcher specifically verified the descriptions of the participant quotes, the codes, the subthemes and the themes.
Confirmability	Researcher triangulation, participant verification, and triangulation of data collection methods. Researcher reflexivity was encouraged through reflective reporting and description of the study.

integration into subthemes and themes. By capturing salient patterns of data, explanations for the stated perceptions and experiences provided by the participants were emphasized in this process. In a constant comparison process, the ascribed codes were compared with new data from the subsequent interviews and adapted if necessary. In the third step, all members of the research team reviewed the themes, subthemes, codes, and raw data; provided feedback; and formed a consensus to ensure that the findings were an authentic representation of the data. Participant quotes representative of the richest and best examples of widely held patterns in interviews were reported verbatim, and unique participant identifiers without any personal information were used to protect confidentiality. Memos were kept to provide evidence of the analytic process and the decisions made to develop subthemes and themes. All analyses were performed in Chinese and translated into English, and the translated versions and the original Chinese versions were assessed by an independent and bilingual person outside the research team. WS provided supervision throughout the entire analysis process.

Trustworthiness

The criteria suggested by Lincoln and Guba were used to ensure the trustworthiness of the data [30]. Table 1 shows the trustworthiness criteria and procedures.

Table 2 CHW characteristics ($n=60$)

Characteristic	Number	%
Age		
≤30	17	28.33
31–40	19	31.67
41–50	18	30.00
51–60	6	10.00
Sex		
Male	18	30.00
Female	42	70.00
Education		
Senior high school	1	1.67
Medical secondary school	4	6.67
Junior college	20	33.33
Bachelor's degree and above	35	58.33
Years of work as a CHW		
1–5	8	13.33
6–10	17	28.33
11–15	8	13.33
16–20	8	13.33
>20	19	31.67

Ethical considerations

The study was approved by the Ethics Committee of Sichuan Cancer Hospital (SCCHEC-02-2021-050).

Results

Participant characteristics

In total, 60 CHWs were interviewed. The participants' characteristics are presented in Table 2. The mean age of the participants was 37 ± 9 years, with a range from 21 to 57 years. 70% of the participants were female. More than half of the participants had a bachelor's degree or above. Approximately one-third of the participants had worked as CHWs for 20 years or more.

Themes

CHWs' awareness of problems in cancer health education in China and the solutions that they were considering were analyzed, and the results are presented in Table 3. For problems, four themes were identified: (a) uncooperative inhabitants; (b) poor organization; (c) low-frequency provision; and (d) inadequate training for CHWs. For solutions, five themes were identified: (a) combining online and offline education; (b) health education after screening; (c) cancer plus others; (d) health education in the workplace; and (e) volunteer recruitment.

Problems

Theme 1: uncooperative inhabitants

Almost all CHWs mentioned that inhabitants were not active in participating in health education on cancer. A number of inhabitants took part in cancer health

Table 3 Examples of themes and subthemes

Items	Themes	Subthemes
Problems	Theme 1: Uncooperative inhabitants	1. Some inhabitants had low awareness of prevention. 2. Several inhabitants believed that talking about cancer was unlucky. 3. A very small number of inhabitants had a strong drive to avoid the anxiety, tension and fear that would be associated with being told about cancer-related terminology. 4. A few elderly inhabitants thought that taking part in health education was unnecessary because whether they developed cancer and even died was irrelevant due to their age.
	Theme 2: Poor organization	1. The timing of health education was unreasonable. The busy farming season and working hours should be avoided as much as possible. 2. The contents of health education on cancer were not formulated according to the demands of inhabitants. Inhabitants of different ages and sexes should be provided with different health education contents. 3. Health education provided inhabitants only with knowledge about cancer and not behavioral intervention guidance. 4. Lacking feedback from inhabitants after receiving health education on cancer prevented CHWs from targeted improvement.
	Theme 3: Low- frequency provision	1. So many items were needed to prepare for health education, such as education materials and participation gifts. In addition, the shortage of funds limited the amount of health education available. 2. A shortage of CHWs relative to the served population was noted. In addition, CHWs were overwhelmed by BPHS, including 49 items in 12 categories. Thus, they had to deprioritize one of the 49 items—health education on cancer. 3. CHWs had difficulty creating materials such as brochures and slides for health education on cancer independently due to a lack of time and ability. Additionally, materials provided by superior institutions such as the Centers for Disease Control and Prevention (CDC) and Center for Cancer Prevention and Control (CCP) were insufficient. 4. CHWs had little motivation to conduct health education on cancer because of unclear assessment criteria.
	Theme 4: Inadequate training for CHWs	1. A large number of CHWs failed to have a deep understanding of cancer knowledge. 2. More than a half of participants mentioned that increasing the popularity, vividness and interest in health education was difficult.
Suggestions	Theme 1: Combining online and offline education	None.
	Theme 2: Health education after screening	None.
	Theme 3: Cancer plus others	None.
	Theme 4: Health education in the workplace	None.
	Theme 5: Volunteer recruitment	None.

education only to receive free participation gifts. Four reasons can account for this finding.

