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Development and validation of a physician dialogic risk communication instrument scale in Chinese online medical consultations on cancer treatment risks

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Given the complexity and diversity of risks involved in cancer treatment, physician dialogic risk communication (PDRC), which refers to dynamic, responsive, and interactive communicative expressions that take into account patients' perspectives, concerns, and emotions regarding risks, is gaining increasing prominence. However, there is a gap in the availability of a validated instrument scale to measure PDRC, particularly in the context of online medical consultations (OMCs), which are experiencing global growth with a significant surge in China. PDRC benefits from the accessible, flexible, private, and interactive processes offered by OMCs, which help patients manage treatment risks, monitor for recurrence, and address emotional needs. This study aims to develop and validate a new instrument scale for assessing the PDRC from patients' perspectives in the Chinese OMCs for cancer treatment risk communication. An eight-item instrument scale was developed using the Delphi method, translated into simplified Chinese, and its content and readability were confirmed through expert cross-checks and patient interviews. The scale was subsequently validated with 250 eligible participants from the Chinese mainland. The scale demonstrated high content validity, internal reliability (Cronbach's $\alpha = 0.801$), homogeneity (corrected item-total correlations: 0.430–0.570), and a robust one-dimensional structure (eigenvalue > 1, loadings: 0.563–0.706). Over 90% of participants rated items as critical, with three items deemed 'very important' significantly more often. This study contributes to physician-patient communication literature and risk communication practices. Researchers could use this scale to evaluate the adherence of OMCs to PDRC as a physician communication quality indicator, adapt it for linguistically and culturally diverse populations, and apply it to guide physicians in addressing patient concerns through dialogic and patient-centered communication across online healthcare settings. Physicians can refer to the scale to enhance their communication skills during OMCs, foster patients' positive psychological outcomes, and encourage patients' proactive behaviors in cancer care and beyond.

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Introduction

In cancer treatment decision-making, it is crucial for both patients and physicians to carefully evaluate the risks associated with various treatment options, such as chemotherapy, radiation, and immunotherapy (Collins and Street Jr 2009). These treatments come with potential risks that can profoundly influence both the physical and emotional well-being of patients (McDermott 2008; Rizvi et al. 2018; Ward and Evans 2020). The prognosis for cancer varies based on the cancer type, stage, and patient-specific factors, adding complexity to risk management (Gagliasso et al. 2017; Miller et al. 2019). Effective risk communication by physicians is thus essential to stabilize patients' emotions and facilitate informed decision-making (Elwyn et al. 2012; Williams et al. 2017).

Risk communication in cancer treatment contexts involves discussions about the acceptability of treatment risks, primarily through the transmission of statistical data from physicians to patients (Klein and Stefanek 2007; Thorne et al. 2006). However, this communication style may lead to misunderstandings, with patients misinterpreting clinical risks and physicians underestimating patients' perspectives (Rowan et al. 2003; Rowan et al. 2020). Physicians often use analytic reasoning, whereas patients may prefer experiential reasoning, leading to a disconnect in decision-making (Hunt et al. 2006; Slovic et al. 2005). To address this, Collins and Street Jr (2009) proposed a dialogic model of risk communication, emphasizing an interactive and contextual communication process that aims for mutual understanding and informed, quality decisions. Inspired by shared decision-making theories (Charles et al. 1999; Epstein et al. 2005), the model outlines five functions of dialogic risk communication that offer a structured approach for integrating physician and patient perspectives into the decision-making process. These functions include: "Defining the nature of the risk," "Clarifying the conversation's goal," "Describing risk perspectives," "Managing and prioritizing differences in risk perspectives," and "Making a decision" (Collins and Street Jr 2009). Specific communicative actions associated with each function are also outlined to facilitate a dialogic process that improves mutual understanding and decision-making.

The conceptualization of Physician Dialogic Risk Communication (PDRC) in this study is underpinned by this model. The model inherently integrates both physician and patient perspectives; however, it recommends that physicians take a proactive role in initiating and promoting dialogic risk communication. This recommendation is based on the understanding that power imbalances and time constraints inherent in clinical environments may discourage patient engagement (Collins and Street Jr 2009; Lu et al. 2024; Zhang 2022). Patients, often burdened by concerns and unaware of the significance of their involvement, might be reluctant to engage actively. By taking a proactive role in initiating the dialogic risk communication, physicians can facilitate a more inclusive and comprehensive exchange of perspectives for informed decision-making about risks in cancer treatments.

The differences between PDRC and traditional risk communication

PDRC diverges from traditional risk communication which typically features a unidirectional flow of information from physicians to patients. Traditional risk communication often fails to integrate physicians' analytical reasoning with patients' experiential perceptions (Rowan et al. 2020; Thorne et al. 2006). In contrast to the linear, simple sender-receiver communication mode, PDRC facilitates a bidirectional and participatory dialogue that not only involves the mutual clarification of risks but also actively incorporates patient perspectives into the decision-making process (Collins and Street Jr 2009; Epstein and Gramling 2013; Kennedy et al. 2017).

The specific mechanisms of PDRC include (1) mutual clarification of risk perceptions. PDRC emphasizes the importance of physicians actively eliciting and clarifying patients' understanding of risk before offering medical advice (Collins and Street Jr 2009; Hunt et al. 2006). This is not a passive acknowledgment but a deliberate effort to explore how patients perceive and prioritize risks based on their personal values and emotional state. For example, a cancer patient may worry excessively about the immediate side effects of chemotherapy, such as hair loss or nausea, and consider refusing treatment, while the physician focuses on the long-term benefits, such as reducing the likelihood of cancer recurrence. Through reflective dialogue, the physician can explore the patient's concerns, validate their fears, and explain how managing short-term side effects may lead to long-term health benefits; (2) negotiation and reconciliation of perspectives. Unlike traditional risk communication, PDRC makes efforts for reconciling conflicting views between physicians and patients (Collins and Street Jr 2009; Street Jr 2007). For instance, a cancer patient may prioritize maintaining their energy and quality of life in the short term, while the physician emphasizes the importance of aggressive treatment to achieve long-term remission. Through PDRC, the physician can validate the patient's desire for comfort, discuss potential compromises (such as adjusting treatment intensity), and collaboratively arrive at a plan that balances both short-term and long-term priorities; (3) personalized communication strategies. PDRC incorporates practices that adapt communication to the patient's level of health literacy and emotional readiness (Kennedy et al. 2017; Legare et al. 2018). For example, using plain language to explain the risks of chemotherapy to a patient with limited medical knowledge, or employing empathetic expressions to address a patient's anxiety about potential side effects, helps the patient actively participate in the discussion and makes the information more accessible and meaningful; (4) iterative and dynamic interaction. PDRC emphasizes that risk communication is not a one-time event but an ongoing process that evolves as the patient's understanding and concerns change (Epstein and Gramling 2013; Legare et al. 2018). For example, a patient undergoing cancer treatment may initially focus on short-term side effects like fatigue, then later shift attention to long-term risks such as recurrence or survival. Physicians revisit discussions at different stages to address new priorities, reinforce critical information, and keep the communication relevant to the patient's changing needs.

