



## Bridging the Chasm: A Systematic Review of a Shared Digital Platform to Automate ED Discharge to Primary Care Intake

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### Abstract

**Background:** Handover of care between the emergency department (ED) and primary care is a critical milestone that has been proven to be error- and communication-critical. Even in settings where electronic health record (EHR) usage is prevalent, there continues to be a deep digital divide between such settings. This continuity break creates discontinuous care, medication mistakes, lost follow-up on test results, and patient dissatisfaction, and is a resurgent gap in modern healthcare delivery.

**Aim:** The review paper presents and critically examines the concept of a shared digital platform to safely automate transfer from ED to primary care. The core function is the automatic conversion of a patient's ED discharge summary to an actionable, structured "to-do list" in their primary care electronic chart.

**Methods:** Grounded in an aggregation of existing literature, the review surveys evidence and theories regarding health information exchange (HIE), interoperability standards, workflow integration, and implementation science. It further offers a complete architectural framework for the intended platform and accounts for the chief human factors to its uptake.

**Results:** The analysis describes the platform's potential benefits, including increased follow-up adherence, improved care coordination, and reduced provider burdens. But it also suggests formidable challenges to be addressed, including technical interoperability, data privacy, redesign of workflows, and fiscal viability. The review concludes by discussing the policy and fiscal models required for widespread use.

**Conclusion:** By synthesizing current evidence, the review offers a seminal guide for healthcare systems, technology providers, and policymakers to close one of the longest-standing and riskiest gaps in patient care, transforming an interval of risk into one of coordinated care.

**Keywords:** Care Transitions, Health Information Exchange, Interoperability, Patient Safety, Primary Care

### 1. Introduction

The ED is the front door to the medical system for millions of patients, with everything from minor trauma to life-threatening conditions. One of the simple, yet often unmet, roles following an ED visit is getting information and responsibility for follow-up care transferred to the patient's medical home—their PCP (Horwitz et al., 2009). The current state of such a transformation is usually characterized by information

silos. The majority of EDs discharge electronically, and the resulting discharge summaries are usually transmitted by fax, mail, or patient hand-carry, all of which are slow, unreliable, and insecure mediums (Klein et al., 2023). Even if carried digitally, they can be stored in a passive component of the PCP's EHR, e.g., a general "inbox" or "documents" folder, where they can be easily overlooked amidst a deluge of other clinical tasks (Stiell et al., 2018).

The consequences of such communication breakdown are severe and well-documented. Studies indicate that over 30% of ED-discharged patients lack follow-up with a PCP within a timely period, exposing them to ED recidivism and hospitalization (Hesselink et al., 2012). Incomplete reconciliation accounts for medication discrepancies in nearly half of all ED discharge cases (Stiell et al., 2018). Most troubling perhaps, pending ED test results, such as imaging or cultures, are frequently lost to follow-up, leading to delay of diagnosis and potential harm to patients (Weber et al., 2022). This chaotic system is causing such tremendous strain on both the patients, who must get around a complex system, and on the PCPs, who are frequently left to work with incomplete information (Arbaje et al., 2014).

The proposed intervention—a co-shared electronic platform that automatically translates an ED discharge summary into a prioritized to-do list within the primary care chart—is a radical departure from passive transfer of information to active management of care. This review will examine systematically the evidence, elements, and issues involved in the design and implementation of such a system. It depends on the assumption that technology, if properly designed and implemented, can be a powerful agent to facilitate the unification of acute and ambulatory care, eventually maximizing patient safety, improving outcomes, and optimizing utilization of the healthcare system.

### **The Conceptual Framework: From Passive Document to Active To-Do List**

The major innovation of the proposed platform is its paradigm shift in the concept of the discharge summary from a static, narrative document to a dynamic, structured repository of data that auto-generates targeted, actionable tasks into the mainstream primary care workflow (Ballard et al., 2019). It is a movement from passive information sharing to active care coordination, where a closed-loop process is developed that ranges from data capture through task completion and feedback. The redesigned process addresses the critical failure points in today's care transitions by not only providing information to the primary care practice but also infusing it in a form that necessitates and facilitates action (Kripalani et al., 2007). The design is based on the core principles of organized data, standard interoperability, and intelligent task creation to bridge the communication chasm effectively.

