Current Status and Influencing Factors of Smart Health Management Services and Equipment Usage Among Chinese Adults: A Mixed-Methods Study Postprint

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Abstract

Background: Health management in China faces a structural contradiction between surging demand and insufficient high-quality supply. This has made smart health management services—which integrate the entire process of health monitoring, assessment, and intervention by leveraging information communication and artificial intelligence technologies—a new point of demand. Objective: To systematically analyze the current status of use, needs, and influencing factors of smart health management services and devices among adult residents in China, providing an evidentiary basis and strategic recommendations for the long-term development of smart health management services. Methods: This study employed an explanatory sequential mixed-methods research design to integrate quantitative and qualitative findings. Quantitative data collection was conducted from September to December 2023, using a stratified cluster random sampling method to select adult residents aged 18 and above for a survey via the Wenjuanxing platform. The questionnaire covered general demographic characteristics and utilized standardized scales and self-developed items to measure e-health literacy, media motivation, behavioral attitudes, subjective norms, perceived behavioral control, as well as the demand, intention, and actual usage behavior regarding smart health management services. Structural equation modeling was applied to analyze the factors influencing the intention and behavior of using smart health management services. The qualitative study was conducted from May 2024 to March 2025, involving one-on-one, semi-structured interviews between interviewers and participants. Interview topics included: basic information of the participants, personalized needs for smart health management services, usage and experience of smart health monitoring devices, preferences for smart health management service models, and sugges-

tions/feedback. Finally, the explanatory sequential mixed-methods approach was used to integrate and interpret the quantitative data analysis and qualitative interview results. Results: A total of 2,900 questionnaires were distributed in the quantitative study, with 2,786 valid questionnaires recovered, yielding a valid recovery rate of 96.1%. The qualitative study included 13 interviewees. The study found that: (1) The usage rate of smart health monitoring devices among adult residents in China was 37.7% (1,051/2,786), showing a downward trend with increasing age, with significantly lower usage rates among the elderly population. (2) Usage needs exhibited multi-level and age-differentiated characteristics: overall demand was concentrated on basic functions such as health monitoring and answering health questions; the qualitative study further revealed advanced needs ranging from "basic life management" to "empowering self-actualization." Younger groups preferred basic prevention and lifestyle optimization, while the elderly focused more on practical functions such as disease management. (3) The intention to use was at a moderately high level $(62.68\$\pm20.65 points)$. $Structural equation modeling results showed that behavioral attitude(= 0.568, P < 0.001) was the strongest predictor of usage intention, while subjective norms(= 0.103, P < 0.001) and media motivation(= 0.089, P < 0.001) also had significant positive effects. E-health literacy significantly influenced usage intention(= 0.045, P < 0.001) and usage behavior(= 0.051, P < 0.001) through media motivation, and perceived behavioral control indire 0.014, P < 0.001) and usage behavior(= 0.016, P < 0.001) through media motivation. Living in urban areas hadin 0.056, P < 0.001) and usage behavior(= 0.125, P < 0.001), and medical insurance significantly promoted usage i$ P=0.008). Qualitative findings indicated that barriers to using smart health monitoring devices among adults included objective factors such as high costs and product quality issues, as well as concerns about wearing comfort and privacy security. Adults' attitudes toward smart health monitoring devices showed significant polarization; positive or negative evaluations stemmed directly from usage experience, perceived benefits, and the level of product intelligence, while those with neutral attitudes were prone to discontinuation due to a failure to perceive clear value. Furthermore, personal beliefs and cultural backgrounds profoundly influenced technological decision-making. Conclusion: This study reveals that smart health management services among adult residents in China are characterized by "high intention but low usage," with age-stratified differences in current usage and demand structures. Regarding influencing factors, behavioral attitudes and subjective norms are the core drivers of intention, e-health literacy and media motivation play a significant chain-promoting role, and perceived barriers are the primary resistance limiting behavioral transformation. Future promotion of smart health services should focus on age-appropriate design and precision implementation, while leveraging the synergistic role of primary healthcare to effectively bridge the gap between technological usage intention and actual behavior, thereby enhancing adults' capacity for proactive health management and contributing to the goal of healthy aging.

Full Text

Current Status and Influencing Factors of Smart Health Management Services and Equipment Usage Among Chinese Adults: A Mixed-Methods Study

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Abstract

Background: In China, the structural contradiction between surging health management demands and an insufficient supply of high-quality resources has driven the need for smart health management services. By leveraging information and communication technology (ICT) and artificial intelligence (AI), these services integrate health monitoring, assessment, and intervention into a seamless process, emerging as a critical new area of demand.

Objective: To systematically analyze the current usage, demands, and influencing factors of smart health management services and devices among adult residents in China, providing an evidence base and strategic recommendations for sustainable development.

Methods: An explanatory sequential mixed-methods design was employed. Quantitative data were collected from September to December 2023 using a stratified cluster random sampling method. Adults aged 18 and above ($n = 2,786$) were surveyed via the Wenjuanxing platform. The questionnaire measured e-health literacy, media motivation, behavioral attitudes, subjective norms, perceived behavioral control, and actual usage behavior. Structural equation modeling (SEM) was applied to analyze influencing factors. The qualitative phase (May 2024 to March 2025) involved semi-structured interviews with 13 participants to explore personalized demands and usage experiences.

