Decentralizing Healthcare: Embracing Patient-Centric Care through Distributed Models and Technologies

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Abstract

This paper delves into the shift towards decentralized healthcare models, emphasizing the integration of technology and patient-centric approaches. It examines how decentralized identities (DIDs) enable physicians to deliver diverse care models through AI-CDSS and Web 2.0 technologies, beyond traditional borders. We argue that decentralization counters facility monopolies and supports physician autonomy, with facilities adopting DIDs to better meet patient needs and promote practice diversity. The paper highlights how this model reduces financial barriers for physicians, fosters facility interoperability, and strengthens system robustness, ultimately empowering patients to influence their care choices and access services more broadly.

1.1 Decentralized Health Network: AI-CDSS Driven Physician's Practice Models

In the realm of decentralized health networks, a significant paradigm shift is observed in the practice models adopted by physicians. These models are increasingly driven by AI-CDSS (Artificial Intelligence - Clinical Decision Support Systems) technologies and devices. The distinctive feature of these practice models is their reliance on technology rather than solely on the individual physician's expertise.

Key Characteristics of AI-CDSS Driven Models:

- **Standardization of Practice**: Unlike traditional models that depend heavily on the individual physician's skills and judgments, these AI-CDSS driven models adhere to a set standard of care. This standardization ensures that the care delivered meets or exceeds the precision and accuracy required in medical practice, independent of the individual physician's capabilities.
- **Physician's Role**: The role of physicians in this model is to be credentialed and trained in the use of these AI-CDSS technologies and devices. Once trained, the physician is not responsible for determining the standard of care independently. Instead, they re-issue a technology-driven standard of care, ensuring consistency and reliability in the healthcare services provided.
- **Authentication and Implementation**: The process of implementing these technology-driven practice models involves the authentication of physicians, as outlined in section 2.2. This ensures that only those with the appropriate credentials and training can deliver these standardized services, whether in-person or telemedically.

This evolution towards AI-CDSS technology and device-driven models represents a fundamental shift from the traditional practice of medicine, which relied heavily on the individual physician's judgment and expertise. It marks a move towards a more consistent, accurate, and precise standard of healthcare delivery, enhancing overall patient care quality.

1.2 Embracing Diversity through Technology in Healthcare

This section introduces a technology-driven approach to healthcare that leverages intellectual capital to distribute diverse care models while ensuring universal quality standards. It focuses on integrating AI-CDSS driven models across various geographic and regulatory landscapes, highlighting how technology can adapt to and uphold diverse healthcare standards globally. This method transcends traditional barriers, offering a sophisticated system for maintaining high-quality care universally, without homogenizing the unique facets of regional healthcare practices.

1.3 Decentralized Distribution of Healthcare Practices

The ability to distribute healthcare models revitalizes the provider pool by introducing a diverse array of practices, steered by the collaborative efforts of physicians, patients, and communities. This distribution affords patients the liberty to choose from a spectrum of healthcare options, transcending the limitations of geography. Without such

exportable models, patients may become overly dependent on individual physicians, potentially leading to issues of accessibility and high costs. By enabling a sovereign healthcare system that adapts to the cultural, temporal, and locational nuances of patient populations, healthcare provision becomes more tailored and diverse. The initial focus on outpatient and day-case environments sets the stage for a broader vision where patients could access advanced care, like telerobotic surgery, across multiple locations without the need for physical displacement of themselves or the physician, embodying the essence of healthcare as a public good.

Figure 1: Scalable Deployment of Decentralized Healthcare Models

Figure 1 portrays a schematic network of healthcare facilities that are not constrained by geographical borders, ranging from local to international locations. Central to this network is the physician, depicted alongside gears representing AI-CDSS and Web 2.0 technologies, signifying the tools that enable healthcare practice. These gears, superimposed upon each facility, represent the deployment of uniform healthcare practice models throughout the network.

