

Institutional Mechanisms Shaping the Digital Divide Among Older Patients in China's Appointment-Based Outpatient System

Wenjie Huang¹ & Liang Chen¹

¹ Anhui Medical University, China

Correspondence: Liang Chen, Anhui Medical University, China.

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Abstract

Digital appointment systems have become the primary entry mechanism for outpatient care in China's public hospitals. At the same time, rapid population aging has increased the proportion of older adults within the healthcare system. Although digital access among older adults has expanded, disparities remain in their ability to navigate complex procedural platforms. Existing discussions often interpret this situation as a problem of individual digital literacy. This paper adopts a different perspective and examines the digital divide as an institutional outcome.

Through a structural analysis of policy rationality, organizational restructuring, and micro-level interaction processes, the study shows how digital competence becomes embedded as an implicit entry condition. Platform-centered allocation mechanisms link procedural performance to resource access, especially in high-demand specialist services. Repeated differences in appointment acquisition gradually translate into disparities in medical quality and health trajectories. Over time, these patterns stabilize and become normalized within routine hospital governance.

The findings suggest that the digital divide in outpatient care is not merely a technological gap but a structured consequence of institutional design. Rebalancing efficiency and equity in aging societies requires adjustments in access pathways rather than sole reliance on individual adaptation.

Keywords: digital divide, appointment-based outpatient system, aging population, institutional design, healthcare governance, platformization, access inequality

1. Introduction

In the past ten years, outpatient care in China has changed significantly because of digital reform. Appointment-based systems are no longer optional. They have become the main way to enter hospital services in many cities. Large tertiary hospitals require patients to book visits through mobile applications, hospital

websites, or public service platforms. The *Statistical Communiqué on the Development of Health and Medical Services in China* issued by the National Health Commission shows that almost all tertiary public hospitals now provide appointment services. In many major cities, more than 70 percent of outpatient visits in leading hospitals are booked online. What began

as a measure to reduce long queues has gradually become a routine institutional arrangement in hospital management.

At the same time, China is experiencing rapid population aging. Data from the Seventh National Population Census indicate that by the end of 2020, the population aged 60 and above had reached 264 million, accounting for 18.7 percent of the total population. The proportion has continued to increase in subsequent years. Digital technology has also expanded across society. The China Internet Network Information Center reports that internet use among older adults has grown steadily. However, differences remain in usage depth and operational ability. Many older adults use smartphones for basic communication and simple applications. Tasks that involve multiple steps, such as online registration, real-name verification, and time-slot selection, remain challenging for a considerable portion of this group.

Key demographic and digital indicators are summarized below.

Table 1. Aging Population and Digital Usage Among Older Adults in China

Indicator	Year	Value	Source
Population aged 60+	2020	264 million (18.7%)	Seventh National Population Census
Population aged 65+	2020	190.6 million (13.5%)	Seventh National Population Census
Internet users aged 60+	2022	Approx. 153 million	CNNIC Statistical Report
Internet penetration rate (60+)	2022	Around 52%	CNNIC Statistical Report

These figures show two structural trends. The older population is large and growing. Internet access among older adults has increased. Digital inclusion in basic terms is expanding. At the same time, digital participation does not necessarily mean digital competence in complex institutional procedures.

Digital medical reform and population aging now intersect within the same institutional

space. The appointment system assumes that patients can use digital tools independently. Many older patients cannot do this easily. In the past, access to outpatient services depended on physical presence. Patients waited in line. The system was slow but visible. The current model replaces physical waiting with procedural navigation on digital platforms. Access now depends on successful digital operation.

Public discussion often explains this situation as a digital divide caused by lack of skills among older adults. The focus remains on individual adaptation. Proposed solutions include digital training programs, family assistance, and simplified interface design. These responses address surface difficulties. They do not explain why access disparities persist even as smartphone ownership expands. They also do not explain how small differences in digital ability can produce large differences in access to scarce medical resources.

This paper approaches the issue from a different angle. It does not treat the digital divide as a problem of personal deficiency. It treats it as a consequence of institutional design. The shift toward digital appointments reflects a governance logic that prioritizes efficiency, traceability, and resource control. Embedded within this logic are assumptions about what patients can do and how they should behave. When these assumptions encounter an aging population with uneven digital competence, structural mismatches emerge. The central question is not why some older patients lack digital skills. The central question is how institutional arrangements convert differences in digital ability into unequal access to healthcare.