Consider a PDRC example in which a physician begins the consultation with a greeting and encourages patients to ask questions about their concerns regarding risks in cancer treatments. Following this, the physician actively listens, clarifies the purpose of different cancer treatments, discusses the potential risks associated with these treatments, and reflects on patients' input while checking for understanding. In contrast, traditional risk communication might unfold as follows: A patient presents a list of questions or concerns about risks, to which the physician responds with only general or statistical information, neglecting to address specific concerns or to invite further input from the patient. The physician's responses are authoritative and do not promote a cooperative dialogue. An example of such a response might be, "Please follow the standard treatment protocol," delivered without explaining the rationale for the recommendation or asking if the patient understands or has concerns about this treatment and the risks associated with it. Therefore, PDRC is not merely about politeness, acknowledging questions, or exchanging messages; it involves deeply understanding and

integrating the patient's perspectives, needs, and concerns into the medical advice provided about risks. The dialogic nature of the interaction, whether the patient poses many questions or few, is defined by how these inquiries are addressed and incorporated into the overall care process.

PDRC and online medical consultations

Previous studies show that PDRC-related practices improve patient satisfaction, strengthen doctor-patient relationships, and increase adherence to treatment protocols (Crowe et al. 2011; Daack-Hirsch et al. 2020; Fenton 2019; Kennedy et al. 2017). However, traditional face-to-face consultations might not sustain the benefits of PDRC due to time constraints, physician workload, and inherent power imbalances in clinical settings (Lu et al. 2024; Zhang 2022). With advancements in Internet healthcare technologies and online medical services, online medical consultations (OMCs) have emerged as a viable alternative to enable continuous dialogic interactions that transcend geographical barriers and offer cost-efficient follow-up care (Farias et al. 2017; Lu et al. 2024; Pang et al. 2022). OMC refers to "online, Internet, or web-based medical consultations between a doctor/physician and a patient in which medical services are provided, such as medical advice, information, assessment, diagnosis, treatment, prescription, and appointment scheduling" (Lu et al. 2024, p.2). OMCs serve as a complement to traditional healthcare by mitigating access barriers inherent in in-person services (Lu et al. 2024; Zhang 2022). This adaptation particularly benefits distinct patient groups, such as older adults, individuals with disabilities, chronic pain sufferers, and residents of rural areas (Jiang 2019).

PDRC benefits from the OMC due to its accessible, flexible, private, and interactive communication processes. These attributes allow patients to manage their treatment risks, monitor for recurrence, and address their emotional needs more effectively (Hasson et al. 2021; Lu et al. 2024; Jiang 2019). The flexibility of OMCs facilitates timely and convenient communication, mitigating the logistical challenges often associated with traditional clinical visits. Privacy in OMCs fosters more open and personalized dialogues, enabling patients to discuss sensitive issues without the discomfort that might be present in face-to-face settings. The interactive nature of OMCs supports continuous engagement and follow-up, which are essential components of effective PDRC. Patients can ask questions, seek clarifications, and receive timely responses, which strengthen their understanding and compliance with treatment plans. Despite these benefits, the effectiveness of PDRC in OMCs faces challenges due to its inherent differences in communication dynamics compared to in-person interactions. The absence of non-verbal cues and physical presence can hinder the development of trust and rapport, while technical issues and varying levels of digital literacy among patients can impact the quality of interactions. Therefore, evaluating the quality of PDRC within OMCs is instrumental in identifying potential challenges and facilitating the realization of personalized, patient-centered communication within the digital landscape of risk communication. Feedback on PDRC practices in OMCs also empowers healthcare providers to foster their communication skills to better meet patient needs and improve healthcare outcomes.

Research aim and context

Our extensive literature review reveals a notable gap: there exists no validated scale for measuring PDRC, including both face-to-face and online settings across any medical contexts. Furthermore, no instrument validated from the patients' perspective has been found. Following the UK National Institute for Health and Care Research (2022), this study defines "patients" broadly, including current, former, and potential patients, carers, and users of health and social care services, along with their representatives. Given that patients are fundamental to medical consultations, it is essential to develop a scale that can be used to evaluate PDRC from their perspective for meeting their expectations, ultimately facilitating the physician-patient interactions on cancer treatment risks.

This study aims to develop and validate an instrument scale for PDRC from the patient perspective, focusing on OMCs concerning cancer treatment risks in China. Considering the substantial cancer burden in China, approximately 4.57 million new cases in 2020 accounting for 23.7% of the global total (International Agency for Research on Cancer 2020), and aligning with the National Cancer Center's 'Healthy China Initiative 2030' that advocates for online health education and cancer risk assessments, the utilization of OMCs in China is increasing (Sun et al. 2022). This growth is accompanied by an uptick in the number of registered physicians and the frequency of discussions regarding cancer treatment risks on Chinese OMC platforms (China Internet Network Information Center 2017; Li et al. 2019). A PDRC instrument scale specifically validated for the Chinese OMC context is highly warranted. Such an instrument would enable precise evaluations of PDRC within the Chinese healthcare context and facilitate the efficacy of cancer treatment risk communication in online platforms.

In China, prominent online platforms such as Haodaifu, Chunyu Doctor, and Left Hand Doctor primarily utilize text-based communication as the principal mode of interaction in OMCs (Zhang 2020). Unlike video and voice communication, text-based messages on these Chinese OMC platforms are generally accessible to the public and readily available for online users (Lu et al. 2024). This openness facilitates diverse and contextually rich discussions on OMC platforms, prompting researchers to delve into the nuances of OMC characteristics and the dynamics of physician-patient communication (Zhang 2022). Furthermore, asynchronous text-based communication holds significant value alongside synchronous face-to-face verbal interactions. Studies have shown that participants in online asynchronous text-based interactions often exhibit more interpersonal affective expressions compared to face-to-face interactions (e.g., Walther et al. 2005). In this regard, texts are deemed crucial for affective engagement within OMC contexts (Zhang 2022). Accordingly, this study aims to develop and validate a PDRC instrument scale specifically designed for text-based Chinese OMC environments.