The most crucial and initial stage of this system is emergency department data capture and structuring. The ED discharge summary must transcend free-text narrative with an ancient paradigm to achieve a high degree of structuring on the basis of standardized terminologies and data fields (Hripcsak et al., 2014). Machine readability and additional automation of tasks necessitate the necessary structured data elements. These include correct patient

identifiers to enable matching appropriately, coded ED diagnoses via mechanisms like ICD-10 or SNOMED CT, the ultimate list of drugs reconciled during the visit, and the obvious indication of any ordered study with its expected result dates (Stiell et al., 2018). Most critically, perhaps, follow-up activities should be concrete and executable, with both proposed timing and clinical reason given, beyond "follow up with your doctor" type of broadness (Marin et al., 2021). The routine use of such templated information is the cornerstone upon which interoperability is erected, as it allows the receiving system to parse and interpret clinical data unambiguously, a prerequisite for any automated process (Benson & Grieve, 2016).

When the data is aggregated, it must then be exchanged securely and reliably from ED EHR to primary care EHR, which comes under the ambit of health information exchange (HIE). The platform can operate under various architectural models, such as a centralized HIE hub, a federated query-based model, or direct point-to-point interfaces between separate EHR systems (Adler-Milstein & Pfeifer, 2017). Regardless of the architecture employed, the transmission must comply with stringent security standards, including HIPAA requirements, with robust encryption being applied to data both in transit and at rest to protect patient confidentiality (The Office of the National Coordinator for Health Information Technology [ONC], 2020). Of more significance, even secure transmission is not sufficient; data must be semantically interoperable, with the receiving system being able to comprehend and make use of the information. The FHIR standard developed by HL7 is gaining prominence as the framework of choice for this endeavor (Mandel et al., 2016). FHIR's atomic data elements, or "resources" (such as Condition for diagnosis, ServiceRequest for follow-up), can be bundled to express a discharge summary in a formal, structured way so that the platform can "talk" to the primary care EHR to create specific tasks, thereby moving beyond mere document sharing (Boussadi & Zapletal, 2017; HL7 International, 2023).

The final step of the conceptual framework is the generation and aggregation of tasks within the primary care EHR, i.e., completion of the "to-do list." Once the structured FHIR bundle is received and validated, a clinical logic engine within the primary care system reads the information against a set of configurable rules to generate discrete, context-specific tasks (Marin et al., 2021). These are not generic reminders but are specific, actionable tasks integrated within the PCP's native clinical workflow dashboard, just like other such activities as responding to patient messages or signing orders (O'Malley et al., 2010; Sinsky et al., 2016). For instance, the system will automatically generate the task of "Follow-up Appointment Required" with a recommended time, or "Review Pending ED Result: Blood Culture" with a due date and a direct link to the laboratory report. This

active integration and tasking transform the primary care team from passive recipients of information, obligated to sift manually through papers, to proactive post-ED care managers, ensuring important actions are rigorously followed up on and are far less likely to be missed (Weber et al., 2022; Kripalani et al., 2007). Active management is necessary to promote follow-up compliance and mitigate patient safety hazards associated with care transitions.

#### **Potential Value and Value Proposition**

Implementation of a shared digital platform for ED-to-primary care intake can potentially introduce multi-dimensional value to patients, providers, and the health system.

#### **Enhancing Patient Safety and Quality of Care**

The most significant benefit is the potential for a dramatic reduction in medical errors and patient harm. By providing automated tracking of outstanding test results, the system directly addresses one of the most significant patient safety hazards. A systematic review by Liu et al. (2019) concluded that computerized notification and tracking systems reduced the rate of missed actionable test results significantly. Moreover, by alerting to changes in medications for explicit reconciliation at the first post-discharge visit, the platform can prevent adverse drug effects (Stiell et al., 2018). Prompt follow-up, facilitated by automated tasking, has been associated with improved outcomes for conditions like pneumonia, heart failure, and infection, reducing complications and readmission risk (Hesselink et al., 2012; Kromka & Simpson, 2019).

#### **Improving Care Coordination and Continuity**

The platform represents a tangible vehicle for care coordination, creating a "closed loop" communication system between primary care and the ED. The PCP gains an unambiguous, timely, and comprehensive perspective of the ED visit and can provide informed and continuous care (Schoen et al., 2011). It evokes a sense of common responsibility for the patient, bridging the traditional chasm between chronic and acute care management (O'Malley et al., 2010). For those patients with complex chronic illness, continuity is also important because the ED visit is most likely an acute exacerbation that must be managed carefully in the ambulatory setting (Arbaje et al., 2014).