2. Reframing the Digital Divide as an Institutional Outcome

The concept of the digital divide has been widely discussed in studies of technology and society. Early research focused on access to devices and internet connections. Later studies examined differences in skills, frequency of use, and types of online activity. In many cases, the divide is explained as a gap between those who can use digital tools effectively and those who cannot. The emphasis stays on individual capacity. Older adults are often described as a vulnerable group because they are less familiar with new technologies and less confident in using complex digital systems.

This line of explanation is useful in showing

unequal patterns of digital participation. It does not fully capture what happens in the field of healthcare. In medical settings, digitalization is not simply a matter of adopting new tools. It is a process of institutional restructuring. When hospitals introduce appointment platforms, online registration systems, and real-name verification procedures, they are not just offering additional options. They are redesigning the rules of access. Digital procedures become embedded in formal workflows. They define how patients enter the system, how resources are distributed, and how time is allocated.

Under these conditions, digital technology operates as part of an institutional framework. It shapes expectations about patient behavior. It sets procedural requirements that must be completed before care can be received. The system assumes that patients are able to navigate interfaces, follow multi-step instructions, and respond to automated prompts. These assumptions are often invisible because they are built into the structure of the system itself. Patients who meet these expectations pass through the process smoothly. Patients who do not meet them face delays, confusion, or exclusion.

The key issue, therefore, is not only whether older adults possess digital skills. The more important issue is how institutional arrangements convert differences in ability into differences in access. When digital competence becomes a condition for obtaining medical appointments, capability differences turn into structural barriers. The digital divide is no longer a simple gap in technology use. It becomes a product of institutional design. It emerges from the mismatch between the assumptions embedded in digital reform and the actual capability structure of an aging population.

This perspective shifts the focus of analysis. Instead of asking how older adults can adapt to digital systems, the analysis asks how digital systems define acceptable forms of participation. It examines how policy rationality, organizational restructuring, and procedural requirements shape patterns of inclusion and exclusion. The following sections develop this analytical framework by examining the governance logic behind digital reform, the reorganization of outpatient access, and the micro-level processes through which exclusion

is produced.

3. Policy Rationality and the Hidden Assumptions of Digital Reform

3.1 Efficiency-Centered Governance Logic

The expansion of appointment-based outpatient systems in China did not take place by chance. It emerged within a broader reform agenda that seeks to improve efficiency in public service delivery. Large public hospitals face high patient volumes, limited specialist resources, and strong public demand. Long queues, overnight waiting, and crowd congestion were common problems in major cities. Digital appointment systems were introduced as a way to manage these pressures.

Official policy documents from the National Health Commission have repeatedly emphasized orderly medical treatment, time-based appointments, and information-based management. The stated goals include reducing on-site congestion, improving resource allocation, and strengthening traceability of medical services. Online booking makes it possible to distribute patient flow across time slots. It also allows hospitals to monitor demand patterns and adjust schedules. In this governance framework, efficiency is closely linked to control and predictability.

Digital platforms support this model by standardizing procedures. Each patient must complete a fixed sequence of steps before obtaining an appointment. The system records identity information, department selection, time slot choice, and payment status. These processes create data that can be tracked and analyzed. Hospital managers can use these data to evaluate workload distribution and reduce idle capacity. The digital interface becomes part of the management toolset.

This efficiency-centered logic prioritizes smooth workflow and measurable outcomes. Physical queuing is seen as disorderly and hard to regulate. Digital queuing, in contrast, can be structured and monitored. The shift from on-site registration to online booking is therefore not only a technical adjustment. It reflects a preference for rule-based, standardized, and data-driven governance. Within this framework, the main concern is whether the system operates smoothly. Less attention is given to how different patient groups experience the new entry requirements.

When efficiency becomes the dominant policy value, access is reorganized around procedural compliance. Patients who can follow the digital process benefit from faster and more predictable service. Patients who struggle with the process face additional barriers before reaching clinical care. The governance logic does not explicitly aim to exclude older adults. It does, however, define access in a way that assumes procedural competence. This assumption forms the background against which digital exclusion begins to take shape.