Materials and methods

Theoretical underpinnings for developing the PDRC instrument scale. The PDRC instrument scale is underpinned by the dialogic risk communication model, which is influenced by shared decision-making theories (Collins and Street Jr 2009). Shared decision-making theories advocate for active patient involvement in care decisions, aiming for informed, mutual decisions and a collaborative relationship between physicians and patients (Charles et al. 1999; Epstein et al. 2005). Building on this foundation, the study aims to develop a PDRC instrument scale that integrates elements from both the model and established shared decision-making measurement tools. Notably, Braddock et al. (1997) developed the Informed Decision-Making instrument to evaluate shared decision-making across diverse medical settings. Weiss and Peters (2008) subsequently improved this tool by incorporating additional items suitable for general practice. In a similar vein, Elwyn et al. (2003) in Wales designed the Observing Patient Involvement instrument scale, which specifically targets physician behaviors that support shared decision-making,

including defining problems, presenting options, and leading the decision-making process, all of which closely align with the principles of dialogic risk communication. The development of the PDRC instrument scale comprises three critical phases: firstly, merging the measurement items from the Informed Decision Making instrument and the Observing Patient Involvement-5 scales with communication behaviors identified in the dialogic risk communication model to produce newly-developed measurement items; secondly, translating these items into Chinese; and thirdly, identifying their efficacy for assessing PDRC within the context of Chinese OMCs on cancer treatment risks.

Ethical considerations. Permission was granted by Professor Richard Street Jr, a co-creator of the dialogic risk communication model, to proceed with the development and translation of the PDRC instrument scale. This study was approved by the Institutional Review Board of the Hong Kong Polytechnic University (Ref.HSEARS20230527002). The development and validation procedures for the scale adhered to the research protocols utilized in previous studies (Chang and Schulz 2018; Kwong and Tsang 2021; Lamm et al. 2020).

The confirmation of measurement items in the Chinese PDRC instrument scale

The development of the English PDRC instrument scale. Given that the development of the PDRC scale was underpinned by the Informed Decision-Making instrument and the Observing Patient Involvement-5 scales, as well as the dialogic risk communication model, all of which are in English, the English version of the PDRC instrument scale was developed first. Its face and content validity was assessed using the Delphi method. We employed a four-step methodological process (Nasa et al. 2021) recognized in healthcare research for implementing the Delphi method, including (1) identifying the problem area, (2) selecting panel members, (3) conducting Delphi rounds, and (4) establishing closing criteria.

The objective of the study was to develop and validate the PDRC instrument scale to assess patients' perspectives on PDRC in OMCs concerning cancer treatment risks. The focus was driven by the growing importance of PDRC as an innovative communication skill in cancer care research and practice. An extensive systematic literature review by the authors was conducted prior to initiating the study, which revealed that existing knowledge of standard PDRC competencies remains incomplete and that validated assessment tools are lacking in the context of OMCs related to cancer treatment risks. The identified problem area was discussed within a steering group comprising the authors and two healthcare researchers, who collectively determined the necessity of conducting this study. The process was explicitly communicated to all expert panel members before the start of the Delphi rounds to maintain clarity and transparency throughout the study.

The selection of expert panel members was guided by our predefined objective to uphold both expertise and relevance to the study's focus. Four experts were invited to participate in the Delphi process. This number of experts is considered acceptable in healthcare studies, particularly when the research problem requires detailed input from highly specialized individuals (Armstrong et al. 2005; Gunawan et al. 2021). Each expert was selected based on extensive knowledge and experience in healthcare communication and research. The panel included: a professor specializing in social research in health, an associate professor with expertise in health communication, an associate professor knowledgeable in digital physician-patient interactions, and an experienced clinician with a focus on patient care. The first three experts contributed ideas from an academic perspective, while the fourth member, a clinician, provided practical insights from clinical practice. While the panel was homogenous in its focus on healthcare communication, it incorporated diversity in academic, clinical, and regional perspectives, which strengthened the credibility and applicability of our findings.

Two rounds of structured surveys and interviews were carried out to develop and refine the PDRC instrument scale. In the first round, the experts were provided with an information sheet via email detailing the study's objectives, the conceptualization of PDRC, the dialogic risk communication model, the Informed Decision-Making instrument, the Observing Patient Involvement-5 instruments and an example of PDRC as demonstrated in text-based OMCs, along with an explanation of non-PDRC (refer to Appendix 1 for the examples and their illustrations). All of the information was provided to facilitate the understanding of PDRC and to differentiate it from other types of risk communication. The experts were asked to evaluate the preliminary measurement items (using Yes/No inclusion for each item) and provide open-ended feedback, including reasons for inclusion or exclusion, as well as suggestions for modifications or additions. Their responses were anonymized, compiled, and analyzed by the authors to identify areas of agreement and disagreement. In the second round, controlled feedback was provided to the experts through anonymized written summaries (e.g., the average agreement rate for each selected item and the main reasons for inclusion or exclusion of relevant terms) to highlight areas of consensus and divergence, enabling the experts to reconsider their positions and refine their responses. Subsequently, the authors conducted individual discussions with each panelist to deliberate on contentious items, continuing until consensus was achieved. Response stability was assessed by comparing the results of the two Delphi rounds to confirm that the consensus was stable and not subject to significant variation.

After two rounds of Delphi surveys, the panel reached complete agreement that the PDRC instrument should either be adapted from or employ the Observing Patient Involvement-5 instrument, rather than the Informed Decision-Making instrument, as the latter is neither specific nor behavior-oriented. Subsequently, the experts recommended incorporating three supplementary items adapted from the dialogic risk communication model, which do not replicate or overlap with those already present in the Observing Patient Involvement-5 instrument. In adherence to copyright and intellectual property regulations related to the use of the Observing Patient Involvement-5 instrument, permission was obtained from Professor Glyn Elwyn, one of the developers of the instrument. Professor Elwyn consented to its application and advised employing its original English and Chinese versions without alterations. Considering this and the expert panel's determination, a total of eight items in English were determined for the PDRC instrument scale. Three of these items were drawn from the dialogic risk communication model, while five items were derived from the Observing Patient Involvement-5 instrument. Subsequently, the experts were requested to evaluate different components of a questionnaire to be disseminated among eligible participants, including the questionnaire title, instructions, rating scale, and the eight PDRC items, regarding their relevance. These were rated by each expert as (1) not relevant, (2) somewhat relevant, (3) moderately relevant, (4) highly relevant or (5) absolutely relevant. These relevance ratings enable the calculation of indices that assess the face and content validity. The item-level content validity index (I-CVI), scale-level content validity index based on the average method (S-CVI/Ave), and scale-level content validity index based on the universal agreement method (S-CVI/UA) were computed as demonstrated by Yusoff (2019). All experts rated each

component as highly relevant or absolutely relevant. I-CVI value of 1.00 was found in all components of the PDRC (English) instrument scale. Scale-level CVIs were computed based on the relevance rating of the eight items. S-CVI/Ave and S-CVI/UA were found to be 0.963 and 1 respectively.