This illustration conveys the portability of healthcare models, emphasizing that the delivery of care is driven by technology rather than the physical presence or specific credentials of physicians. Physicians, irrespective of their individual licensing jurisdictions, can adopt and 'sign in' to these standardized models, enabling them to provide consistent care across various regions. This approach reduces the dependency on the varied credentials of individual physicians, focusing instead on the dissemination of a validated model of care. The figure underscores the shift from a traditional credential-reliant practice to a model-centric healthcare system, where diverse licensing backgrounds of physicians enhance the reach and adaptability of care without compromising the integrity and quality of services provided.

2.1 The Role of Facilities in Decentralized Healthcare

2.1.1 Necessity of In-Person Care

Despite advances in telemedicine, in-person care remains a crucial component of healthcare services. Facilities, therefore, are vital stakeholders within the decentralized healthcare model. They serve as potential points of centralization within a system that otherwise strives for the distribution of care.

2.1.2 Challenges of Facility Centralization

The trend toward centralized identity architectures and the consequent consolidation of health data has led to a competitive landscape where facility acquisition becomes a strategy to drive out competition. This environment creates significant barriers for physicians intending to establish independent practices, as the startup costs and operational expenses associated with maintaining a facility are often prohibitively high.

2.1.3 Economic Implications on Practice Development

Physicians who manage to establish successful practices may resort to prioritizing income generation over the expansion and scalability of their practice. This economic behavior leads to market restriction, as services become more expensive to match the demand, inadvertently capping the market population. Such a scenario limits access to healthcare and propels the system toward scarcity rather than scalability, which could otherwise drive costs down.

2.1.4 Consequences for Innovation and Diversity

The existing system's dynamics often result in a trade-off between innovation and the diversity of practices within a region, to the detriment of the patient population. As facilities become monopolized, the ability of patients to access diverse and sovereign-based provision diminishes, leaving them with limited healthcare options.

2.1.5 Addressing Monopolization Through Harberger Taxation

One approach to counteract the monopolization of facilities is the introduction of Harberger taxation, which could potentially lower rent and incentivize the most profitable use of a facility. However, the application of such an

economic principle to healthcare provision requires careful consideration, particularly regarding the incentives for maintaining a population's health.

2.1.6 Institutional Strategies and Patient Sovereignty

Institutions might utilize their facilities as strategic assets to form exclusive partnerships with a select group of physicians, thereby driving out other potential providers. This strategy benefits shareholders but undermines patient sovereignty by limiting access to a broader range of healthcare providers.

2.2 Decentralization of Healthcare Identities

The decentralization of identities within the healthcare ecosystem is pivotal to dismantling the monopolistic tendencies of traditional healthcare institutions. By uncoupling the identities of healthcare facilities from physicians and patient health records, we remove the leverage institutional entities have in controlling who practices within a region. This shift enables a more patient-centric model, where facilities are used based on patient needs rather than the financial interests of shareholding entities.

Figure 2: Separating Physicians from Institutional Facilities

Figure 2 conceptualizes the decoupling of physicians' identities from healthcare facilities within a decentralized health network. At the center of the illustration stands a prominent structure, likely symbolizing an institutional healthcare facility. This facility is depicted as a node from which various connections emanate, extending towards distinct entities. On one side, there is a depiction of a physician aligned with a smaller building, representing a non-institutional facility, suggesting a shift towards a more distributed model of healthcare provision. Additional physician icons are situated independently, away from the central structure, indicating their operational autonomy from the institution. The overall layout of the image underscores the envisioned separation, where physicians maintain their practice independent of the central facility, highlighting the move towards a more flexible and patient-centric healthcare model.

2.2.1 Facility Independence through Decentralized Identities (DID)

Healthcare facilities are an integral component of the healthcare ecosystem and can greatly benefit from assuming their own Decentralized Identity (DID) within a health network. This autonomy allows facilities to operate independently, driven by healthcare demands rather than institutional partnerships that may restrict provider diversity.

2.2.2 Enhancing Access to Healthcare Facilities

Providing readily available access to facilities that are responsive to a sovereign healthcare setup can prevent the formation of restrictive partnerships between facilities and a limited group of physicians. As facilities adopt their own DID, they become authenticated participants in the decentralized health network, much like any professional entity, including physicians. This paradigm also acknowledges that many healthcare encounters, such as medical consultations, do not necessitate the specialized licensing of premises, thus further simplifying the process of healthcare delivery.