3.2 Implicit Presumption of Universal Digital Competence

The efficiency-centered reform described above rests on a silent premise. The system assumes that patients are able to complete the digital process on their own. This assumption is rarely stated in policy documents. It is embedded in the design of the platform and in the sequence of required steps. To obtain an appointment, a patient must download an application or access a website, register an account, complete real-name verification, select a department, choose a time slot, confirm payment, and receive electronic confirmation. Each step requires a certain level of familiarity with smartphones and online procedures.

The system treats these actions as routine. It does not distinguish between patients with different levels of digital literacy. There is no built-in screening of digital capacity. Instead, the ability to navigate the interface becomes an informal prerequisite for access. The platform is designed for independent operation. It does not assume that users will need continuous assistance. In this sense, digital competence is treated as a universal condition.

This implicit presumption shapes the entry conditions of the outpatient system. In the past, access depended mainly on physical presence. A patient could go to the hospital, wait in line, and speak directly to registration staff. The main requirement was time and mobility. Under the digital model, the requirement shifts to procedural ability. Patients must demonstrate competence before they can even enter the waiting system. Those who cannot complete the steps are filtered out before reaching clinical care.

The filtering effect does not operate through explicit exclusion. There is no rule that prohibits older adults from making appointments. The

exclusion occurs through procedural design. When the interface is complex, when verification codes must be entered quickly, when time slots are released at fixed moments, the system favors users who are familiar with digital routines. Small differences in skill lead to large differences in outcome. A missed time window or an incorrect input can mean losing access to a specialist slot.

The assumption of universal digital competence therefore functions as a hidden institutional threshold. It defines who can pass smoothly through the system and who cannot. The requirement is not visible as a formal policy condition. It appears neutral and technical. In practice, it reorganizes the boundary of participation. Digital competence becomes the new form of eligibility. This is how institutional assumptions shape entry conditions and transform capability differences into structured barriers.

4. Organizational Restructuring and the Relocation of Access Gateways

4.1 Transformation of the Entry Point

The shift to appointment-based outpatient care has changed where and how patients enter the hospital system. In the past, the main entry point was physical space. Patients went to the hospital early in the morning. They waited in line at the registration window. Access depended on arrival time, physical presence, and patience. The hospital gate and the registration hall were the first barriers. The order of service was visible and based on spatial sequence.

Under the digital appointment system, this entry point has moved. The first barrier is no longer the hospital building. It is the digital platform. Patients must secure a time slot before they arrive. Without a confirmed appointment, access to many departments is limited or not allowed. The process of entry now begins on a smartphone screen. The platform becomes the new gate.

This transformation changes the logic of access. Physical queuing follows a spatial logic. Patients compete through presence. Digital booking follows a platform logic. Patients compete through speed of operation and familiarity with the interface. When appointment slots are released at fixed times, users must log in, select departments, and confirm quickly. Those who can navigate the system fast have an advantage.

Those who hesitate or make mistakes may lose the opportunity.

The relocation of the entry point also changes visibility. In physical queues, patients can see their position. They can observe how the line moves. In digital systems, the process is less transparent. Appointment slots may disappear within seconds. The competition happens on screens that are not shared. This reduces the sense of collective waiting and replaces it with individualized interaction.

The new entry structure reshapes the relationship between patients and institutions. Hospitals no longer manage crowds only in physical space. They manage demand through digital filters. The platform decides who enters the next stage of care. This organizational shift places digital competence at the very beginning of the treatment process. Access to medical resources starts with successful interaction with the system rather than with arrival at the

hospital.

4.2 Platformization and Resource Allocation

As the entry point moves to digital platforms, the platform becomes the center of resource allocation. It is no longer only a booking tool. It becomes the mechanism through which outpatient resources are distributed. Specialist clinics, popular departments, and limited expert slots are released and managed through the system. The platform controls the timing, quantity, and visibility of available appointments.

National statistics and policy reports indicate the extent of this transformation. Appointment-based management is now standard practice in tertiary public hospitals. In many major urban hospitals, online booking accounts for the majority of outpatient registrations. The platform has therefore shifted from an auxiliary channel to the dominant allocation mechanism.