#### **Reducing Provider Burden and Workflow Efficiency**

Contrary to introducing a new "list" of tasks, the platform is intended to reduce cognitive burden and administrative workload. For ED clinicians, it promotes the creation of quality, well-formatted discharge summaries through the provision of real-time utility, likely improving their documentation (Marin et al., 2021). For primary care teams, it saves them time and effort and also the error-prone process of manually receiving, interpreting, and sorting faxed or scanned discharge reports (Klein et al., 2023). The work is pre-sorted and put into context so that medical

assistants, nurses, and physicians can perform to the highest level of license in dealing with it. This can deliver significant efficiency gains so that PCPs can focus their cognitive energy on clinical judgment rather than administrative archaeology (Sinsky et al., 2016).

#### **Facilitating Patient Engagement**

Though the fundamental focus is provider-to-provider engagement, the platform can be utilized to engage patients as well. Through an engaged patient portal, the to-do list, or its patient-readable version, can be rendered visible to the patient. This can include reminders to schedule their follow-up appointment, a clear list of new medications, and notifications when pending results are finished and accessed (Irizarry et al., 2015). Engaging patients as active participants in their own care transitions has been shown to improve follow-up plan compliance and satisfaction (Griffey et al., 2015).

#### **Critical Challenges and Implementation Barriers**

While its potential power is compelling, the creation and widespread adoption of such a platform are open to daunting challenges that must be identified and addressed. The most significant technical barrier is the lack of seamless interoperability among incompatible EHR systems. While standards like FHIR provide a path forward, most systems in use today lack robust FHIR application programming interfaces (APIs), and even where APIs exist, data mapping between different institutional implementations can be complex and time-consuming (Benson & Grieve, 2016; Mandel et al., 2016). Patient identification—having the ED record correctly cross-refer to the appropriate primary care record—is a non-trivial issue whose failure leads to disastrous errors (Grannis et al., 2019). Moreover, success relies on high-quality, structured entry in the often chaotic ED setting, which is itself beset by workflow and usability challenges (Hripcsak et al., 2014).

#### **Data Security, Privacy, and Consent**

Exchanging sensitive health information across organizational boundaries inevitably increases the threat of data breach. The platform must be designed with a "security by design" mindset, with rigorous access controls, audit trails, and encryption (ONC, 2020). On top of this, compliance with state and federal requirements for patient consent for sharing data may become complex. Some states require upfront patient consent for HIE, and this may present an obstacle unless resolved amicably at the point of care (Adler-Milstein & Pfeifer, 2017).

#### **Workflow Integration and Change Management**

It is not the technology alone; it must be integrated into ED and primary care providers' clinical workflows. A poorly integrated system that necessitates extra clicks or conflicts with habits will be avoided by users, even though it is useful (Chishtie et al., 2023). In the ED, physicians can push back against more formal documentation if it is perceived to be burdensome. In primary care, too many new

automated tasks can cause alert fatigue unless they are properly prioritized and managed (Greenberg et al., 2021; Sinsky et al., 2016). Successful adoption requires significant end-user involvement from the outset, evolutionary design, and intensive training and support (Harrison et al., 2007).

#### Financial Services and Models for Sustainability

Manufacturing, deployment, and maintenance of a cross-institutional digital platform require enormous costs of investment costs. The business model is complex, whereby the costs may be covered by one organization (for example, the insurer or the HIE) and monetary returns (for example, reduced readmissions) may accrue to another (for example, the hospital or the accountable care organization) (Holmgren et al., 2023). There must be models of funding that are sustainable, which may include shared savings under value-based care agreements, fees per transaction, or direct public and private grants.

#### A Proposed Architectural Design and Functional Specifications

To translate this conceptual model into a working reality, a detailed standards-based architectural design is needed. The proposed platform would be a middleware solution, an intelligent broker that would facilitate safe and understandable data exchange between the often-heterogeneous electronic health records (EHRs) of primary care practices and emergency departments (Benson & Grieve, 2016). This architecture is comprised of several important elements that work in sequence. The process starts with an ED-Side FHIR Client, an integrated module of the ED EHR that packages the structured discharge data into a FHIR bundle of standardized resources such as Encounter, Condition, and ServiceRequest (Mandel et al., 2016). This package is subsequently routed to a Secure FHIR API Gateway, which checks the source, accepts information, and performs basic

early validation and patient matching verification to ensure data integrity and the identification of correct recipients (Grannis et al., 2019).

