RESEARCH ARTICLE

How does patient-centred communication reduce chronic disease risk in adults? exploring the sequential mediation of personal electronic health records and health literacy

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Abstract

Objective: To investigate the mediating roles of personal electronic health record usage and health literacy in the relationship between patient-centred communication and chronic diseases.

Method: The study was conducted at Chongqing, China from September 2024 to December 2024, and used secondary data from the Health Information National Trends Survey related to adults aged 18 and above. Guided by the conceptual framework from patient-centred communication pathway models, the sequential mediating roles of behavioural and cognitive factors in the relationship between PCC and chronic disease were examined. Data was analysed using SPSS 27.

Results: A negative association was found between the individual's patient-centred communication scale and chronic diseases (p<0.001). Furthermore, patient-centred communication was negatively associated with chronic diseases through the serial mediation of personal electronic health record usage and health literacy (bp=-0.001, 95% confidence interval: -0.002--0.0004).

Conclusion: Both personal electronic health record usage and health literacy sequentially mediated the relationship between patient-centred communication and chronic disease, highlighting the importance of these factors in enhancing health outcomes.

Keywords: Patient-centred communication, Electronic health record use, Health literacy, Chronic disease.

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Introduction

Patient-centred communication (PCC) is a healthcare approach that emphasises the importance of understanding patients' needs, preferences and values.[1] In recent years, PCC has been regarded as a global public health priority[2-4] has been widely promoted, and it has been integrated into medical training programmes across different cultural contexts.[3,5] Previous studies highlight the importance of PCC in directly or indirectly reducing individuals' risk of chronic disease.[6]

Chronic diseases, including conditions such as hypertension (HTN), diabetes mellitus (DM) and mental illness, have a significant impact on public health.[7] According to a survey, a considerable number of Americans die from chronic diseases each year.[8] Therefore, effectively managing chronic conditions is a crucial societal goal. Previous research has suggested that the use of personal electronic health records (PEHRs) may potentially impact chronic diseases.[6] Specifically, previous research has shown that PEHR can promote early disease prevention and control.[9] While there are advantages to using PEHR, overall usage remains low.[10,11] Thus, it is crucial to address the barriers to using PEHR. PCC plays an essential role in overcoming barriers to PEHR usage,[12] as PCC provides patients with information about their treatment and guidance on how to use PEHR.[12,13] Additionally, previous research has shown a connection between the use of PEHR and health literacy (HL).[14-16] Thus, PCC may enhance HL through the increased use of PEHR.

While there is a potential relationship between PCC and chronic diseases, research on the direct and indirect relationships between PCC and chronic diseases remains limited. Additionally, previous studies have mainly regarded HL as a motivating factor or prerequisite condition[14-16] and there is a lack of research exploring the role of PEHR and HL in the relationship between PCC and chronic diseases. The relationship between PCC and chronic diseases can be explored through both direct and indirect pathways (Figure) under a conceptual framework based on a pathway model.[17]

PCC may reduce the probability of chronic diseases. First, PCC may help patients better understand their treatment options[14,18] which can facilitate decision-making and meets patients' needs and preferences, enabling them to engage more actively in treatment decisions. Thereby, it

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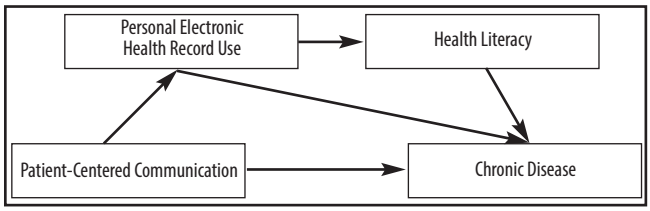

Figure: The concept framework.

may indirectly reducing the risk of disease progression.[18] Second, research has shown that higher level of PCC can promote health behaviours, which contribute to disease prevention and health improvement.[4,19] Moreover, PCC enables patients to exchange health-related information and empowers them in self-management.[20] This includes sharing health-related information with healthcare providers or family members, leading to more frequent use of health technologies, and increased attention to chronic disease prevention.[4,19] As a result, individuals are able to monitor their health status more effectively and identify health abnormalities. Thus, they can take preventive actions to reduce the risk of disease. Furthermore, this exchange of information can enhance health self-efficacy,[14] making individuals more informed and better equipped to prevent chronic diseases. Given the substantial evidence highlighting the significant impact of PCC on chronic diseases,[14,19] it could be hypotheses (H1) that there is a negative correlation between adults' PCC score and their probability of chronic diseases.