Table 2. Digital Appointment Coverage in Public Hospitals in China

Indicator	Approximate Level	Source
Tertiary public hospitals providing appointment services	Nearly 100% coverage	National Health Commission Statistical Communiqué
Major urban tertiary hospitals with online booking systems	Universal implementation	National Health Commission
Online booking proportion in leading urban hospitals	Often above 70% of outpatient visits	Hospital annual reports / municipal health data

These figures show that digital platforms are not marginal tools. They form the structural core of outpatient entry in large public hospitals. When the majority of appointments are distributed online, the platform defines how medical resources circulate.

In many hospitals, expert appointments are released at fixed times. Patients must log in at that moment and compete for limited slots. This practice is often described as “online grabbing.” The speed of operation, network stability, and familiarity with the interface influence the outcome. The platform determines how long a slot is reserved before payment. It determines how many attempts are allowed. These technical rules structure competition.

Under this arrangement, digital performance becomes directly connected to resource access. Patients who understand release schedules and

can operate quickly increase their chances of securing high-demand appointments. Patients who are unfamiliar with these patterns often miss opportunities. They may not know when slots are released. They may not complete the process within the required time. Access to scarce medical resources therefore becomes linked to digital competence.

The platform also centralizes and standardizes information. Departments, doctors, schedules, and fees are displayed in fixed formats. This supports administrative control and data management. It limits flexibility at the same time. In earlier registration systems, patients could interact with staff and request clarification. In the platform model, the interface defines the range of choices. What appears on the screen becomes the boundary of possibility.

Through platformization, outpatient resources

are no longer allocated mainly through physical presence. They are allocated through procedural completion and digital interaction. The system applies uniform rules. These rules appear neutral. Their effects are not uniform. When high-value appointments depend on rapid and accurate digital action, users with stronger digital skills gain structural advantages. The platform thus functions as both allocator and filter within the outpatient system.

4.3 Contraction of Offline Alternatives

The growth of digital appointment systems has also changed the role of offline registration channels. In many large hospitals, the number of on-site registration windows has been reduced. Some hospitals reserve only a small portion of slots for walk-in patients. In certain departments, appointments must be made online in advance. Patients without a confirmed booking may be asked to use self-service machines or mobile platforms inside the hospital.

This reduction of offline options weakens the fallback mechanisms that once balanced differences in ability. In the past, patients who were unfamiliar with new procedures could rely on staff at registration counters. Face-to-face communication allowed clarification and correction. Staff could guide patients through department selection and scheduling. This human support acted as a buffer. It reduced the impact of skill differences.

Under the platform-centered model, that buffer becomes thinner. Self-service kiosks often mirror the same digital steps found in mobile applications. They require identity verification and time-slot selection through touch screens. If assistance desks exist, they may focus on technical guidance rather than full substitution. The responsibility shifts to the patient to complete the digital process. Offline space no longer guarantees equal entry.

Organizational restructuring therefore changes how capability differences translate into outcomes. When offline channels shrink, patients with limited digital skills lose compensatory pathways. Patients with stronger digital competence are able to secure appointments in advance. They arrive at the hospital with confirmed slots. Patients who depend on offline registration face uncertainty. They may find that no slots remain. In this way, digital ability turns into a practical advantage in

accessing scarce resources.

The system does not openly rank patients by skill. It maintains uniform procedures. However, by narrowing offline alternatives, the organization reduces its capacity to offset inequality in digital competence. Digital ability becomes directly linked to resource acquisition. The weakening of compensatory channels is therefore a key step in the conversion of technological difference into structured advantage.

5. Micro-Level Production of Digital Exclusion

5.1 Cognitive and Interface Complexity

Digital exclusion is not produced only at the level of policy or organization. It is also produced through everyday interaction with the appointment system. The structure of the interface and the sequence of required steps play a direct role in shaping access. What appears to be a neutral technical process often contains multiple layers of procedural demand.

Most hospital appointment platforms require users to complete several consecutive steps. A patient must log in, select a hospital, choose a department, identify a specific doctor, review available time slots, confirm personal information, complete real-name verification, and finalize payment. Each step requires attention and accuracy. Missing one step means starting again. For users familiar with digital systems, these actions feel routine. For many older adults, they create cognitive pressure.