Results: (1) The usage rate of smart health management monitoring devices among Chinese adults was 37.7% (1,051/2,786), showing a declining trend with age. (2) Demands are age-stratified; younger groups prefer lifestyle optimization, while the elderly focus on disease management. (3) The intention to use was moderately high (62.68 ± 20.65). SEM results indicated that behavioral attitude ($\beta = 0.568, P < 0.001$) was the strongest predictor of intention. Subjective norms ($\beta = 0.103, P < 0.001$) and media motivation ($\beta = 0.089, P < 0.001$) also had significant positive effects. E-health literacy and perceived behavioral control indirectly influenced behavior through media motivation. Qualitative findings identified high costs, technical complexity, and privacy concerns as primary barriers.

Conclusion: Smart health management in China is characterized by "high intention but low usage." Future promotion should prioritize age-appropriate

design and leverage primary healthcare to bridge the intention-behavior gap.

Keywords: Smart health management; Adult; Health literacy; Theory of planned behavior; Mixed methods; Intention and behavior

1. Introduction

As population aging intensifies and public health literacy improves, a massive demand for health management has been unleashed in China. However, the supply of high-quality services remains insufficient due to limitations in traditional healthcare personnel and models [**?**]. This contradiction has made smart health management—utilizing ICT, AI, and bioinformatics to sense and analyze health data—an emerging focal point. Research indicates these models provide significant benefits in risk prediction and prevention [**?**].

While the digital health market in China is projected to exceed 1.2 trillion RMB by 2024 [**?**], practical application faces challenges. Existing research has focused primarily on the elderly or technology acceptance alone, often failing to address multi-level drivers across social ecology or the deep-seated motivations explored through qualitative narratives. This study combines quantitative and qualitative methods to comprehensively characterize the usage status and internal drivers of smart health management among Chinese adults.

2. Theoretical Framework and Hypotheses

This study adopts the Theory of Planned Behavior (TPB) [**?**] as its core framework, integrating Social Ecological Theory (SET) to organize variables into micro, meso, and macro levels. We introduce e-health literacy and media motivation as antecedent variables to enhance the model' s explanatory power.

[Figure 1: see original paper]

The following hypotheses are proposed: - **H1:** Media motivation positively predicts usage intention (H1a) and behavior (H1b). - **H2:** eHealth literacy positively influences usage intention and behavior through the mediating role of media motivation. - **H3:** Behavioral attitude positively predicts usage intention. - **H5:** Perceived behavioral control positively predicts usage intention. - **H8:** Subjective norms positively predict usage intention.

3. Subjects and Methods

3.1 Quantitative Phase

A stratified cluster random sampling method was used to select 2,900 adults from 15 provinces. The final valid sample included 2,786 participants. Standardized scales were used to measure e-health literacy (Cronbach' s $\alpha = 0.951$), media motivation ($\alpha = 0.887$), and perceived behavioral control ($\alpha = 0.921$).

Usage behavior was defined as the active use of smart monitoring devices (e.g., smartwatches, body fat scales).

3.2 Qualitative Phase

Purposive sampling was used to recruit 13 participants for semi-structured interviews. Data were analyzed using NVivo 12 through three-level coding (open, axial, and selective) until information saturation was reached.

4. Results

4.1 Usage and Demand Status

The overall usage rate of smart health devices was 37.7%. Smartwatches (21.1%) and smart wristbands (15.4%) were the most common. Usage was highest among youth (45.8%) and lowest among the elderly (approx. 21%).

Primary demands included "answering health questions" (46.2%) and "sleep monitoring"(46.0%). Qualitative analysis revealed a hierarchy of needs from "basic life management" (reminders, monitoring) to "empowered self-actualization" (advanced medical management).

4.2 Structural Equation Model (SEM) Results

The model showed good fit: $\chi^2/df = 5.00$, RMSEA = 0.038, CFI = 0.982, TLI = 0.978.

Behavioral attitude was the strongest predictor of intention ($\beta = 0.568$). Media motivation directly predicted behavior ($\beta = 0.103$). A significant chain mediation path was identified: eHealth Literacy → Media Motivation → Behavioral Attitude → Behavioral Intention ($\beta = 0.043, 95\%\text{CI} = 0.029$–$0.057$).

4.3 Qualitative Findings on Barriers

Coding identified three core categories: Perceived Behavioral Control (technical barriers, safety concerns), Behavioral Attitude (perceived intelligence, benefit), and Microsystem (socialization preferences, technological exclusion). Barriers included high costs, "bugs," and privacy risks. Some elderly users actively avoided technology to "exercise their brains," while younger users used it to avoid offline social burdens.

5. Discussion

5.1 The Intention-Behavior Gap

The study reveals a "high intention, low usage"phenomenon. While awareness is high, the usage rate among the elderly remains low (13.9% in some sub-groups), consistent with previous findings [**?**]. This is attributed to the digital divide

and a perceived threat to autonomy when technology conflicts with established routines.

5.2 Age-Stratified Demand

Needs evolve from lifestyle optimization in youth to disease management in older age. This suggests that "one-size-fits-all" products are insufficient. Future services must integrate emotional and social designs alongside core health monitoring.

5.3 Implications for Primary Care

General practitioners should recommend cost-effective, easy-to-use devices tailored to patient literacy. Integrating smart device data into routine clinical workflows—such as reviewing blood pressure trends during follow-ups—can demonstrate practical value to patients and motivate sustained use.

6. Conclusion

There is significant room for improvement in the utilization of smart health devices in China. Usage is driven by behavioral attitudes and subjective norms, while e-health literacy and media motivation facilitate the transition to intention. However, perceived barriers remain the primary resistance. Promoting smart health requires age-friendly design and the integration of these technologies into the primary healthcare system to achieve healthy aging goals.

Note: Figure translations are in progress. See original paper for figures.