As for the mediation role of PEHR in the relationship between PCC and chronic disease risk, PEHR allows individuals to conveniently access their personal health information from anywhere at any time,[6,21] benefiting both hospitals and individuals.[22,23] Research has shown that the use of medical records can have a positive impact on the early prevention and control of chronic diseases.[9,24] It can provide patients with more health-related information and facilitates communication, enabling them to better understand their health status and actively participate in the decision-making process related to chronic disease.[2,12] Additionally, PEHR enables patients to access more health-related information, which increases the likelihood that they will make informed health decisions and engage in preventive health behaviours related to chronic disease.[6,25]

Previous research indicates a positive correlation between PCC and the frequency of PEHR use.[12,13] This may be due to the fact that higher level of PCC promotes individuals' understanding of PEHR, including how to use it,[12,13] making them more willing to use PEHR for health information queries or communication with healthcare providers.[22,26,27] Based on the correlations involving PCC, PEHR and chronic diseases, it can be hypothesised (H_2) that PCC is positively associated with PEHR usage, and PEHR use is negatively associated with the risk of chronic diseases.

The use of PEHR and communication factors may enhance an individual's HL. Research indicates that technology use can have various effects on an individual's knowledge, awareness, and skills[28] that may be crucial for improving HL. Additionally, PEHR enables individuals to efficiently access detailed information[29] resulting in higher HL for these individuals. PCC may positively influence HL through the use of electronic medical records. Specifically, through PCC, individuals may become more motivated to understand their PEHR and health conditions, leading to a greater willingness to carefully examine their medical conditions, have diagnoses or prescriptions, further increasing PEHR usage. That being so, it can be hypothesised (H3) that the relationship between PCC and chronic disease probability is sequentially mediated by the use of personal electronic medical records and HL.

Based on the three hypotheses, the current study was planned to assess the relationship between PCC and the risk of chronic disease in adults, and to explore the role of PEHR usage and HL in the relationship between PCC and the risk of chronic disease.

Materials and Methods

The study was conducted at Chongqing, China from September 2024 to December 2024, and used secondary data from the National Cancer Institute's Health Information National Trends Survey (HINTS) conducted in 2022.[6] HINTS is a nationally representative, cross-sectional survey designed to gather data on the American public's health-related knowledge, attitudes and behaviours using stratified sampling techniques. Comprehensive details about HINTS are available online website (http://hints.cancer.gov).[30] The current study focused on adults aged 18 and above, identified through a dichotomous gender question.

PCC was assessed using seven questions adapted from prior studies[2,21,31] The respondents rated their communication experiences with healthcare professionals over the preceding 12 months on a four-point scale, ranging from 1=always to 4=never. The seven items included the opportunity to ask health-related questions and involving the patient in decisions. Responses were reverse-coded and averaged to create a composite score, with higher scores indicating greater PCC level (mean: 1.69±0.67; Cronbach's alpha: 0.98).

PEHR was assessed using four adapted items:[3] accessing test results, downloading health information, sharing medical info with third parties, and viewing clinical notes. The responses were coded as 0=no or 1=yes, and the scores

were summed to create a PEHR usage index, with higher scores indicating greater use of PEHR technology (Cronbach's alpha: 0.95, mean: 1.92±0.38).