Verification mechanisms add another layer of difficulty. Many platforms require users to enter short-lived verification codes sent by text message. These codes must be read, remembered, and entered quickly. The time limit is often strict. If the code expires, the process must be repeated. This design assumes that users can switch between applications, copy information correctly, and respond within seconds. For individuals with slower reaction time or limited experience with smartphone navigation, this requirement becomes a barrier.

Real-name binding also introduces procedural complexity. Patients must input identification numbers, confirm personal details, and sometimes upload documents. Errors in typing can lead to system rejection. Correction procedures are not always clear. The process demands a level of familiarity with digital forms and standardized input rules. Even small

mistakes can prevent completion.

Time-slot selection further intensifies the filtering effect. Many specialist appointments are released in limited quantities at fixed times. Users must understand release schedules and act quickly. The interface may refresh automatically, and available slots can disappear within moments. Successful booking depends on both speed and confidence in navigating options. Hesitation increases the chance of failure.

These layers of complexity do not operate as explicit exclusion rules. They function as procedural filters. The system does not ask whether a user is digitally skilled. It simply requires successful completion of each step. Users who can manage the sequence pass through. Users who struggle drop out at different stages. The cumulative effect of multi-step navigation, verification demands, and time pressure transforms small capability differences into decisive outcomes.

In this way, institutional design shapes access through interactional detail. The interface becomes a site where governance logic meets individual capacity. The complexity of the process is not accidental. It reflects priorities such as security, accuracy, and control. Yet these priorities also create a layered screening mechanism. Digital competence becomes the condition for entry, and the appointment system quietly sorts users according to their ability to handle procedural complexity.

5.2 Delegated Access and Loss of Autonomy

When older patients cannot complete digital procedures on their own, they often turn to others for help. This leads to delegated access. The act of booking an appointment shifts from the patient to another person. Access to care becomes dependent on social networks rather than individual action.

One common form is assistance from adult children. Many older patients ask their sons or daughters to register accounts, monitor release times, and secure appointments. This arrangement may work in families with available and digitally skilled members. It does not work equally for all households. Some older adults live alone. Some have children who work long hours or live far away. Access then depends on the availability and willingness of family members. Medical appointments become coordinated around family schedules instead of

patient needs.

A second form is reliance on third-party intermediaries. Some patients pay service providers to complete the booking process. These intermediaries monitor appointment release times and use multiple devices to increase success rates. In high-demand departments, this practice has become common. It introduces additional costs. Patients with financial resources can improve their chances. Patients without such resources remain at a disadvantage.

There is also the reappearance of informal brokers often described as “scalpers.” Although digital platforms were partly introduced to reduce in-person scalping, the logic of scarcity remains. When expert slots are limited and highly competitive, new forms of brokerage emerge in online space. Individuals with strong digital skills can secure appointments and resell them. The platform does not directly endorse this behavior, but the structure of competition makes it possible.

These patterns show that limited digital ability does not simply block access. It creates dependency. Older patients who cannot navigate the system must rely on family, market actors, or informal networks. This dependence changes the meaning of autonomy in healthcare. The ability to seek medical treatment becomes mediated by others. Decision-making and timing are no longer fully under the patient’s control.

Delegated access also reshapes inequality. Patients with strong family support or financial means can compensate for digital limitations. Patients without such support face repeated failure or delayed care. Capability gaps therefore expand into social and economic differences. The appointment system does not directly require delegation. It produces conditions in which delegation becomes necessary for some groups. In this way, digital exclusion at the micro level leads to structured patterns of dependence within the healthcare system.

5.3 Psychological Withdrawal and Institutional Alienation

Digital exclusion does not stop at procedural difficulty. It gradually enters the psychological domain. When older patients encounter repeated obstacles in the appointment process, their response is not limited to technical

frustration. Emotional reactions begin to shape behavior. The interface may appear simple to experienced users, yet for many older adults it feels unstable and fast-moving. Pages refresh quickly. Appointment slots disappear within seconds. Error messages interrupt the process. Each failed attempt increases tension.

