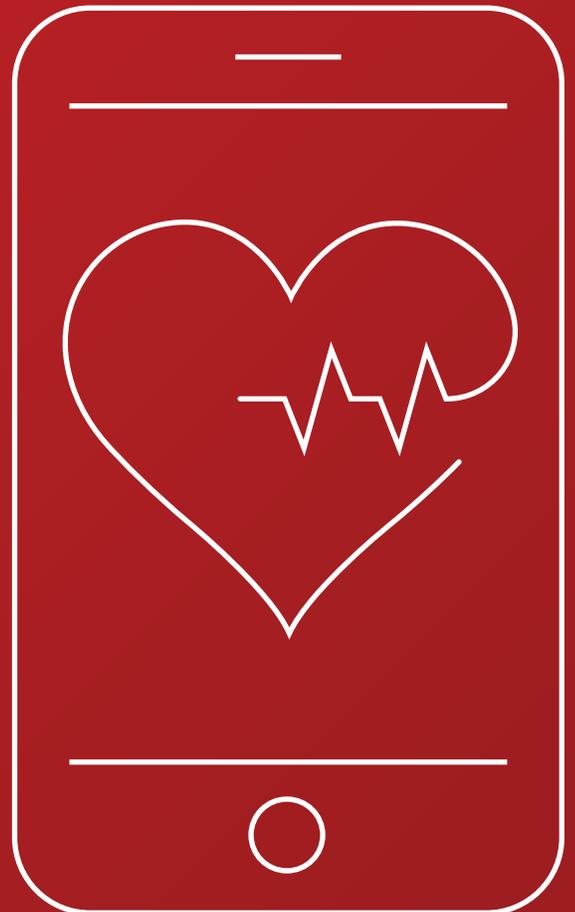


The Apple Health Integration Guide

Using Smile CDR to Power SMART on FHIR Data Sharing

WHITE PAPER



1. Executive Summary

With health data on the iPhone, third-party applications of the user's choice can provide novel insights into the user's health that cut across information silos.

Integrating with Apple Health is great for organizations seeking to drive patient engagement. Having data on their iPhone gives patients frictionless access to their health records whenever they need them. It can also increase awareness and uptake of patient portals since users can self-authenticate in the Health app with their existing portal credentials.

Smile CDR has years of standards governance and implementation experience as the maintainers of HAPI FHIR, which is the reference implementation of the FHIR specification in Java. It's also the most widely adopted stack globally for FHIR implementations. Smile CDR leveraged this experience to build out an enterprise grade platform that provides an ideal integration enabler for providers looking to accelerate and simplify data sharing with Apple Health.

Apple's Health application leverages the latest interoperability standards like SMART and FHIR to aggregate health records from different providers for secure viewing and storage on the user's iPhone.



2. New Opportunities for Patient Engagement

The advent of electronic health records (EHRs) was supposed to make it easier for providers to connect patients with their health data.

But even years after digitization, much of that data remains trapped in single system silos, limiting its accessibility to patients.

Pressure is building from various stakeholders to finally put patient health data, particularly EHRs, in the hands of patients. Government regulators want to ensure compliance with interoperability legislation. Providers want to improve outcomes and lower costs by integrating patients into their own care team. Payers, seeking to alleviate rising costs, want to increase patient activation and find new opportunities to connect with their clients.

What about the patients themselves? On the one hand, ballooning deductibles and copayments are leaving patients on the hook for a larger share of health care costs. These rising costs, along with the recognition that they generally receive better care when more engaged, are incentivizing patients to take greater ownership of their own health. Unsurprisingly then, patients are increasingly demanding easy and secure access to their EHRs.

However while patient portal use is generally on the rise, it varies widely and remains far from universal. A majority of providers now offer patient portals, but these usually only provide a narrow slice of one's overall health record. That information is frequently spread over multiple provider portals, forcing the patient to jump from silo to silo.

This stands in stark contrast to the high-quality and convenient digital customer experiences offered by industries like retail and travel. These and other industries are raising consumers' expectations—expectations they bring with them whenever they have a digital healthcare interaction.

Fortunately, a suite of new interoperability technologies has emerged in recent years that finally lets providers put EHRs right into the hands (and pockets) of their patients.