The Clinical Logic Engine is the backbone of the platform, which reads in the arriving FHIR bundle to a configurable clinical rule set and determines the specific tasks required; for example, a rule might be, "IF ServiceRequest code equals 'Follow-up' AND occurrence DateTime falls within 7 days, THEN assign a 'Schedule Follow-up' task" (Greenberg et al., 2021). The outcome, a bundle now including FHIR Task resources, is submitted to the Primary Care-Side FHIR Client, which integrates these actionable items into the PCP's native workflow dashboard (Figure 1). Finally, An Audit and Feedback Module tracks the lifecycle of each task, generating quality improvement reports and providing feedback to the ED on the usefulness and effectiveness of their discharge summaries, forming a cycle of continuous improvement (Harrison et al., 2007).

The entire data stream is governed by existing interoperability standards to ensure consistency and accuracy. The platform would leverage FHIR Release 4 or later, with the application of specific implementation guides like the Da Vinci Project Clinical Data Exchange (CDex) to facilitate uniform implementation across different sites (HL7 International, ~2023). Security is paramount in cross-organizational data exchange; the architecture would therefore employ OAuth 2.0 for secure authentication and TLS 1.3 for encryption of data in transit and adhere to rigorous standards like those defined by HIPAA (ONC, 2020). The individual FHIR resources are the lexicon of this exchange, each playing its distinct role, such as the Patient for identification purposes, the ServiceRequest for follow-up instructions, and the Task resource itself, which is the "to-do" task in the middle, designed for the primary care team (Table 1).

**Table 1: Proposed FHIR Resources for Platform Data Exchange**

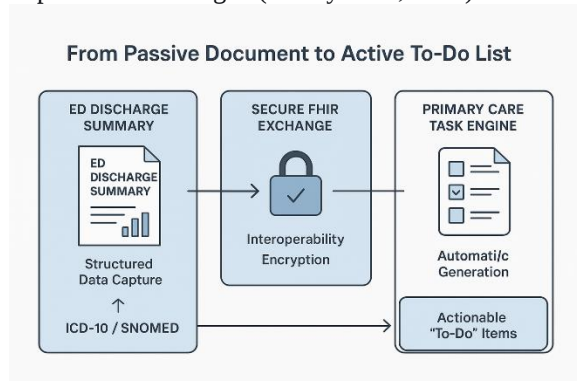
| Component                     | FHIR Resource     | Purpose and Key Data Elements                                                          |
|-------------------------------|-------------------|----------------------------------------------------------------------------------------|
| <b>Patient Identity</b>       | Patient           | Uniquely identify the patient (name, birth date, identifier).                          |
| <b>Visit Context</b>          | Encounter         | Define the ED visit (status: "finished", class: "emergency", period).                  |
| <b>Diagnoses</b>              | Condition         | Record the ED diagnosis (code from ICD-10, verificationStatus: "confirmed").           |
| <b>Medications</b>            | MedicationRequest | Specify new prescriptions (medication, dosage, intent: "order").                       |
| <b>Follow-up Instructions</b> | ServiceRequest    | Communicate the need for follow-up (code, priority, occurrenceDateTime).               |
| <b>Pending Tests</b>          | ServiceRequest    | Represent a pending laboratory or imaging study.                                       |
| <b>Generated Action</b>       | Task              | The core "to-do" item (description, for [patient], status, priority, executionPeriod). |

#### The Human Factor: Usability, Workflow, and Governance

Technology is only half the story. The individuals and organizational considerations are equally critical to success. The platform interface needs to be tailored to its different users. For the ED

physician, the interface for data entry needs to be convenient, fast, and part of their standard discharge workflow, perhaps through intelligent forms and templates that pre-populate where appropriate (Ballard et al., 2019). Task presentation for the primary care team must be unambiguous, prioritizable, and allow

easy delegation. Color-coding, filters, and smart default sorting (e.g., by due date or acuity) are required to prevent alert fatigue (Sinsky et al., 2016).