The structure of online booking introduces a new type of uncertainty. In physical queues, waiting is visible. Patients can see how many people are ahead of them. They can estimate time through observation. The digital platform removes this spatial transparency. The competition takes place in an invisible environment. Users cannot observe others. They cannot assess their position in line. When a desired slot disappears, there is no visible explanation. The experience creates a sense of unpredictability. For older patients who are accustomed to tangible procedures, this invisibility weakens their sense of control.

Anxiety grows when success depends on speed and accuracy. Verification codes must be entered within limited seconds. Time slots must be selected quickly. Any hesitation may lead to failure. For users who type slowly or who need time to read instructions carefully, this structure produces pressure. The body reacts to the countdown timer and rapid screen changes. What appears to be a neutral interface becomes a source of cognitive stress.

Repeated failure affects self-perception. When older patients cannot secure appointments despite multiple attempts, they may attribute failure to personal inadequacy. They may believe that they are “not capable” or “too old to understand.” This internalization of failure has consequences. Confidence in interacting with digital systems decreases. A single unsuccessful experience does not produce withdrawal. Continuous unsuccessful experiences create a pattern. That pattern reshapes expectations.

Behavioral withdrawal often follows psychological strain. Some older patients stop trying to book appointments online. They postpone visits. They wait until symptoms worsen. They avoid departments that require online reservation. In chronic disease management, delayed consultation interrupts continuity of care. The system does not formally deny access. The withdrawal occurs at the level of patient decision. The exclusion is silent.

This withdrawal also alters the patient’s

relationship with the institution. Hospitals appear procedural rather than relational. The interaction shifts from speaking with staff to interacting with screens. Older adults who value face-to-face communication may feel detached from the system. They do not experience the hospital as a responsive organization. They experience it as a rigid platform.

Trust can erode under these conditions. When access depends on digital speed instead of perceived medical need, fairness becomes questionable in the eyes of some patients. They may believe that those who are more skilled with phones gain advantage. The impression of competition replaces the expectation of equal treatment. Even if the rules are uniform, the outcomes are uneven. This perception weakens institutional legitimacy at the individual level.

Dependence on others intensifies the sense of alienation. When patients must rely on children or third parties to secure appointments, autonomy declines. The act of seeking medical care becomes mediated. Older adults may feel hesitant to ask for help repeatedly. They may worry about burdening family members. This emotional hesitation contributes to delayed action. The system thus shapes not only access but also family dynamics.

Institutional alienation does not mean open resistance. It appears as distance. Patients comply when assistance is available. They withdraw when it is not. The hospital remains physically present, yet psychologically distant. Interaction becomes transactional rather than communicative. For patients who built expectations of care in an earlier administrative model, this transformation alters the meaning of medical access.

Over time, psychological withdrawal reinforces structural inequality. Patients who continue to engage with the digital system secure timely appointments. Patients who retreat lose opportunities. The gap widens not through explicit policy discrimination but through cumulative behavioral differences. The digital interface becomes the site where governance logic meets human vulnerability.

This process reveals that exclusion is not only technical. It is relational and emotional. The appointment platform filters users through procedural requirements. It also reshapes how patients understand their position within the healthcare system. When digital interaction

repeatedly produces stress, confusion, or failure, the result is not only missed appointments. It is reduced willingness to participate.

In an aging society, this psychological dimension carries long-term implications. Older adults form a growing share of outpatient users. If a portion of this group disengages from digital systems, the gap between institutional design and population needs widens. The system continues to operate efficiently for those who adapt. It becomes increasingly distant for those who do not. Exclusion thus stabilizes through everyday experience.

The micro-level production of digital exclusion therefore involves more than interface complexity and delegated access. It includes a gradual shift in perception. Older patients move from active participants to hesitant users. Some become passive observers of a system that feels difficult to navigate. The withdrawal is quiet. It leaves few visible traces in administrative data. Yet its impact accumulates across time.

Digital reform was designed to reduce congestion and improve order. It succeeds in organizing patient flow. At the same time, it reorganizes emotional engagement. The platform does not intend to produce alienation. The outcome emerges from repeated interaction between standardized procedures and uneven capabilities. Psychological withdrawal becomes the final stage in the conversion of digital difference into institutional distance.