HL was assessed using five items adapted from the previous studies.[22,32] It was measured using four items: It took a lot of effort to obtain the information you needed; You felt frustrated while searching for information; You were concerned about the quality of the information; The information you found was difficult to understand. These four items were rated on a 4-point scale, ranging from 1 = strongly disagree to 4=strongly agree. The four items were summed to create a HL index, with higher scores indicating higher HL levels (Cronbach's alpha: 0.88; mean: 2.73±0.79). The fifth item was about chronic diseases that was assessed using five sub-questions adapted from previous studies, capturing major chronic conditions in the US selected for their high prevalence and public health burden.[22,32] The respondents were asked whether a doctor or healthcare professional had ever diagnosed them with these chronic conditions: DM or high blood sugar; high blood pressure or HTN; heart condition; chronic lung disease, asthma, emphysema, or chronic bronchitis; and depression or anxiety disorder. The scores for these five items were summed to create an index of chronic diseases, with higher scores indicating a greater likelihood of having chronic conditions (mean: 1.17±0.22).

Demographic information included respondents' age, gender (1=male, 0=female), education level, and annual household income.

Data was analysed using SPSS 27 to examine the mediation model. First, descriptive statistics were computed. Then, a diagnostic assessment of multicollinearity was conducted by computing the variance inflation factor (VIF) for all predictor variables. After that, the chain mediation model was tested using Model 6 from the SPSS macro-PROCESS. This model was selected because it specifies a serial mediation pathway with two mediators, which directly corresponds to the proposed model that PCC influences chronic disease risk sequentially through PEHR use and HL. To streamline the analysis, the study employed the percentage coefficient (bp), a standardised metric used when both the dependent and independent variables are linearly scaled, ranging 0-1.[5,6] By eliminating the differences in measurement scales across the original variables, this transformation allows the regression coefficients (bp) to be compared and interpreted on a unified, unitless benchmark, thus making the path coefficients (i.e., the mediation effects) more comparable and meaningful. This approach has been widely used in previous studies.[33] All effects were assessed using 5,000 bootstrap samples to estimate 95% bias-corrected confidence intervals (CIs).

The HINTS 6 general population survey was designated "exempt research" under 45 CFR 46.104 and approved by the Westat IRB on May 10, 2021 (Project # 6632.03.51), with a subsequent amendment approved on November 24, 2021 (Amendment ID #3597). HINTS 6 also received a "Not Human Subjects Research" determination from the NIH Office of IRB Operations on August 16, 2021 (iRIS reference number: 562715).[34]

Results

All VIF values fell within a range of 1.01 to 1.06, well below the threshold of 5, indicating that multicollinearity was not a concern.

Demographic characteristics of the sample were noted in detail (Table 1). In the context of H1, a negative association was found between the individual's PCC scale and chronic diseases (bp=-0.07, p<0.001, 95% CI: -.09--0.05) (Table 2).

In the context of H2, a negative association was found between PEHR and chronic disease (bp=-0.04, p<0.001, 95% CI: -.06--0.02). Bootstrap analysis confirmed the mediation effect (bp=-0.01, 95% CI: -0.02--0.01). The absence of zero in the CIs from bootstrapping indicated the

Table-1: Sample characteristics (n=6,252).

Characteristic	**Value** [n (%)]
Mean Age (years)	55.6±17.0
Gender, n (%)5842	
Male	2307 (36.9)
Female	3535 (56.5)
Missing	410 (6.6)
Education, n (%)5848	
Less than 8 years	116 (1.9)
8 through 11 years	271 (4.3)
12 years or completed high school	1068 (17.1)
Post high school training other than college	433 (6.9)
Some college	1239 (19.8)
College graduate	1613 (25.8)
Postgraduate	1108 (17.7)
Missing	404 (6.5)
Annual income (USD), n (%) 5520	
0 to 9,999	389 (6.2)
10,000 to 14,999	304 (4.9)
15,000 to 19,999	266 (4.3)
20,000 to 34,999	729 (11.7)
35,000 to 49,999	732 (11.7)
50,000 to 74,999	937 (15.0)
75,000 to 99,999	694 (11.1)
100,000 to 199,999	1012 (16.2)
200,000 or more	457 (7.3)
Missing	732 (11.7)
Mean Chronic disease	1.17±0.22
Mean Patient-centred communication	1.69±0.67
Mean PEHR	1.92±0.38
Mean Health literacy	2.73±0.79

USD: United states dollar, SD: Standard deviation, PEHR: Personal electronic health record.