First, some inhabitants had low awareness of prevention.

"Inhabitants may refuse to be involved in health education, mainly because of the concept of emphasizing treatment over prevention." (Y11).

"A range of elderly inhabitants didn't care about the contents of health education. They attended health education just to get the participation gifts." (L24).

Next, a number of inhabitants believed that talking about cancer was unlucky.

"A few inhabitants believed it was unlucky to talk about cancer." (Y06).

"A minority of inhabitants considered that if they talked about cancer, they would be caught by cancer." (Y02).

In addition, a very small number of inhabitants had a strong drive to avoid the anxiety, tension and fear that

would be associated with being told about cancer-related terminology.

"A few inhabitants were afraid of cancer and were reluctant to mention it. If you talked to them about cancer, they would reject it." (Y16).

"Several inhabitants were resistant to cancer-related contents of health education." (Y18).

Finally, a few elderly inhabitants thought that taking part in health education was unnecessary because whether they developed cancer and even died was irrelevant due to their age.

"A minority of inhabitants indicated that they were old enough to not care whether they got cancer or not, and it was okay, even death." (Y02).

"Several inhabitants pointed out they were too old to need to join in health education. To be ill or not, it was not important." (L18).

Theme 2: poor organization

Most CHWs admitted that cancer health education was poorly organized in four ways.

First, the timing of health education was unreasonable. A busy farming season and working hours should be avoided as much as possible.

"Sometimes, the time was not suitable, like the busy farming season. It was only in the non-busy season that CHWs could conduct health education in rural areas." (Y04).

"Health education was usually during working hours. During this time, young inhabitants had to go to work, and elderly individuals usually needed to look after their grandchildren." (Y27).

Second, the contents of cancer health education were not formulated according to the demands of the inhabitants. Inhabitants of different ages and sexes should be provided with different health education contents.

"Before health education, we didn't know what inhabitants wanted to learn about. We just asked inhabitants to have knowledge about what we had prepared for them." (L17).

"Health education on cancer was not targeted, and the contents of health education should be different for inhabitants of different age groups." (Y24).

Third, health education provided inhabitants only with knowledge about cancer and not behavioral intervention guidance.

"I believed behavioral intervention programs were more important than theoretical knowledge. However, now, we just asked inhabitants to quit smoking but didn't give them some solutions to achieve it step by step." (L11).

Fourth, the lack of feedback from inhabitants after cancer health education prevented CHWs from implementing targeted improvements.

"To be honest, we just conducted health education on cancer but didn't care whether the inhabitants absorbed it or not." (Y06).

"We just poured the knowledge into the inhabitants, but we didn't know how well they accepted it. Moreover, we didn't investigate changes in inhabitants' knowledge and intentions." (Y08).

Theme 3: low-frequency provision

The low-frequency provision of health education related to cancer is another problem.

First, many items were needed to be prepared for health education, such as education materials and participation gifts. In addition, the shortage of funds limited the amount of health education.

"There were a lot of difficulties. I think the biggest difficulty was the lack of funds. Health education required a wide variety of things, and economic inputs were necessary." (L07).

"The funds were insufficient. We were very economical in health education. It is hard to do the job. It is not easy." (Y11).

Next, a shortage of CHWs relative to the served population was noted. CHWs were overwhelmed by BPHS, which included 49 items in 12 categories. Thus, they had to deprioritize one of the 49 items—health education on cancer.

"As for the frequency of health education on cancer, there were too few CHWs to do it very often." (Y02).

"The amount of health education could still be increased, but it was hard to do that owing to the shortage of CHWs." (Y11).

"Due to the shortage of CHWs, each CHW had to take responsibility for multiple jobs. Even if a work plan was made, it would be changed by other things." (Y20).

In addition, CHWs had difficulty creating materials such as brochures and slides for health education on cancer independently due to a lack of time and ability. Additionally, materials provided by superior institutions such as the CDC and CCP were insufficient.

"We lacked materials for health education on cancer, like PowerPoint." (L07).