Translation of the English PDRC instrument scale into the Chinese version. After confirming the face and content validity of the English PDRC instrument scale, its adaptation for specific use in Chinese OMCs concerning cancer treatment risks is needed. The traditional Chinese version of the Observing Patient Involvement-5 instrument was initially adopted in this study. Given the present study focuses on the Chinese mainland, this version was converted to simplified Chinese without altering the original meanings to ensure clarity and ease of comprehension. A translator, highly experienced in English-Chinese translation, translated the three English items developed from the dialogic risk communication model into simplified Chinese. Another translator with extensive professional expertise in English-Chinese translation performed a back-translation of the simplified Chinese version into English to verify accuracy and consistency.

Face and content validity of the Chinese PDRC instrument scale. The original English items and the back-translated English items were crosschecked by an associate professor with substantial research experience in communication and translation studies to pinpoint any discrepancies. Differences identified were collaboratively addressed by the authors and the associate professor to ensure cultural suitability. Modifications were made to the Chinese version of the PDRC scale to improve its consistency, accuracy, and readability for use in OMCs related to cancer treatment risks. The face validity of this revised Chinese version was confirmed. The revised instrument scale was distributed to 20 individuals who had previous experience in Chinese OMCs, all over 30 years old and holding at least bachelor's degrees. These recruited participants, who were friends or relatives of the authors, provided feedback through online individual interviews. They assessed the comprehensibility of the scale, pinpointed any challenges in understanding, and suggested improvements. This input, coupled with ongoing discussions within the translation team, informed further revisions to the format, sentence structure, and vocabulary of the scale for optimizing its readability and precision. See Appendix 2 for the final measurement items of the developed Chinese PDRC instrument scale along with its English version. Following guidance from the developer of the Observing Patient Involvement-5 instrument and feedback from participants, it was decided that the PDRC instrument would utilize a 6-point response scale, ranging from 1 ('No effort') to 5 ('Exemplary effort'), with an additional option of 6 ('Does not apply').

Content of the questionnaire for validating the Chinese PDRC instrument scale. In addition to the consent form and related introduction (e.g., the detailed explanation of PDRC and the examples of PDRC), the questionnaire consists of the developed Chinese PDRC instrument scale followed by asking about the participants' opinions on the importance of each of the developed items according to their previous experience. This section is answered using a 5-Likert scale ranging from "very important" to "very unimportant". Participants were also asked to provide demographic and socioeconomic status information, including age, gender, marital status, educational degree, employment and monthly income. Furthermore, the questionnaire collects information regarding the frequency of cancer treatment-related OMCs, the time period when participants had their last time cancer treatment-related OMCs, the OMC platform used last time, and the type of communication with their physicians last time. Data were also gathered on the perceived importance of PDRC to OMCs concerning cancer treatment risks and its potential improvements. These content sections were previously used in related research, discussed among the expert panel and further modified by the authors to align with the research objective in this study.

Participants recruitment and data collection for the validation. The platform WenJuanXing (WJX) was chosen for participant recruitment in this study due to its established credibility and extensive use in academic research (Cheng et al. 2022; Lin and Lan 2023; Na et al. 2022). WJX has over six million members, with a balanced gender distribution and comprehensive geographic coverage across China. Its diverse membership base across various occupations renders it ideal for representing a wide range of research subjects. WJX has supported over 2000 studies in the Chinese academic context (Zheng and Zheng 2014), with more than 258 million questionnaires distributed as of January 2024.

For robust factor analysis, literature recommends a minimum of 200 subjects (Comrey 1988; Hair et al. 2010). Given the specific focus on patients experienced with cancer treatment risk-related OMCs in this study, a sample size between 200 and 300 is considered adequate to balance resource and time constraints (Gunawan et al. 2021). Both Exploratory Factor Analysis and Confirmatory Factor Analysis (CFA) also suggest that a sample size of 200 to 300 is sufficient for essential analyses (Hair et al. 2010). Previous validations in psychology, education, and healthcare have also successfully used 200 to 300 participants for scale validation (Charman et al. 2004; Costello and Osborne 2005; Tran 2014).

For this study, it was required that participants have relevant OMC experience concerning cancer treatment risks in China and could clearly recall their last OMC experience, as their ratings on the developed PDRC measurement items were based on their most recent OMC concerning cancer treatment risks. This was confirmed through a detailed screening process that included questions about their internet activities, specific experiences with cancer, and recall of cancer treatment topics discussed during their most recent OMCs. Participants self-reported their experience with cancer-related consultations, either for themselves, their families, or friends. Given that this study emphasized the physician's role in OMCs, it was not necessary for all participants to be cancer patients; having prior experience with cancer-related consultations was sufficient. Participants were authenticated using real-name and mobile number verification. An official statement from WJX confirming the eligibility of participants was provided to the authors. Participants were briefed with a consent form and an information sheet to ensure informed participation. To address potential issues with disqualified or incomplete responses, WJX was instructed to recruit a minimum of 200 participants. Ultimately, a total of 263 individuals were recruited, each compensated Chinese RMB 14 upon completing the questionnaire.