Table-2: Serial mediation effects of PCC on chronic disease through PEHR use and health literacy (Valid n=5,462).

	bp	SE	95%Boot CI	*p*-value
PCC➠ PEHR	0.29	0.02	[0.26, .32]	<.001
PEHR➠Chronic Disease	-0.04	0.01	[-0.06, -.02]	<.001
PEHR ➠Health Literacy	0.13	0.01	[0.11, .15]	<.001
Health Literacy➠Chronic Disease	-0.03	0.01	[-0.05, -.01]	.011
PCC➠Chronic Disease	-0.07	0.01	[-0.09, -.05]	<.001
PCC➠ PEHR ➠Chronic Disease	-0.01	0.003	[-0.02, -0.01]	/
PCC➠PEHR➠Health Literacy➠Chronic Disease	-0.002	0.001	[-0.002, -0.0004]	/

PCC: Patient-centred communication, PEHR: Personal electronic health records, bp: Percentage coefficient, SE: Standard error; 95% confidence intervals (CIs) are presented in parentheses.

significance of the indirect effect (Table 2).

With respect to H_3, a positive association was found between PEHR use and HL (bp=0.13, p<0.001, 95% CI: 0.11-0.15), as well as between HL and chronic disease risk (bp=-0.03, p<0.05, 95% CI: -.05--.01). PCC was negatively associated with chronic diseases through the serial mediation of PEHR use and HL (bp=-0.002, 95% CI: -0.002--0.0004]) (Table 2).

Discussion

The results revealed a negative association between PCC and the risk of chronic disease, either directly or indirectly through the mediator of PEHR. Additionally, the sequential mediating effect of PEHR and health literacy in the relationship between PCC and chronic disease demonstrated that PCC can enhance HL by encouraging adults to use personal medical records, thereby reducing the risks of chronic disease. First, PCC can reduce disease risk by promoting the use of PEHR. Previous studies suggest that the potential reason may be that through PCC, patients gain a clearer understanding of their health information, particularly regarding chronic diseases, and develop the skills necessary to utilise PEHR effectively.[35] Research indicates that PCC enhances patients' ability to use health technologies, enabling them to access relevant health data and medical resources.[36] Frequent use of PEHR, supported by PCC, allows patients to apply health information in practical ways, improving their ability to prevent or manage chronic diseases.[37] Second, the current study found that adults more engaged in PCC may indirectly acquire higher health literacy through the use of PEHR. This aligns with prior research, which suggests that effective patient-provider communication indirectly helps improve HL.[38] When interactions meet PCC standards, patients are better equipped to understand their health issues[39] and make informed decisions using health knowledge.[40] This targetted use of PEHR enhances patients' engagement with health information, and improves their ability to manage chronic conditions.[41] As HL increases, patients are more likely to adhere to treatment plans, access necessary support, and maintain better health outcomes, ultimately reducing the risk or progression of chronic diseases. From a broader public health perspective, these findings underscore the value of PCC as a cross-cutting strategy within global health frameworks, such as the World Health Organisation's integrated people-centred health services approach.[42] The mediating roles of PEHR and HL further suggest that digital tools, when combined with effective communication, may act as key levers in advancing Sustainable Development Goals (SDGs).[43]

The current results not only align with the theory of PCC's impact on health outcomes proposed by Street et al. in 2009[20] but also extend the understanding of the mechanisms by which PCC influences health outcomes. Street et al. argued that communication between patients and providers affects health outcomes not only through direct pathways, but also through indirect pathways, particularly by influencing mediating variables, to improve health outcomes.[20] Based on this theoretical framework, the chain mediation model proposed in the current study — PCC → PEHR use → health literacy → chronic disease risk — emphasises that PCC is not only a direct factor influencing health outcomes, but also promotes the use of PEHRs, which further enhances HL and indirectly reduces the risk of chronic diseases.