"Superior institutions would better distribute more materials about health education on cancer to us." (L01).

Finally, CHWs had little motivation to conduct health education on cancer because of unclear assessment criteria.

"Frankly, health education on cancer was mainly to cope with assessments at present. If it was going to be assessed, we would do it as soon as possible." (L04).

"The regulation of health education related to cancer was unclear. Considering that hypertension and diabetes are prioritized in health education on chronic diseases, we incidentally incorporated cancer knowledge into the health education on hypertension and diabetes." (Y10).

Theme 4: inadequate training

A very high proportion of CHWs were in the nursing profession, and they acknowledged that the profession had limited the ability to provide health education on cancer to a certain extent. Hence, they expected to receive specific training on cancer knowledge and presentation skills.

First, a large number of CHWs failed to have a deep understanding of cancer.

"We lacked theoretical knowledge about cancer, like cancer screening." (Y09).

"Training on cancer prevention should be strengthened to help us learn about the early warning signs of cancer." (Y15).

In addition, more than half of the participants mentioned that increasing the popularity, vividness and interest in health education was difficult.

"I believed it was more important to strengthen communication skills to help inhabitants understand what you had told than to master rich knowledge about cancer prevention and treatment. If you told so much but the inhabitants couldn't understand it, it would make no sense." (L07).

"Some CHWs were nervous when speaking in public, and a number of CHWs just read what they had presented on the slides and hardly interacted with the listeners. That would dampen the enthusiasm of inhabitants to receive health education, and even someone who was originally interested in the content still fell asleep." (L07).

Suggestions

The interviewed CHWs proposed several suggestions in response to the problems in providing health education on cancer.

Theme 1: combining online and offline education

Health education related to cancer should include both online, mainly for young inhabitants, and offline, mainly for elderly inhabitants, formats.

"I thought the best way was to combine online and offline formats. If there was an offline health education program about cancer, it was best to do it online simultaneously so that the inhabitants could choose

offline or online participation according to their own situation." (L19).

"I stated that both online and offline channels were necessary because different groups had different demands. Elderly inhabitants preferred offline formats because they were inclined to engage in face-to-face communication, and they had more free time than young inhabitants. In contrast, young inhabitants would rather learn about the knowledge online than offline because they were too busy." (L31).

"It was difficult for many elderly inhabitants to attend health education online because they were not internet-literate and used non-smartphones." (L04).

Theme 2: health education after screening

Cancer screening is a useful method for achieving early diagnosis of cancer. Health education conducted after cancer screening could attract more inhabitants.

"Inhabitants were more willing to take part in it if there was free screening rather than only health education." (L01).

"I believed it was necessary to combine free screening with health education because screening could not only increase the participation of inhabitants but also help inhabitants detect cancer early." (L15).

Theme 3: cancer plus others

The acceptance of cancer health education increased if it was combined with something that inhabitants were more interested in such as children's health for young inhabitants and hypertension and diabetes for elderly inhabitants.

"We could add something that would interest young inhabitants into health education about cancer, such as children's health." (Y24).

"The knowledge of cancer could be combined with that of hypertension and diabetes. Because the incidence of cancer was not as high as that of hypertension and diabetes, inhabitants were not as interested." (Y20).

Theme 4: health education in the workplace

Cancer health education could be conducted not only in primary health care sectors and residential areas but also in the workplace.

"I felt we could go to institutions or organizations to tell professional inhabitants how to reduce occupational exposure to risk factors for cancer in the future." (L18).

"Many inhabitants were too busy to attend health education. However, we could go to institutions or organizations to pass on cancer knowledge positively." (L11).

"An organization or institution could be regarded as a basic unit to conduct health education. Good effectiveness could be brought in this way." (Y12).

Theme 5: volunteer recruitment

Considering the shortage of CHWs, volunteers could be recruited for health education from schools and elderly associations.

"We could recruit young volunteers to work on cancer health education in the future. Volunteering could become a social practice for students to attract young people." (L10).

"Inhabitants attached little importance to cancer prevention. Case-based peer education may be a good way." (L12).

Discussion

Health education conducted by CHWs is an evidence-based strategy to promote cancer prevention, cancer screening, and adherence to medical guidance from doctors by increasing the cancer knowledge of inhabitants [31]. Unlike in high-income countries, where CHWs are focused mainly on marginalized populations [32], Chinese CHWs provide health education on cancer for all members of the community. Therefore, the potential to generalize and expand health education on cancer in China is high and should be explored further. However, in-depth evaluations of cancer health education have

rarely been reported in China. This study aimed to clarify CHWs' awareness of problems in cancer health education in China and the solutions that they were considering.