2.2 Empowering Patient-Centric Care through Decentralization

2.2.1 Breaking Monopolistic Practices

The decentralization of healthcare identities is pivotal in preventing the monopolistic use of facilities by large entities. By separating the identities of facilities from physicians and health records, we impede the ability of these entities to use their facilities as bargaining chips to selectively permit or deny professionals the opportunity to practice within a region.

2.2.2 Autonomous Facilities as Decentralized Identities

Healthcare facilities are central to the healthcare ecosystem and can greatly benefit from assuming their own Decentralized Identities (DIDs). This autonomy enables facilities to serve the patient community directly, rather than being instruments of profit driven by shareholding interests and restrictive partnerships.

2.2.3 Accessibility and Responsiveness to Healthcare Demands

Ensuring that facilities are accessible and responsive to the needs of a sovereign healthcare system mitigates the risk of exclusive partnerships that limit physician diversity and patient choice. By adopting their own DIDs, facilities like surgical centers can authenticate themselves within the decentralized health network just as physicians do, enhancing their ability to provide care that aligns with patient needs and expectations.

2.2.4 Simplifying Healthcare Delivery

The recognition that not all healthcare encounters require special facility licensing—for instance, medical consultations—further simplifies the delivery of healthcare services. This approach encourages the use of decentralized facilities for a wider range of healthcare services, extending beyond those requiring specialized environments.

Figure 2: Interaction Dynamics in Decentralized Healthcare Provision

Figure 3 illustrates the interaction dynamics among various stakeholders within a decentralized healthcare system. It demonstrates the flow of information and verification between a licensed medical doctor (MD), a patient, the public ledger, a medical society, and a healthcare facility. The numbered arrows indicate the sequence of interactions:

- The physician records a healthcare provision request into the patient's Personal Health Record (PHR), in response to a patient-initiated request for healthcare services.
- The physician can verify the licensure of the on-premise healthcare facility through the public ledger, ensuring that the facility meets the necessary standards for certain practices such as surgery.
- Concurrently, the patient interacts with both the public ledger and the physician, playing a central role in initiating and consenting to healthcare services.
- The healthcare facility, upon receiving a request, is responsible for confirming the physician's credentials independently with the medical society or licensing body.
- This creates a closed loop of authentication and authorization, ensuring that all entities are operating with verified credentials and within their scope of practice.

The diagram encapsulates the decentralized nature of healthcare provision, where a facility's capability to deny service is constrained by the verified status of a physician's credentials and the patient's request. This system is designed to be compatible with the concept of 'joining physicians' as shown in Figure 1, allowing for seamless hosting of practice models within various areas. Automation of these processes is achievable through server components of the participants, labeled as SSST, enhancing efficiency and reducing administrative burdens.

2.4 Advancing Facility Development through Physician Diversity

The introduction of a diversified portfolio of physicians carries the potential to spur the development of interoperable healthcare facilities. Such facilities are designed to lower the capital risks associated with physicians operating their practice models in new regions. The telemedical model serves as a prime example of this principle in action, where the decentralized structure significantly reduces operational costs for facilities, making the hosting of diverse healthcare provisions more economically viable.

2.4.1 Interoperable Facilities and Diversification

By adopting their own Decentralized Identities (DIDs), facilities become equipped to support a varied array of healthcare practices. This interoperability not only fosters a more dynamic healthcare environment but also provides facilities with resilience against the natural ebb and flow of practice demands within a region. It allows facilities to adjust quickly to the shifting landscapes of healthcare needs and patient preferences.

2.4.2 Patient-Driven Healthcare Choices

Patients retain the autonomy to initiate healthcare services either at the physician's original facility or through telemedical care at a remote site, thereby accessing their preferred model of healthcare. This flexibility is pivotal, provided there is a physician credentialed to practice within the region, ready to host the selected healthcare model. This system transcends traditional boundaries, offering patients an expansive array of healthcare options and empowering them to directly influence the healthcare offerings in their locality or within their community networks.

References and Further Reading

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