Statistical analysis. All statistical analyses for the study were conducted using IBM SPSS Version 27.0 (IBM SPSS Statistics, Armonk, NY: IBM Corporation), with the significance level set at 0.05. Missing values in the PDRC measurement items from participants' responses were planned to be addressed through item mean imputation. Percentage frequency distribution was employed to evaluate the perceived importance of each item. A

Table 1 Demographic and socioeconomic status characteristics of recruited participants.

	n (%)		*n* (%)
Gender		Occupation	
Male	100 (40.0)	Student	3 (1.2)
Female	150 (60.0)	Business personnel (e.g., working in the state-owned, foreign and private enterprises)	178 (71.2)
Age group		Public institution staff or civil servants	63 (25.2)
18–25 years	18 (7.2)	Not employed/retired	3 (1.2)
26–30 years	89 (35.6)	Others	3 (1.2)
31–40 years	117 (46.8)	Educational level	
41–45 years	14 (5.6)	Senior Secondary Education level or below	8 (3.2)
>45 years	12 (4.8)	College's Diploma	16 (6.4)
Marital status		Bachelor's Degree	199 (79.6)
Single	33 (13.2)	Master's Degree	27 (10.8)
Married	216 (86.4)	Online medical consultation (OMC) frequency	
Divorced	1 (0.4)	Seldom	51 (20.3)
Widowed	0	Sometimes	136 (54.2)
Monthly income (RMB)		Often	63 (25.1)
<3001	6 (2.4)	Perceptions on whether physician dialogic risk communication (PDRC) is crucial in OMCs	
3001–5000	16 (6.4)	Yes	245 (97.6)
5001–10000	106 (42.4)	No	5 (2.0)
10000–20000	103 (41.2)	Perceptions on whether PDRC in prevalent in OMCs	227 (90.4)
		Yes	
>20000	19 (7.6)	No	23 (9.2)

Chi-Square Goodness-of-Fit Test then tested if the proportion of responses categorized as "very important" was significantly different across the items. The Mann–Whitney Test and the Kruskal–Wallis Test were utilized to explore the relationships between overall PDRC scores, participants' characteristics, and their other responses. Face validity was assessed by the number of "does not apply" responses for each item, participants' ratings of item importance, and their feedback on whether the items adequately represented PDRC in Chinese OMCs on cancer treatment risks. Cronbach's alpha coefficient was calculated to determine the internal consistency of the scale. Homogeneity was examined through corrected item-total correlations, with values above 0.20 indicating high homogeneity (Crosta Ahlforn et al., 2017). For construct validity, principal component analysis (PCA) was conducted to analyze the dimensional structure of the scale, identifying factors based on an eigenvalue > 1.0 and factor loadings above 0.5 (Hair et al. 2010). CFA was performed to test the fit of a one-factor model representing PDRC. Model quality was evaluated using global fit criteria, including RMR (≤ 0.05), SRMR (≤0.1), TLI (≥ 0.90), NFI (≥ 0.90), CFI (≥ 0.95), IFI (≥ 0.90), and RFI (≥ 0.90) (Byrne 1994; Hu and Bentler 1999).

Results

A total of 263 participants meeting the authors' specified criteria were recruited by WJX, out of which the questionnaire was completed by 250 participants with a response rate of 95.1%. Incomplete responses were primarily due to insufficient financial incentives, amount of time required, the complexity of questions, and issues with internet connectivity. Nevertheless, the response rate achieved is regarded as satisfactory.

Participant demographic and socioeconomic characteristics. As shown in Table 1, of the 250 study participants, 100 (40%) are male and 150 (60%) are female. Participant age ranges from 18 to over 45 with the 31–40 years aged group accounting for the most (46.8%). Participants are mainly married (86.4%) and more than 42% of them receive a monthly income from Chinese RMB5001 to RMB10,000. A total of 241 out of the 250 (96.4%) work in the business area or public institutions. Nearly 80% of them have obtained a bachelor's degree. 54.2% of participants had OMCs sometimes and 25.1% of them consulted physicians online quite often. 97.6% of participants believed that the PDRC is crucial in cancer treatment-related OMCs. 90.4% assumed that PDRC is prevalent in the OMCs.

Participant last time OMC characteristics. One out of seven participants had their last time OMCs within 1–7 days. One fourth of the participants attended their OMCs last time within 7–14 days. Only 8% of them reported that their last time OMCs occurred within one year. All of participants confirmed that risk-related issues were involved or discussed in their last time OMCs concerning cancer treatment. The participants engaged in the OMCs primarily for their families (58.8%), followed by friends (30%), and themselves (10.8%). The vast majority of the participants consulted their online physicians last time via text-based messages (92.8%), followed by picture (71.2%), voice (51.2%), and video (40.4%). The top OMC platforms participants used last time were Baidu Doctor (33.2%), Haodaifu Online (31.2%), Dingxiang Doctor (22%), Chunyu Doctor (8.4%) and PingAn Good Doctor (1.2%). See Table 2 for the details.

Importance of the individual Chinese PDRC measurement items. All participants completed the perceived importance of the measure items and no missing data was found. More than 92% of them felt that each of the PDRC items was important to their OMCs ("very important", "important", and "mildly important"). Items 1, 2, and 3 were rated the highest (≥93.5% supported their importance). Items 8 had the lowest ratings but was still considered to be important by 87.6% of participants. Only approximately 7.4% of participants in average rated the items as "unimportant" and "very unimportant". The proportions of "very important" differ by items, X^2 (7, $N = 689$) = 38.118, $p < 0.001$). Item 2 ($N = 106$), Item 3 ($N = 109$) and Item 7 ($N = 103$) were rated "very important" significantly higher than the other items. See Table 3 for the participants' perceived importance of the measurement items.

Associations between individual differences and overall PDRC scores. The overall PDRC scores were acceptably normally distributed (Skew = −0.74, Kurtosis = 1.24). The mean

Table 2 Last time OMC characteristics of recruited participants.

	n (%)		*n* (%)
The time frame of your most recent OMC regarding cancer treatment		**The medium through which you had last time OMC (multiple choice is acceptable)**	
Within 1–7 days	36 (14.4)	Text	232 (92.8)
Within 7–14 days	63 (25.2)	Video	101 (40.4)
Within 14–30 days	68 (27.2)	Voice	128 (51.2)
Within half a year	63 (25.2)	Picture	178 (71.2)
Within one year	20 (8.0)	Others	0 (0%)
Who was the last OMC regarding cancer treatment for		**The platform where you had last time OMC**	
Self	27 (10.8)	PingAn Good Doctor	3 (1.2)
Family	147 (58.8)	Haodaifu Online	78 (31.2)
Friends	75 (30.0)	Baidu Doctor	83 (33.2)
Others	1 (0.4)	Dingxiang Doctor	55 (22.0)
Did your last OMC regarding cancer treatment involve or mention topics or content related to risk?		Chunyu Doctor	21 (8.4)
Yes	250 (100)	Huayitong	1 (0.4)
No	0	Good Doctor app	2 (0.8)
		Jingdong Health	4 (1.6)
		Yongyou Smart Healthcare Platform	1 (0.4)
		Cancer 123	1 (0.4)
		Doctor Deng	1 (0.4)

Table 3 Participants' perceptions on the importance of the individual Chinese PDRC measurement items.

