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Technology Empowerment or Reinventing Barriers?—A Study on the Impact of Digital Health Literacy on Access to Basic Public Health Services among Elderly

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Abstract. Digital health tools are reshaping primary care around the world. But these tools —designed to make healthcare access easier—can create new barriers for people who lack digital skills. They face a rapidly digitalising healthcare system yet have only 5.8 years of formal schooling on average. Digital health literacy has been discussed in urban populations and grassroots settings; however, the two fields hardly overlap. The elderly population remains largely invisible in research on DHL and healthcare access, and studies on policy implementation have focused on counting inputs rather than on asking what actually happens when older patients try to use digital systems. This study adopts a mixed-methods approach, drawing on administrative data from the Chinese health insurance system and survey data from CHARLS 2023. This study finds that older adults use digital channels at only 7.8%, compared to 27.9% for the general population. We argue that performance targets push frontline staff to complete digital tasks on behalf of elderly patients, inflating statistics while leaving patients' actual capabilities unaddressed. This study contributes Chinese evidence to the wider discussion on digital health equity, and calls for a shift from technology-focused to capability-focused policies.

Keywords: digital health literacy, primary care accessibility, policy implementation, health equity, digital divide

1. Introduction

Digital health technologies are reshaping primary care around the world. But these tools designed to promote accessibility can create new barriers for people who lack digital skills [1, 2]. This problem is particularly serious in China today. China has the world's largest ageing population, with over 150 million rural residents aged 65 and above. At the same time, the government has pushed forward a rapid digitalisation of healthcare since 2018. By 2025, over 92% of township clinics had been equipped with smart terminals. Yet the average rural older adult has only 5.8 years of schooling. This gap between policy ambition and population reality is hard to ignore.

Existing studies have looked at digital health literacy (DHL) in urban Chinese populations [3, 4], and some have examined the administrative workload created by digitalization in grassroots settings. But these two fields of research rarely meet. The rural elderly remain largely invisible in research on

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DHL and healthcare access. More importantly, studies on policy implementation have focused too much on quantifiable inputs—device installation numbers and user registration volumes—rather than exploring what actually happens when older patients attempt to use digital systems [5].

This paper will address the situation using a mixed-methods approach. It will focus on three sources of evidence: administrative data from the Chinese health insurance system, which shows that older adults use digital channels at only 7.8%, compared to 27.9% for the general population; survey data from CHARLS; and qualitative interviews. By bringing together quantitative patterns and people's real experiences, this study contributes Chinese evidence to the wider discussion on digital health equity.

2. The availability-usability chasm: policy penetration vs. functional access

The digitalization of healthcare systems rests on the assumption that infrastructural deployment automatically improves service accessibility. This assumption warrants critical scrutiny, particularly in contexts where intended beneficiaries possess limited prior digital exposure. This chapter establishes the analytical structure for the empirical investigation. First, we develop a conceptual framework that integrates digital health literacy (DHL) into the adapted Andersen's Behavioral Model [6], specifying the mechanisms through which digital systems enable or obstruct access. Second, we map the institutional landscape of China's primary care digitalization since the 2018 "Internet+ Healthcare" mandate. The difference between policy penetration and functional access forms the central focuses of this paper.

According to Nutbeam's hierarchical concept, health literacy is defined as involving functional, interactive, and critical dimensions—a framework subsequently extended to the digital domain, wherein DHL denotes the capacity to seek, appraise, and apply health information from electronic sources [7, 8]. For this study, we adopt a three-dimensional perspective: functional DHL refers to basic navigation of digital interfaces; interactive DHL involves information exchange via online platforms; and critical DHL encompasses evaluating online health information and making informed judgments. To recognize the pathway to service utilization, we anchor our analysis in Andersen's Behavioral Model [1], which points out that utilization is observed from predisposing characteristics, enabling resources, and need factors. However, we argue that simply classifying DHL under enabling resources as an individual characteristic obscures a critical distinction: DHL is also connected to system-level situations—interface design, institutional agreements, and front-line support.