**Figure 1: Conceptual Framework — “From Passive Document to Active To-Do List”**

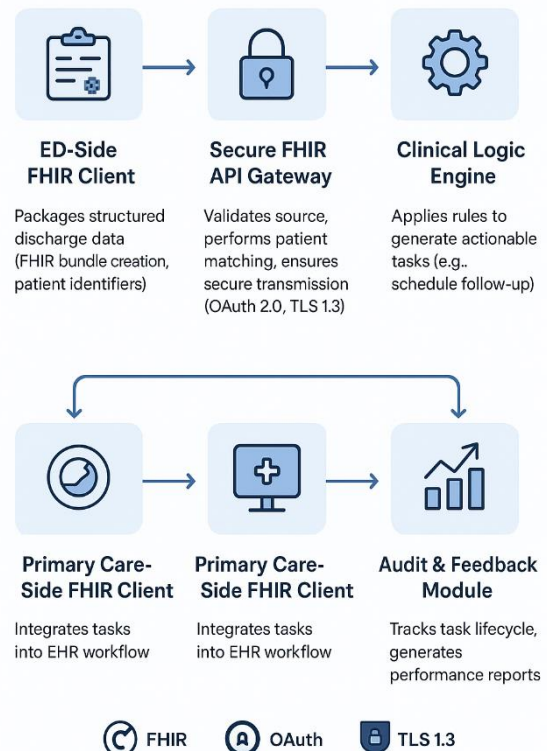
Implementation must be supported by a formal redesign of ED discharge and primary care intake processes. Inside the ED, this might involve establishing a novel role for an MA or nurse to verify the structured data before it is transmitted. Inside primary care, it is about having clear procedures about which team member (MA, nurse, physician) does different kinds of tasks (O'Malley et al., 2010). For example, a "schedule follow-up" task can be assigned to a medical assistant, but a "review abnormal CT scan" task can be assigned directly to the physician.

A shared platform requires a shared governance model. There should be a joint committee that has ED and primary care leadership, IT, and front-line clinicians appointed to oversee the operation of the platform, resolve conflicts, and approve clinical rule changes (Everson et al., 2021). Trust is essential; PCPs must be assured that what they are being

presented with from the ED is accurate and relevant, and ED providers must trust that the PCPs will implement the tasks that they assign. Such trust is founded on transparency, reliability, and demonstrated mutual value (Table 2 & Figure 2).

## System Architecture Overview

### Shared Digital Platform Data Flow



**Figure 2: System Architecture Overview**

**Table 2: Key Stakeholders, Areas of Concern, and Mitigation Strategies**

| Stakeholder Group                       | Primary Concerns                                                                           | Proposed Mitigation Strategies                                                                                                             |
|-----------------------------------------|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| <b>ED Physicians</b>                    | Increased documentation burden, disruption to fast-paced workflow.                         | User-centered design; integration with existing templates; demonstrate reduced call-backs from PCPs.                                       |
| <b>Primary Care Physicians</b>          | Alert fatigue, being overwhelmed by a new source of tasks, and liability for missed tasks. | Intelligent prioritization (e.g., "high," "medium," "low"); clear delegation protocols; integration with existing task management systems. |
| <b>Nurses &amp; Medical Assistants</b>  | Unclear responsibilities, added workload without compensation.                             | Involved in workflow redesign; define clear role-based protocols; demonstrate how it makes their work more efficient and less chaotic.     |
| <b>Patients</b>                         | Privacy of their data, confusion about who is responsible for their care.                  | Transparent consent processes; patient portal integration; clear communication about the new process.                                      |
| <b>Healthcare System Administrators</b> | Cost, ROI, interoperability complexity, and legal liability.                               | Develop value-based business case; pursue grant funding; pilot in a high-value population (e.g., complex chronic patients).                |

## Measuring Success: Evaluation Framework and Metrics

The impact of implementing such a platform should be assessed substantively using a multi-dimensional framework that will measure its impact on clinical, operational, and experiential outcomes. Overall measurement is critical to demonstrate value added and to inform iterative improvement (Proctor et al., 2011). For clinical outcome measures, two key indicators include the Rate of Follow-up Completion and median Time to Follow-up since timely follow-up has been strongly associated with reduced complications (Lin et al., 2015). Also, the platform's immediate impact on patient safety can be measured by the Rate of Missed Abnormal Results from the ED, which is a heavily documented area of weakness in transitions of care (Liu et al., 2019). Lastly, an effect on healthcare utilization, such as ED Recidivism Rate and Hospital Readmission Rate at 30 days, are most highest-level indicators of the platform's success in stabilizing patient care post-discharge.