PDRC measurement item	Very important	Important	Mildly important	Unimportant	Very unimportant
	n (%)				
Item 1	63 (25.2)	155 (62.0)	18 (7.2)	11 (4.4)	3 (1.2)
Item 2	106 (42.4)	103 (41.2)	25 (10.0)	9 (3.6)	7 (2.8)
Item 3	109 (43.6)	91 (36.4)	34 (13.6)	10 (4.0)	6 (2.4)
Item 4	86 (34.4)	124 (49.6)	22 (8.8)	11 (4.4)	7 (2.8)
Item 5	48 (19.2)	128 (51.2)	55 (22)	14 (5.6)	5 (2.0)
Item 6	92 (36.8)	104 (41.6)	37 (14.8)	12 (4.8)	5 (2.0)
Item 7	103 (41.2)	100 (40.0)	30 (12.0)	10 (4.0)	7 (2.8)
Item 8	83 (33.2)	94 (37.6)	42 (16.8)	23 (9.2)	8 (3.2)

Table 4 Chinese PDRC measurement scores.

PDRC measure item	Poor (%)	Fair (%)	Good (%)	Very good (%)	Excellent (%)	Does not apply (%)
Item 1	0 (0)	14 (5.6)	64 (25.6)	128 (51.2)	44 (17.6)	0
Item 2	1 (0.4)	9 (3.6)	54 (21.6)	107 (42.8)	79 (31.6)	0
Item 3	1 (0.4)	15 (6.0)	72 (28.8)	100 (40.0)	62 (24.8)	0
Item 4	1 (0.4)	10 (4.0)	64 (25.6)	103 (41.2)	72 (28.8)	0
Item 5	1 (0.4)	18 (7.2)	67 (26.8)	113 (45.2)	51 (20.4)	0
Item 6	3 (1.2)	10 (4.0)	54 (21.6)	102 (40.8)	81 (32.4)	0
Item 7	1 (0.4)	12 (4.8)	49 (19.6)	109 (43.6)	79 (31.6)	0
Item 8	2 (0.8)	15 (6.0)	65 (26.0)	105 (42.0)	63 (25.2)	0

overall score was 31.2 ± 4.5 (range: 8–40). 50.4% of consultations were given at least 32 scores by participants and 0.8% of them rated the maximum score of 40. An average of 0.5% of participants recording "poor" and 24.5% for "good" scores. Up to an average of 26.6% recording "excellent", ranging from 32.4% for item 6 to 17.6% for item 1. No evidence of any floor or ceiling effects was found. See Table 4 for the Chinese PDRC each item score. The overall scores were statistically higher in the participants' response that PDRC has met expectations (mean rank = 32.39) than the response that PDRC should be further improved (mean rank = 29.94) ($U = 10091.5$, $p < 0.0001$). Likewise, a significant association was noted in participants' OMC frequency, $X^2(2) = 55.668$, with seldom consultations having a lower score (mean rank = 29.06) than sometimes consultations (mean rank = 31.46) and often consultations (mean rank = 32.48) ($p < 0.01$). No more significant associations were identified between the overall scores and other participants' characteristics.

Reliability and validity of the Chinese PDRC instrument scale. The face validity of the Chinese PDRC instrument scale was supported by the high perceived importance rates of the measurement items, the high selection rate of "yes" on the response "if these items well present the PDRC in Chinese OMCs concerning cancer treatment risks", no significant associations identified between participant socio-demographics and overall PDRC scores, and no missing data for the PDRC assessment. As shown in Table 5, the Cronbach's alpha coefficient of 0.801 indicated a high and reliable internal consistency for the Chinese

Table 5 Reliability, homogeneity, PCA, and CFA results for the Chinese PDRC instrument scale.

PDRC measurement item	Scale mean if item deleted	Corrected item-total correlation	Cronbach's alpha if item deleted	PCA factor loadings
Item 1	27.42	0.57	0.771	0.706
Item 2	27.21	0.557	0.772	0.695
Item 3	27.4	0.536	0.775	0.674
Item 4	27.28	0.509	0.779	0.65
Item 5	27.44	0.43	0.791	0.563
Item 6	27.23	0.501	0.78	0.631
Item 7	27.21	0.455	0.787	0.586
Item 8	27.38	0.536	0.775	0.669
Kaiser-Meyer-Olkin test		0.849		
Bartlett's test of sphericity				
Bartlett's $\chi 2$		456.196		
Degree of freedom		28		
Significance (P)		<0.001		

Goodness of fit indicators by CFA: Root Mean Squared Residual (RMR) = 0.031; Standardized Root Mean Squared Residual (SRMR) = 0.031; Tucker-Lewis Index (TLI) = 0.939; Normed Fit Index (NFI) = 0.916; Comparative Fit Index (CFI) = 0.956; Incremental Fit Index (IFI) = 0.957.

PDRC Instrument scale. When any of the items were deleted, slight reductions in Cronbach's alpha were identified. Corrected item-total correlations ranged from 0.430 to 0.570, exceeding the cut-off value of 0.2 suggested by prior literature (Crosta Ahlforn et al. 2017), indicating high homogeneity. PCA with varimax rotation and Kaiser normalization was performed, extracting only one component with an eigenvalue greater than 1. Thus, the eight items of the Chinese PDRC Instrument scale measured a single factor. The Kaiser-Meyer-Olkin measure was 0.849, and Bartlett's test of sphericity showed $X^2 = 456.196$, $p < 0.001$, confirming the validity and sampling adequacy of the data. All PDRC items loaded on one factor with loadings ranging from 0.563 to 0.706, suggesting the measure possesses an acceptable and stable one-dimensional internal structure. A one-factor model met the criteria for excellent goodness of fit as indicated by the following fit indices: RMR = 0.031, SRMR = 0.031, TLI = 0.939, NFI = 0.916, CFI = 0.956, IFI = 0.957. The null hypothesis of the chi-square test was rejected ($X^2 = 30.023$, $p = 0.007$), suggesting an adequate fit of the data with the one-factor model.