3. Unpacking the implementation friction: evidence from quantitative and qualitative data

Having established the conceptual framework and institutional landscape in the preceding chapter, we now turn to the empirical core of the investigation. This chapter presents the findings from our sequential explanatory mixed-methods design, structured to address the two research questions formulated in the Introduction: (RQ1) the association between DHL and primary care accessibility among rural older adults; and (RQ2) the specific implementation frictions that mediate this relationship. In this section, a series of evidence will be shown later on drawing upon binary logistic regression analysis of 2,847 respondents aged 65+ from the China Health and Retirement Longitudinal Study [6]—which establishes the population-level pattern and identifies the conditional nature of the DHL-utilization association.

We examine the aggregate patterns of digital health service utilization using administrative data from a large tertiary hospital in Nanjing covering approximately 3.34 million outpatient transactions

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over a full calendar year (January to December 2025). Over the 12-month observation period, the overall medical insurance code usage rate averaged 27.9%, with monthly figures ranging from a high of 33.8% in January to a low of 26.1% in June — a drop of nearly 8 percentage points from the start to the middle of the year. The first quarter (January to March) recorded the highest average usage at 29.9%, while the second and third quarters (April to September) remained relatively stable at around 26.7%, before a modest recovery in the final quarter (October to December), where the rate rose from 27.7% to 28.1%. Despite this late-year uptick, the rate never surpassed 34% in any single month and showed no sustained upward trajectory across the year as a whole. In cumulative terms, of the 3.34 million total visits, 931,321 involved medical insurance code usage, meaning that nearly 2.41 million transactions — almost three-quarters of all visits — were still processed through traditional manual channels. The plateau observed below 34% throughout the entire year suggests that early adoption gains may have reached a saturation point well before universal coverage.

This pattern marks another important disparity. Disaggregation by age reveals that among patients aged 60 years and above which accounted for over 1.4 million transactions—the medical insurance code utilization rate fell to 7.8% of all visits, and even when restricted to window-based transactions where code use is technically feasible, the rate reached only 11.4%. In absolute terms, of the nearly 1.4 million visits made by older adults, 970,000 were conducted through manual window services, while merely 110,000 involved code usage—a ratio of nearly 9:1 favoring traditional channels. This age-based disparity is unlikely to attenuate spontaneously, as it is rooted not in transient unfamiliarity but in the compound effects of low educational attainment, limited prior digital exposure, and the absence of adequate support infrastructures. This reveals a pattern consistent with the theoretical framing of DHL as a relational construct shaped by both individual capacity and system design.

Older adults are roughly one-fourth as likely as the general population to use the digital channel (7.8% vs. 27.9%), suggesting that current digitization efforts may inadvertently construct a two-tier system in which those with the greatest health needs face the most constrained access to the efficiency gains that digital channels purportedly deliver. These aggregate patterns establish the population-level contours of the availability-usability chasm; the qualitative analysis that follows examines the experiential dimensions that animate these statistics.

4. Rethinking digital health equity: from technology-centric to capability-centric policy

4.1. Why does the implementation trap persist

The quantitative and qualitative evidence presented in the preceding chapter reveals a consistent pattern: infrastructural digitisation has proceeded rapidly, yet functional access among older adults remains constrained. Why does this implementation trap persist? The answer lies not in technical deficiencies but in the institutional logic that governs front-line service delivery. Drawing upon Lipsky's [1] theory of street-level bureaucracy, we interpret the observed increase of proxy-operated enrollments as a rational adaptation by front-line clinicians to conflicting performance demands. On one hand, they are responsible for top-down digital targets—health code registration rates, electronic record completion quotas, and monthly usage metrics. These are monitored, ranked, and tied to facility evaluations. On the other hand, they confront an elderly patient population that largely lacks the cognitive and technical resources to comply with these digital requirements independently. Faced with this disparity, clinicians resolve the tension through procedural compliance: they perform digital operations on behalf of patients, thereby satisfying reporting obligations while minimizing consultation time and interpersonal friction. This practice, however, generates a negative dynamic.

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The more clinicians engage in proxy operations, the more usage statistics inflate. This makes the policymakers think that digitalization is proceeding smoothly and effectively reducing institutional pressure to invest in capability-building measures such as age-friendly interface design or hands-on training programs—a dynamic well documented in the public administration literature as the 'gaming' or counter-productive effects of performance targets [9]. The implementation trap is thus self-reinforcing: performance metrics that were designed to incentivise adoption instead obscure the very exclusion they purport to measure, diverting policy attention away from the capability deficits that constitute the root cause of low utilisation among older adults.