In this chain mediation model, PCC is viewed as a direct factor that facilitates health behaviour change. Its direct effect may be due to the PCC's ability to enhance patients' attention to disease prevention or improve their ability to make more scientifically informed decisions related to diseases, thus directly reducing the risk of chronic diseases. As per Street et al.'s model, PCC not only plays a role in the direct pathway, but also influences proximal outcomes, which, in turn, affect intermediate outcomes and ultimately improve health outcomes.[20] the present study confirms that PEHR can be a proximal factor positively influenced by PCC, while HL serves as an intermediate outcome. The continuous mediation of both factors influences the final health outcome and the reduction of chronic disease risk. This conclusion more comprehensively reflects the pathways through which PCC affects health outcomes, and further extends the role of PCC in influencing proximal and intermediate outcomes.

The current study has important practical implications. First, it highlights the critical role of PCC in influencing adult use of PEHR and their health outcomes. Consistent with previous studies, the current study suggests that healthcare providers should enhance their PCC skills, educate patients about the benefits of PEHR, and promote the frequency and diversity of PEHR use.[27] Specifically, education programmes focusing on improving providers' PCC skills can be implemented.[27] Second, in addition to

improving providers' PCC skills, equal attention should be given to improving adults' medical communication skills. The findings suggest that delivering health information through electronic health records may have an effective health intervention strategy, significantly reducing the risk of chronic disease. Practitioners should adopt cross-channel health intervention strategies to reach a wider audience, such as encouraging traditional medical record users (e.g., paper records) to engage with and use electronic health records, while ensuring that more comprehensive disease-related information is provided through the PEHR system. Furthermore, given the sequential mediating roles of PEHR and HL in the relationship between PCC and chronic diseases risk, practitioners should integrate the enhancement of HL into their interventions. Additionally, as adult patients become more familiar with PEHR, healthcare providers should offer continued guidance and support to help them navigate and interpret the information effectively. Additionally, the sequential mediating mechanism may not translate directly to lower- and middle-income countries (LMICs), where digital health literacy and infrastructure are often underdeveloped.[44] The pathway from PCC to the use of PEHR and improved HL may be hampered by such constraints. Successful implementation in these settings therefore requires context-specific strategies, such as simplified PEHR interfaces, community health worker support, and offline functionality, to avoid widening the digital divide. Finally, although the serial mediation effect size was small (bp=-0.002), this may be attributable to the large sample size. The statistical significance of this pathway still provides a theoretical basis for preventive interventions at the population level. For example, from a public health perspective, a public health intervention systematically improving PCC, and thereby promoting PEHR adoption and HL, may prevent a substantial number of chronic disease cases at the population level, demonstrating tangible public health value.

While the current study provides valuable insights into the relationships among PCC, PEHR use, HL and chronic disease, it does have some limitations. First, the study relied on self-reported measures, which may introduce response bias. Future research could incorporate objective measures to validate the findings. Second, the study focussed on general adults, and the findings may not be generalizable to other age groups. Future studies could explore the relationships in different age cohorts to examine potential variations. Third, the cross-sectional nature of the data prevents causal interpretation of the findings. The relationships involving PCC, PEHR use, HL and chronic disease risk could be bidirectional or subject to unmeasured confounding. Future longitudinal or intervention-based studies are essential to establish causality, and confirm the temporal sequence of the mediation chain proposed in the current model.

Conclusion

Empirical evidence established a relationship between PCC and chronic disease in adults both directly and indirectly. Besides, PCC was found to be an important element in reducing the probability of getting chronic disease among adults. The mediating role of PEHR in linking PCC to the probability of chronic disease in adults was also noted. Different scales of PCC may have distinct influences on patients' HL through PEHR, subsequently impacting their health outcomes related to chronic disease. Understanding these associations is crucial for creating interactive environments, fostering efficient patient-provider relationships, and enhancing health outcomes.

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LT: Literature review, data collection, interpretation, writing and final editing.