Discussion and conclusions

Discussion. The aim of the present study is to examine the reliability and validity of the newly-developed Chinese PDRC instrument scale in OMCs concerning cancer treatment risks. We achieved this by collecting responses on 250 eligible participants who had experience attending OMCs of cancer treatment in China. No significant differences were found in varied age, gender, marital status, educational level, monthly income, occupation groups for the overall PDRC scores. Participants were satisfied with the PDRC manifested in their last time OMCs, reflected in the high scores on the overall PDRC scores. The high internal reliability and corrected item-total correlation values indicate the adequate internal consistency and homogeneity of the scale. The PDRC items meet the criteria of excellent goodness of one-factor model fit by CFA, which suggests that the items measure the same factor, supporting the construct validity of the scale. The PCA results also confirm that the scale maintains its unidimensional and robust internal structure, with all items measuring the same latent construct (i.e., PDRC). The face validity of the scale was confirmed through expert panel assessments, pilot interviews, participants' high item relevance and importance ratings, the absence of not applicable responses, and no missing data for all items. These results differ from previous development and validation studies, where a small number of missing data and a few not applicable answers were reported (e.g., Kwong and Tsang 2021; Wolf et al. 2005). It may be due to the provision of adequate instructions to participants on each content section of the online questionnaire before moving to responses. The online questionnaire was designed to allow participants to read instructions multiple times. Participants were asked to leave responses on the premise that they fully understood the study requirements. Participants were not allowed to leave options unanswered. We also set attention check questions for participants to prevent casual and careless responses. Participants were also informed to contact WJX or the authors if they met any questions concerning the questionnaire. These procedures make sure the response completeness and facilitate the face validity of the scale.

What is noteworthy is that the overall factor loadings were relatively lower although all of items loaded on a single factor were within an acceptable and reliable range. It is likely that the participants recruited in our study were asked to complete the questionnaire according to clear memories and impressions of their last time OMC experience. In other similar studies (e.g., Al-Habbal et al. 2022; Kwong and Tsang 2021), responses were collected right after a face-to-face medical consultation with

assistance provided by physicians and researchers. Participants in this study might be affected by the time interval from their actual OMC date to their survey date for this study. The differences between face-to-face and online mode of PDRC patterns may make participants rethink physician performance and quality of care they received, causing possible ambiguities in distinguishing physician communication performance online and offline. The average PDRC score was 31.2 (range 8–40), which is relatively low, especially since the highest score (40) was achieved by only 0.8% of participants. This contrasts with higher scores typically seen in face-to-face medical encounters in China, where patients often complete questionnaires immediately after consultations in the presence of their physicians or with researcher assistance in clinics (Al-Habbal et al. 2022; Lu and Wang 2022). The online environment offers patients the flexibility to compare and switch physicians easily, often without cost if dissatisfied, potentially leading to more critical evaluations (Lu et al. 2024).

Traditional physician-patient communication in China is often characterized by a hierarchical structure that prioritizes physician authority over patient autonomy and emphasizes respect for expert knowledge (Qiao et al. 2015; Wang et al. 2015). Such a structure may cause patients to perceive physician communication as authoritative rather than collaborative. Chinese cultural values, particularly the emphasis on "mianzi" (face-saving), which stresses maintaining harmony and preserving social reputation, may encourage patients to perceive physician communication performance more positively in face-to-face medical encounters (Zhao et al. 2012; Zou et al. 2018). The emergence of OMCs has introduced a less formal and physically distanced mode of communication, disrupting traditional patterns of physician-patient interaction. OMCs (e.g., text-based mode) inherently lack communication elements such as friendly facial expressions, caring eye contact, positive verbal signals, personalized gestures, and immediate feedback, which are often critical for building trust and rapport in Chinese culture. The absence of these elements, combined with technical limitations and the asynchronous nature of many online platforms, may influence patients' perceptions to evaluate physician communication performance as they did in face-to-face settings (Zou et al. 2018). Chinese patients' expectations of healthcare interactions are also shaped by a cultural focus on relational trust, or "guanxi," which is traditionally developed through repeated, direct interpersonal exchanges (Zhao et al. 2012). In OMCs, the lack of opportunities to cultivate such trust, such as sustained personal contact, may lead to lower evaluations of physician communication performance, even when it meets objective standards. Patients may expect physicians to maintain the same authority and attentiveness as in face-to-face settings, but the structural limitations of OMCs such as delays in communication and the inability to convey nonverbal warmth often create a gap between expectations and actual experiences. In addition, although OMCs are increasingly utilized and recognized in China, they are still relatively novel compared to face-to-face medical consultations, which remain the dominant and preferred mode of interaction, particularly for complex issues like cancer treatments. These variations may have collectively influenced the psychometric properties of the developed scale used in this study (e.g., the scale's relatively lower factor loadings and PDRC scores compared to those in face-to-face settings).

In this study, 34.5% of participants, on average, rated all PDRC items as 'very important' to OMCs concerning cancer treatment risks, with item 3 receiving the highest importance, followed by item 2 and item 7. Our findings indicate that most participants engaged in text-based OMCs, where the absence of verbal cues and physical interactions, such as eye contact and body language, poses challenges in establishing emotional connections. This often leads to frustration when patients encounter ambiguous information in OMCs (He and Smit 2021; Jiang 2019), driving a need for more emotional support and reassurance from physicians (Chiu 2016). Item 3, which focuses on the physician's role in reassuring and supporting patients for an informed decision making, aligns with this need, particularly for those managing the complexities of cancer treatment and associated emotional strain. Patients are more satisfied with genuine, respectful, interactive and responsive communication over physician-dominated unidirectional communication (Osei-Frimpong 2016). This is attributed to patients' preferences for physicians who are actively listening and putting efforts to address patients' concerns, making them feel their opinions are heard, respected, and valued by physicians (Wan et al. 2021). Items 2 and 7, which emphasize integrating patient perspectives with clinical evidence and prioritizing patient values in treatment options, reflect such preferences. Thus, it is recommended that physicians not only deliver medical information but also attentively consider patients' individual circumstances, emotional states, and financial capabilities, and respond to these.

Limitations and further studies. Due to resource constraints, our study did not involve physicians distributing the questionnaire immediately after OMCs. Instead, participants reflected on their most recent OMC regarding cancer treatment risks when completing the questionnaire. Additionally, we did not conduct a second survey to assess test-retest reliability. However, we minimized memory biases through strict recruitment criteria and attention-check questions to ensure that participants maintain clear recollections of their experiences. Both the recruitment documentation from WJX, which confirmed adherence to these standards, and our manual checks suggest that the time elapsed between their OMCs and survey completion did not significantly affect the results. Despite this, future research could capture patients' real-time reactions and reduce recall bias. While the absence of missing data in this study may suggest successful information capture, it could also indicate potential response biases, such as acquiescence. Further studies should consider mechanisms to detect and mitigate such biases and employ qualitative methods to better understand patient experiences. The study predominantly captured responses from patients with tertiary education (e.g., nearly 80% of participants held bachelor's degrees) and those within a young to middle-aged demographic. This limits the generalizability of the findings across diverse user profiles. Future research should expand participant demographics and explore how different cancer types and treatment risks influence perceptions of PDRC. Likewise, the sample size of 250 participants may limit the generalizability of the findings to larger or more diverse populations. Future studies with larger datasets are needed to further validate the instrument and strengthen its applicability across broader contexts. Another limitation is the absence of distractor items during the validation of the PDRC instrument scale. Distractor items help validate the authenticity of responses by distinguishing between participants who understand the principles of PDRC and those who may mistakenly equate non-dialogic practices with PDRC. The inclusion of distractor items into the validation, such as statements that subtly introduce non-PDRC practices, is possible. Future revisions of the scale could incorporate distractor items to refine its accuracy and improve the validity of the findings. Given the importance of delivering effective dialogic risk communication in OMCs, a structured, evidence-based framework or guideline could be developed to strengthen PDRC skills in cancer care and beyond. It could include cultivating a deep understanding of dialogic communication principles, designing specialized training