Process and operation metrics provide insight into the effectiveness and workflow integration of the platform. The median Time to Primary Care Task Completion, from ED discharge to resolution of the task, directly measures the system's speed in permitting action (Kripalani et al., 2007). Medication Reconciliation Accuracy at first follow-up visit measures the effectiveness of the platform to avert a common source of medication mistakes (Stiell et al., 2018). For quantitative measurement of efficiency improvement, Provider Time Savings can be quantified through time-motion studies to estimate the time saved by staff from performing post-ED transition tasks manually (Chishtie et al., 2023). Finally, the System Usability Scale (SUS) Score offers a standardized measure to gauge the perceived ease of use and usability from both ED as well as primary care perspectives, being one of the predictors of long-term adoption (Brooke, 1996). For both measures of provider and patient experience, surveys measuring Provider Satisfaction with care coordination and burden reduction are required, since provider buy-in is crucial for success (Sinsky et al., 2016). Similarly, Patient Satisfaction surveys and validated measures like the Care Transitions Measure (CTM-3) reveal the patient's perception of care continuity and communication and confirm the platform meets its goal of enhanced patient-centered care (Parry et al., 2008; Griffey et al., 2015).

#### **Policy, Financial, and Future Directions**

We must have a supportive policy environment, financially sustainable models, and a forward-looking vision for improvement in order to sustain and scale this innovation. Policy and regulation are key drivers as robust facilitators of interoperability. US regulations under the 21st Century Cures Act, in particular its information blocking regulations and standardized API access standards, are establishing a regulatory mandate for EHR vendors to enable the kind of data sharing

required by this platform (ONC, 2020). Furthermore, payers like the Centers for Medicare & Medicaid Services (CMS) can foster acceleration by having specific quality metrics or financial incentives within value-based payment models for successful care transition outcomes, e.g., follow-up documented after an ED visit (Miller, 2009).

Due to the all-too-frequent misalignment of who receives and who pays financially, identifying sustainable financial models is essential. One other promising approach is Value-Based Contracting, where hospitals and primary care groups within shared-risk accountable care organizations (ACOs) jointly invest in the platform as a business strategy to reduce the total cost of care by eliminating costly readmissions and ED reuses (Miller, 2009). The alternative models would include either a Subscription or Transaction Fee by primary care practices, justified based on saved operations time and improved patient outcomes, or a Public Utility Model where local Health Information Exchanges (HIEs) create and offer the platform as a community necessity backed by grants from the state or a consortium of healthcare organizations (Adler-Milstein & Pfeifer, 2017).

In the future, the proposed platform is a foundation upon which more advanced features can be built. Future directions would leverage artificial intelligence (AI) and predictive analytics to take it much further. For instance, machine learning algorithms would be employed to Predict Follow-up Risk through analysis of ED visit history and patient data, so proactive outreach to patients can be made to those who are most likely to have missed their appointment (Sarasa Cabezuelo, 2020). The platform could also Automate Patient Outreach through messaging platform integration to deliver direct patient reminders. Finally, the same design concept is highly scalable and would be extended to Other Settings, such as transitions from inpatient hospital settings to primary care or from specialist consultation to the patient's medical home, building ultimately a full ecosystem for coordinated care throughout the entire healthcare continuum.

#### **Conclusion**

The post-emergency department discharge to primary care intake gap is an entrenched and insidious flaw in the design of modern health care. It is a source of medical missteps, patient harm, provider disillusionment, and system inefficiency. The shared digital platform described herein is technologically feasible and conceptually sound as a fix for this problem. By transforming the passive process of document transfer into an active process of creating an integrated, actionable to-do list, it has the potential to make care transitions a moment of managed care, not checking out.

It will not be simple to do that. It demands a constant effort to overcome deeply entrenched technical interoperability problems, to design with

unwavering focus on human usability, to build equitable financial models, and to instill a culture of collaboration and trust among disparate care settings. But the evidence assembled here suggests that the payoffs—a safer, more efficient, and more patient-centered continuum of care—are well worth the effort. As policy imperatives for interoperability become more robust and the finance transition to value-based care accelerates, it is now time for healthcare systems to commit themselves to building such basic digital bridges. The future of integrated, unbroken care depends on it.

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