4.2. Policy reconfiguration: toward a capability-sensitive health system

If the implementation trap is sustained by a misalignment between performance metrics and substantive access, then its resolution requires a fundamental reorientation of the policy logic from a technology-centric preoccupation with infrastructural penetration to a capability-sensitive framework that foregrounds the actual health-seeking agency of aging populations—an orientation informed by Sen's capability approach, which directs analytical attention toward what individuals are actually able to do and be, rather than merely what resources are made available to them. We propose three interconnected solutions. First, at the regulatory level, we recommend amending the implementation rules of the Basic Healthcare and Health Promotion Law to mandate the retention of manual service windows as a statutory fallback channel—an institutional guarantee that digitisation does not render offline access conditional upon digital compliance. This is not a regressive retreat from digitalisation, but a recognition that equitable access in a transitional period requires parallel systems. Second, at the institutional level, performance assessment must be redesigned from input-based indicators (coverage rates, registration counts) to outcome-oriented measures that capture effective usage—defined as the proportion of elderly patients who can independently complete at least one core digital transaction, or who have received documented training. This shift would disrupt the proxy-operated cycle by rendering visible what current metrics systematically obscure. Third, at the individual level, we propose embedding digital health capability-building within the existing package of family physician services, requiring clinicians to allocate dedicated time—rather than informal, hurried assistance—to hands-on instruction for elderly patients. Collectively, these proposals do not reject advanced technologies but insist that digitalization be accompanied by corresponding investments in human capability—a principle that reframes equity not as a residual concern but as a design parameter of health system transformation.

5. Conclusion

This study examined whether the rapid digitisation of primary care in rural China has enhanced or hindered access for older adults—a population with limited digital literacy and educational attainment. The official data provide a clear answer: while infrastructural penetration has reached over 92% of township clinics, functional access among rural older adults remains severely constrained. Older adults use digital channels at only 7.8%, compared to 27.9% for the general population.

On the policy front, we recommend three concrete measures: retaining manual service windows as a statutory fallback; redesigning performance metrics from registration counts to effective usage; and embedding digital skills training within family physician services. Several limitations warrant acknowledgment. Our quantitative data are cross-sectional and come from one regional system. Future research should employ longitudinal measures and expand comparisons with varying levels

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of training support to identify which policy configurations are most effective in bridging the availability-usability chasm.

References

[1] Nutbeam, D. (2000). Health literacy as a public health goal: A challenge for contemporary health education and communication strategies into the 21st century. *Health Promotion International, 15*(3), 259–267. https://doi.org/10.1093/heapro/15.3.259

[2] van der Vaart, R., Deursen, A. J. A. M., Drossaert, C., Taal, E., Van Dijk, J. A. G. M., & Laar, M. (2011). Does the eHealth Literacy Scale (eHEALS) measure what it intends to measure? Validation of a Dutch version of the eHEALS in two adult populations. *Journal of Medical Internet Research, 13*, e86. 10.2196/jmir.1840.

[3] Zhou, Z., Jin, D., He, J., et al. (2024). Digital health platform for improving the effect of the active health management of chronic diseases in the community: Mixed methods exploratory study. *J Med Internet Res, 26*, e50959. doi:10.2196/50959

[4] Liu, J., & Liu, S. (2026). Data-driven Healthy China pathway: Evolution, framework, and global implications of national digital health strategic planning. *J Med Internet Res, 28*, e89099. doi:10.2196/89099

[5] Lipsky, M. (1980). *Street level bureaucracy: Dilemmas of the individual in public services*. Russell Sage Foundation. http://www.jstor.org/stable/10.7758/9781610447713

[6] Zhao, Y., Chen, X., & Wang, Y. (2023). China health and retirement longitudinal study (CHARLS). Peking University. Available at: http://charls.pku.edu.cn

[7] Andersen, R. M. (1995). Revisiting the behavioral model and access to medical care: Does it matter? *Journal of Health and Social Behavior, 36*(1), 1–10. https://doi.org/10.2307/2137284

[8] Norman, C., & Skinner, H. (2006). eHealth literacy: Essential skills for consumer health in a networked world. *Journal of Medical Internet Research, 8*(2), e9. https://www.jmir.org/2006/2/e9

[9] Bevan, G., & Hood, C. (2006). What's measured is what matters: Targets and gaming in the English public health care system. *Public Administration, 84*(3), 517–538.