Considering the rejection and resistance of some inhabitants to cancer-related contents [33], as well as the shortage and heavy workloads of CHWs [19, 20], health education related to cancer could be combined with that related to other diseases. Young inhabitants might claim that cancer is irrelevant to them because elderly inhabitants are at high risk [34]. However, they attached great importance to their children's health; therefore, health education on cancer for young inhabitants could be combined with that for pediatric diseases. Elderly individuals might be more concerned about hypertension and diabetes due to higher prevalence rates in that population [35–37]. As such, health education on chronic diseases such as cancer, hypertension and diabetes could be carried out simultaneously for elderly inhabitants. In addition to some types of cancer that affect both females and males, other types of cancer affect only females or males [5]. Therefore, health education on cancer that affects only males could be combined with education on andrological diseases, and the same is true for females.

Although the National CCP has compiled systematic health education materials on cancer, such as "Core Information and Key Knowledge Points for Cancer Prevention and Control" and "Guidelines for Cancer Prevention and Screening" (Popular Science Edition), and has developed a National Cancer Prevention and Control Network with modules such as cancer risk assessment, a knowledge base on cancer health education and a training material base for cancer health educators [38], CHWs still report a shortage of health education materials for cancer, possibly because CHWs had to adjust the current health education materials instead of using them directly, such as by adding illustrations and cases and reorganizing, given that they mentioned the demand to create slides and brochures by themselves. In the future, health education materials on cancer developed for CHWs could be presented directly in the form of brochures, posters, leaflets, or slides. Furthermore, the health education materials on cancer needed to be constantly updated and improved according to the demands of inhabitants and best practice principles, which could be grouped into the following categories: content, language, organization, layout and typography, illustrations and cover, and learning and motivation [39].

Our study revealed that health education on cancer was poorly organized by CHWs, while previous studies have demonstrated that factors such as convenience and accessibility, length and frequency, and the characteristics of the setting or organization offering health education could offset the perceived benefits and decrease participation in health education [40–42]. Most inhabitants were willing to allocate only a limited amount of time; therefore, a balance is needed between the length of time necessary to deliver essential information and the convenience and brevity that participants desired to better design effective health education [43]. Our study also showed that health education should be arranged on nonworking days as much as possible, and busy farming seasons should be avoided in rural areas.

Health education must be grounded in evidence-based strategies that have shown effectiveness in promoting behavioral changes and improving health outcomes, and effective health education requires careful planning and consideration of various factors, such as the target population, goals, contents, and delivery methods [44]. Designing systematic and scientific health education programs was difficult for CHWs due to limitations in time and ability. Therefore, we recommend that the National CCP develop guidelines for health education related to cancer. According to guidelines, primary health care sectors could formulate annual plans for health education, including contents, frequency, time, inhabitant coverage, location and participation gifts. Because a number of inhabitants highly value to participation gifts [15], the gifts preferred by inhabitants should be selected within the budget.

Evaluations could provide important data regarding the effectiveness and limitations of health education, and evaluations completed immediately after health education were demonstrated to be effective [43]. Some inhabitants should be randomly selected for evaluation, which could not only avoid the phenomenon that CHWs highlighted—the quantity rather than quality of health education [45]—but also help CHWs improve based on the evaluation outcomes [46]. However, the National CCP has developed an instrument called the Cancer Prevention and Control Core Knowledge Questionnaire to assess changes in cancer knowledge [38]. Moreover, CHWs lack tools for evaluating changes in behaviors and health outcomes in China, which will be an area of future research.

In our study, CHWs mentioned that health education could also be delivered in the workplace, which has four advantages. First, many individuals spend a significant amount of time at work, which makes the workplace a convenient venue for participation in health education [47]. In addition, these changes had positive effects on individuals' health behavior, as validated by another study [48]. Furthermore, CHWs could advise leaders to provide support for employee health by, for example, purchasing cancer screening services and establishing gyms and smoke-free areas, among others. Evidence suggests that health education in the workplace could decrease sick leave [47]. The importance of involving organization leaders in the design and implementation of workplace

health education has been emphasized in a published study [44]. Finally, CHWs could help inhabitants reduce occupational exposure to risk factors for cancer. The Harvard Center for Cancer Prevention estimated that 5% of cancers were caused by occupational exposure to hazards [49]. A causal association has been established between occupational asbestos exposure and mesothelioma and lung cancer [50]. In addition to the workplace, health education could also be conducted at school. Previous studies have shown that health education at school has a significant effect on improving cancer knowledge and awareness among students [51].