This is why digital exclusion must be understood as more than a technical gap. It is a process through which institutional structure shapes behavior, emotion, and trust. The appointment system does not openly reject older patients. It creates conditions under which some of them step back. The step back is voluntary in form. It is structured in origin.

6. Institutionalization of the Digital Divide

The previous sections have traced how digital reform reshapes entry conditions, reorganizes allocation rules, and filters users through procedural requirements. The process can be summarized as a sequence of institutional transformation.

Table 3. Mechanism of Institutionalization of the Digital Divide

Stage	Institutional Process	Structural
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		Effect
1	Digital competence embedded as entry condition	Capability filtering
2	Repeated differential appointment access	Resource stratification
3	Stabilized allocation patterns	Structured inequality

This sequence shows how digital competence becomes gradually embedded in the structure of access. When digital interaction becomes the primary condition for outpatient entry, differences in ability begin to translate into differences in resource acquisition. The change does not occur at a single moment. It develops through repeated encounters with the platform. Patients who navigate the system efficiently secure appointments earlier, select preferred time slots, and reach high-demand specialists. Patients who struggle face delays, missed opportunities, or repeated failure. Over time, digital competence becomes closely tied to the ability to obtain scarce medical resources.

As these patterns repeat, access differences extend beyond scheduling. In large public hospitals, specialist consultations and key departments often have limited daily quotas. When these quotas are distributed through digital release mechanisms, timing and speed shape outcomes. Patients who monitor release schedules and respond quickly increase their success rate. Patients who hesitate or depend on assistance are less likely to secure appointments. The rule remains formally equal. The outcomes become uneven.

Accumulated differences influence clinical pathways. Timely access to specialists supports early diagnosis and structured treatment planning. Delayed access may allow conditions to worsen before intervention. In chronic disease management, regular follow-up enables medication adjustment and monitoring. Interrupted follow-up weakens continuity of care. The gap in digital competence therefore shifts from procedural difference to difference in clinical trajectory.

Once access patterns stabilize, medical quality differences emerge. Patients who regularly obtain specialist care benefit from more detailed evaluation and tailored treatment. Patients who encounter repeated barriers may rely on

lower-level facilities or postpone care. The difference is not the result of explicit discrimination. It develops through institutional mediation. Digital systems define who can enter higher tiers of service smoothly and who cannot. Health outcomes reflect these layered processes. Delayed diagnosis, irregular consultation, and fragmented treatment may influence long-term prognosis. The impact appears gradually. Older adults who face repeated difficulty may seek care only when symptoms intensify. Preventive visits decline. Acute episodes increase. The healthcare system responds at later stages rather than earlier points of risk.

Institutionalization occurs when these processes become normalized. The digital appointment system ceases to be viewed as a transitional reform. It becomes routine practice. Hospitals organize staffing and workflow around digital booking. Offline channels remain limited. New patients enter an already stabilized structure. Digital competence is treated as an expected attribute rather than a variable condition. The initial mismatch between institutional assumptions and population capacity receives less attention.

At this stage, the digital divide is no longer framed as a temporary adaptation issue. It becomes embedded in everyday operation. The system continues to function smoothly for those who meet procedural demands. Barriers persist for those who do not. Capability difference transforms into durable stratification.

This process demonstrates how institutional design can stabilize inequality without explicit exclusion. Uniform rules apply to all users. The interaction between those rules and uneven capabilities produces differentiated outcomes. When digital ability determines access to medical resources, it also shapes exposure to medical quality and health protection. The digital divide shifts from a technological gap to a structural component of healthcare governance. Once stabilized, it reproduces itself through routine practice.

7. Rebalancing Efficiency and Equity in Aging Societies

7.1 Limits of Pure Efficiency-Oriented Reform

The digital transformation of outpatient services has achieved visible gains in order and administrative control. Patient flow is easier to manage. Appointment data can be tracked.

Congestion in hospital halls has decreased in many urban centers. These outcomes reflect the success of efficiency-oriented reform. The system operates in a more predictable manner. Managers can allocate resources with greater precision.