programs to meet the unique demands of online consultations, employing robust methodologies to rigorously evaluate the implementation of PDRC strategies, and establishing sustainable mechanisms for continuous professional development. The development of a systematic guideline or framework for PDRC has the potential to address existing communication challenges in OMCs, streamline the integration of PDRC principles into clinical workflows, and enhance communication practices in digital healthcare environments.

Conclusions. PDRC represents a dynamic shift from traditional, unidirectional risk communication by embracing responsive, less dominant, and interactive communication processes that prioritize patient views, concerns, and emotions during medical consultations. Its importance has been increasing in cancer treatment decision-making. The COVID-19 pandemic, increased internet accessibility, and advancements in healthcare technology have driven a surge in demand for OMCs concerning cancer treatment risks in China. This study has developed and validated a PDRC instrument scale specifically for the Chinese OMC context, drawing on theoretical literature, expert panel insights, and pilot interview feedback for precise and reliable PDRC evaluation online. The scale has demonstrated satisfying reliability and validity and supports further research into its adaptability across linguistic and cultural settings. It is important to acknowledge that while PDRC aims to bridge the gap between physician and patient understandings regarding the risks involved in cancer treatments and to achieve informed decision-making, not all interactions will reach this ideal due to various constraints such as time limitations, the complexity of medical information, and individual differences in communication styles. These variations should be explicitly discussed as they pertain to the practical applicability of PDRC in clinical practice.

That being said, this study contributes to enhancing cancer treatment risk communication in OMCs by developing a validated scale designed to assess physicians' adherence to PDRC. Drawing on patient-centered healthcare and shared decision-making theories, the scale serves not only as a measurement tool but also a practical resource to help physicians develop effective communication skills for addressing patients' psychological and behavioral needs. For example, by adhering to the principles outlined in the PDRC scale, online physicians can promote proactive behaviors among Chinese cancer patients, such as increased participation in cancer treatment options, improved adherence to treatment protocols, and enhanced patient self-efficacy in managing their care. The PDRC skills also enable physicians to alleviate patients' psychological burdens by reducing anxiety, mitigating uncertainty, and fostering confidence as patients navigate the complexities of diverse treatment options and associated risks. In addition, the scale offers an alternative way of supporting Chinese cancer patients who may face cultural stigmas, limited health literacy, or reluctance to openly discuss their condition in online settings. Future research could investigate the long-term impact of physicians' adherence to PDRC on patients' psychological well-being and behavioral outcomes. The scale's adaptability to linguistically and culturally diverse contexts also highlights its potential as a practical tool, extending beyond cancer care to guide physicians in addressing patient concerns through dialogic and patient-centered communication across online healthcare settings.

Furthermore, the study advocates for the incorporation of PDRC into future health communication research and contributes to existing theories. PDRC draws upon shared decision-making theory, self-determination theory, and patient-centered communication, reinforcing these theoretical foundations by emphasizing concrete communication actions that facilitate shared risk understanding within the context of cancer care. For example, shared decision-making theory values collaboration between clinicians and patients, fostering partnership in decisions. PDRC deepens this partnership by outlining detailed communication actions that create a foundation for shared decisions. PDRC offers a practical and innovative mechanism that integrates patients' experiences and viewpoints with professional expertise to communicate cancer treatment risks.

Data availability

We respect the journal policy and acknowledge the importance of data sharing. However, we may not be able to share the full original dataset due to ethical considerations, as the data contains identifying and sensitive participant information. The anonymized dataset will be made available upon request, subject to permission from our research project team. Requests can be sent to the first author via email (chriswenze.lu@polyu.edu.hk). Due to the intellectual property and copyright associated with the development of the PDRC scale, anyone wishing to use this scale should obtain permission from the first author upon request.

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Author contributions

Wenze Lu: Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Resources, Data Curation, Writing - Original Draft, Project administration. **Janelle Yorke:** Conceptualization, Methodology, Validation, Writing-Review & Editing. **Yan Li:** Conceptualization, Methodology, Validation, Writing-Review & Editing. **Winsome-Yuk-Yin Lam:** Methodology, Writing-Review & Editing. **Mengqi Li:** Conceptualization, Writing-Review & Editing. **Yule Hu:** Validation, Writing-Review & Editing. **Cindy Sing Bik Ngai:** Conceptualization, Methodology, Validation, Resources, Writing-Review & Editing, Supervision, Project administration.

Competing interests

Ngai was a member of the Editorial Board of this journal at the time of acceptance for publication. The manuscript was assessed in line with the journal's standard editorial processes, including its policy on competing interests.

Ethical approval

This study was approved by the Institutional Review Board of The Hong Kong Polytechnic University (Ref. HSEARS20230527002) and was conducted in accordance with the Declaration of Helsinki. The approval was granted on May 28, 2023 and covered research involving adult participants through surveys conducted in the Chinese mainland. Informed consent was obtained from all participants prior to their participation. Access to participant information was restricted to authorized personnel, and data encryption was implemented to safeguard privacy and ensure confidentiality.

Informed consent

Informed consent was obtained from all participants prior to their participation in this study. Written consent was collected between June and July 2023 by the first author, with the assistance of WenJuanXing, from participants who had prior experience with online medical consultations concerning cancer treatment risks. The informed consent covered participation in the study, the use of data for research purposes, and consent for publication. Participants were fully informed about the nature of the study, including its objectives, methods, and intended outcomes. This study involved non-interventional research using questionnaires for data collection. All participants were assured of their anonymity. They were informed about the purpose of the research, how their data would be utilized, and that there were no risks associated with their participation.

Additional information

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