Given the shortage of CHWs, a group of volunteers could be recruited to provide health education on cancer. Previous studies have indicated that health education related to cancer provided by well-trained volunteers has positive spillover effects not only on community members but also on the families and friends of volunteers [52]. Students, retirees and cancer survivors are all suitable candidates for volunteers. Volunteering could not only provide a lifelong foundation for students' healthy behaviors by increasing their cancer knowledge and awareness [53] but also improve their ability to organize, coordinate and communicate. For retirees, volunteering could equip them with positive health-related attitudes, promote effective health-seeking behaviors later in life, enrich their retirement life and increase their social participation. Health education provided by cancer survivors could enhance perceived personal relevance [54]. Information perceived as personally relevant was more likely to impact health behavior. For example, smoking cessation advice from lung cancer survivors who used to smoke was more likely to be adopted.

Offline health education was suitable for elderly inhabitants because many elderly inhabitants might have difficulties using online tools, and they preferred the opportunity for health education to communicate with others. However, online health education was primarily tailored for young inhabitants who were busy and proficient in online tools [55]. Considering the shortage and limited capacity of CHWs, online health education on cancer should be provided by national and provincial CCPs in the prevention, detection, diagnosis and treatment categories. To increase authority and credibility, official accounts could serve as a dissemination platform [56]. Additionally, CHWs should have access to sharing such accounts with inhabitants.

Equipping CHWs with adequate knowledge and skills was essential to ensure that their cancer knowledge was communicated effectively, accurately and with sensitivity. The CHWs stated that they demanded training on knowledge and skills, which was consistent with the findings of a previous study [57]. Training on cancer knowledge should consider the relatively low education levels and nursing profession of a number of CHWs [19, 58]. CHWs could be trained to use role stories, jokes, games, analogies, interactive tools such as quizzes, and visual aids such as spoons to measure salt consumption to improve their presentation skills. Role-play activities, which involved a trainee assuming the role of either an inhabitant or a CHW, were also especially useful. Training appeared to be more effective by integrating hands-on practice in community settings rather than just providing classroom learning [59, 60]. In addition to face-to-face training, online training is also a good complement [61]. The access to obtain more cancer knowledge, such as official websites, official WeChat accounts, and official TikTok accounts of national or provincial CCPs, should be delivered to CHWs during training. A trainer could set up a WeChat group for trainees such that they could communicate and discuss any problems faced in health education related to cancer.

Our study had some limitations. First, inhabitants, staff of the CDC and CCP, and relevant government officials who might also contribute to identifying problems and proposing suggestions for health education related to cancer were not included in the study. Second, participants were selected only from Sichuan Province, and the evidence found in the study may not be generalizable to other areas in China.

Conclusion

This study suggested that uncooperative inhabitants, poor organization, low-frequency provision and inadequate training for CHWs were the problems related to cancer health education provided by CHWs in China. CHWs proposed some suggestions to improve the accessibility and acceptability of cancer health education, including combining online and offline education, health education after screening, cancer plus others, health education in the workplace, and volunteer recruitment. Both the problems and suggestions described in the study may provide evidence for health education on cancer and policy-making related to cancer prevention and control. Furthermore, the findings of the study may also provide a reference for the implementation of health education related to cancer in other regions of China or other developing countries.

Abbreviations

CHWs	Community health workers
DALYs	Disability-adjusted life years
BPHSs	Basic public health services
CHCs	Community health centers
THCs	Township hospital centers
AIDS	Acquired immune deficiency syndrome
COREQ	Consolidated Criteria for Reporting Qualitative Studies
GDP	Gross domestic product
CDC	Centers for Disease Control and Prevention
CCP	Centers for Cancer Prevention and Control

Supplementary Information

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Supplementary Material 1.

Supplementary Material 2.

Supplementary Material 3.

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Authors' contributions

WS conceived and designed the study and oversaw the study process. YF and LY served as interviewers. YZ and WQ performed qualitative data analyses. All the authors participated in discussions on the study design and analysis of results. YZ drafted the first version of the manuscript, and WQ, YF and WS critically reviewed and modified the manuscript. All the authors approved the final draft of the article.

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Data availability

The data are not openly available in order to protect the participants' privacy and confidentiality but are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

The study was approved by the Ethics Committee of Sichuan Cancer Hospital (SCCHEC-02-2021-050). All procedures were performed in accordance with relevant guidelines and regulations. Written informed consent was obtained from all study participants.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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