However, the emphasis on efficiency has shaped the value hierarchy of reform. Time savings, measurable output, and standardized procedures occupy the central position. Accessibility and adaptability receive less attention. When efficiency becomes the dominant reference point, design choices tend to favor users who can comply quickly with procedural requirements. Those who require additional time or assistance are treated as exceptions rather than as a core part of the service population.

In an aging society, this imbalance carries structural risk. Older adults represent a growing proportion of outpatient users. If the system assumes uniform digital competence, it places increasing pressure on a population segment with uneven capacity. Efficiency gains for the system may correspond to access barriers for some groups. The reform logic does not openly prioritize one group over another. Yet its design reflects a certain image of the “ideal user” as digitally capable and self-directed.

A governance model centered only on efficiency can overlook long-term equity implications. Medical systems are not only service platforms. They are also public institutions responsible for inclusive access. If procedural speed becomes the main standard, fairness may weaken over time. The tension between efficiency and equity does not require abandoning digital reform. It requires re-examining how values are ordered within institutional design.

7.2 Toward Hybrid and Assisted Access Models

Rebalancing efficiency and equity calls for structural adjustment rather than minor technical fixes. Simplifying interfaces or adding tutorial videos may reduce some difficulty. These steps do not address the underlying assumption that digital self-operation is the normal mode of entry. A more durable response involves redesigning access pathways.

A hybrid access model can combine digital efficiency with stable offline support. Digital booking can remain the primary channel for those who prefer it. At the same time, hospitals can maintain sufficient on-site registration

capacity that does not depend on self-service machines alone. Human assistance desks can function as full substitutes rather than partial guidance points. Offline quotas for high-demand departments can be preserved to ensure that physical presence remains a viable path.

Assisted digital pathways provide another direction. Hospitals may establish structured support roles in which trained staff complete booking procedures on behalf of patients without transferring responsibility entirely to family members. Community health centers can act as intermediary access points, helping older residents secure appointments in higher-level facilities. Such arrangements integrate digital systems into broader care networks instead of isolating them at the hospital gate.

These adjustments do not reverse digital reform. They recalibrate it. The goal is not to remove technological tools but to align institutional design with demographic reality. An aging population requires flexible entry mechanisms. When multiple access routes coexist, digital competence no longer functions as a strict filter. Efficiency remains achievable. Equity becomes structurally protected.

Rebalancing reform in this manner recognizes that digital governance is not neutral. It shapes participation conditions. By adjusting organizational structure rather than focusing only on user adaptation, healthcare systems can reduce the risk that technological change hardens into institutional exclusion.

8. Conclusion

This study has examined how the digital divide among older patients in China's appointment-based outpatient system is produced and stabilized through institutional design. The analysis began by questioning the common explanation that attributes access problems mainly to individual lack of digital skill. It then showed that digital medical reform operates as a restructuring of entry conditions rather than as a simple technological upgrade.

The appointment system is built upon a governance logic that values efficiency, standardization, and data control. Within this logic, digital self-operation becomes an assumed norm. Organizational restructuring relocates the entry point from physical space to digital platforms. Offline alternatives shrink. Procedural completion becomes the prerequisite

for medical access. At the micro level, interface complexity, verification demands, and time-sensitive booking mechanisms function as filters. Capability differences are translated into differences in resource acquisition.

Over time, these differences accumulate. Digital competence becomes linked to access to specialist care. Access patterns influence treatment continuity and medical quality. Medical quality differences may shape health outcomes. When these processes become routine, the digital divide is no longer temporary. It becomes embedded in everyday operation. The system appears neutral. Its effects are uneven.

The findings suggest that digital transformation in healthcare cannot be evaluated only by administrative efficiency. In an aging society, institutional assumptions must be examined in relation to population structure. When digital competence functions as a hidden entry condition, exclusion may arise without explicit discrimination. Addressing this issue requires structural recalibration of access pathways rather than simple technical training for older users.

Understanding the digital divide as an institutional outcome shifts the focus from individual adaptation to governance design. It highlights the need to consider how rules, procedures, and organizational arrangements shape participation. Digital systems can improve order and coordination. They also define who can enter smoothly and who faces barriers. The balance between efficiency and equity will determine whether digital reform enhances healthcare access for all groups or consolidates new forms of inequality.

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