The first of these, Health Level 7's (HL7) Fast Healthcare Interoperability Resources (FHIR) is a standard which provides both an application programming interface (API) and a set of data models for describing and accessing health data. It provides discrete and consistent data and is the foundation upon which any interoperability solution is built. FHIR has proven to be a practical standard for interoperability and has gained endorsement and adoption from vendors, regulators and providers, emerging as the global industry standard.

2. New Opportunities for Patient Engagement *continued*



The second, Substitutable Medical Applications and Reusable Technologies (SMART) is a protocol for standardizing how applications authenticate and integrate data from EHRs, patient portals, and health information exchanges. SMART gives providers the ability to pick from a growing ecosystem of interchangeable apps as their needs dictate, without forcing all providers within one organization to use the same apps. As such, SMART can be thought of as an app platform that works with and on top of FHIR, giving rise to the term “SMART on FHIR”.

The final piece of the puzzle is the Apple Health app. While originally a tool for aggregating user data generated by the iPhone (like sleep tracking or step counts), it made the leap to interoperability platform in 2018 with the addition of the health records feature. This update allows patients to download their health records to their iPhone, using FHIR as the underlying data standard and SMART for one-time authentication using patient portal credentials.

Developers can now use HealthKit—Apple Health’s associated developer API—to create third-party apps that securely make use of patients health data. HealthKit is highly secure, giving users complete control over data sharing permissions. All health data is protected by an encrypted, direct connection when moving between the iPhone and provider APIs. When the iPhone is protected by a password, Face ID or Touch ID, any health data stored on the phone is encrypted-on-device.

In essence, Apple has turned the iPhone into a secure repository for patient health data that users can access anytime and anywhere, much like the Apple Wallet.

Providers know that increasing patient engagement is crucial for improving long-term health outcomes, especially for the chronic diseases which tend to drive the largest portion of healthcare costs. Integration with Apple Health using SMART on FHIR gives providers a unique opportunity to share EHR data with patients via the one device that’s always on them.

3. Existing Solutions

The core of Apple's idea—to compile a complete record of each patient's data on one platform— isn't new, but Apple's innovative approach is. Additionally, timing is a key factor in the success of any innovation, and Apple's Health Records API has come at a time when the market is primed for such a product and the technologies exist to make it feasible. This wasn't always the case.

Since the late 2000s, several attempts have been made to integrate patient health data from different providers, including notable initiatives by large, global tech firms. Ultimately, all of these failed to achieve significant adoption.

Early efforts, especially those launched prior to 2010, were hampered by the dearth of digital record systems at the time. They also lacked a viable mobile platform since smartphones had yet to achieve widespread use. While these two factors were less of an issue by the mid-2010s (as health records were digitized and smartphones went mainstream), personal health platforms still struggled to optimize their offerings for mobile and to integrate patient-generated data from outside clinical EHRs (like wearables data).

These platforms were not entirely without success in the basic goal of connecting users with their health data, but they weren't able to attract and sustain large user bases. One widely cited criticism was that most people didn't know what to do with the information in their health record. This underscores the fact that giving users access to their data isn't enough: to be truly useful, platforms need to help users interpret their health data and then present them with actionable insights.

Patient portals, while not designed as interoperability platforms, can nevertheless be considered part of a patient engagement solution. A majority of patients in the US now have access to a patient portal via their healthcare provider and, as noted, their use is trending upwards. This is encouraging, given that evidence suggests portals can play an important role in patient engagement.

However, patient use of portals to access their health records is limited. One 2018 study showed that, while 52% of patients surveyed were given access to their health record by their provider, only about half that number actually viewed their record online. Those that did view their records tended to do so only once or twice a year. Moreover, only a small minority chose to actually download their medical records. Patient portals, while potentially useful, generally lack the kind of consistent, robust engagement from patients that providers strive for. Perhaps the biggest strike against them, however, is the limited scope of the information they provide, since they're generally tied to a single provider.

4. Optimal Solution: Smile CDR as an Integration Platform for SMART on FHIR Data Sharing With Apple Health

As discussed, Apple Health leverages SMART on FHIR to enable integration between EHR data from providers, the user's iPhone, and third-party apps. The upshot is that providers wishing to share data with Apple Health must expose a SMART on FHIR app for Apple to consume. Doing so will not just enable integration with Apple Health; it also opens up access to the entire SMART on FHIR ecosystem and confers a variety of other benefits.

What can SMART on FHIR do?

The SMART and FHIR standards are both based on the idea that health care data should be easy to transmit and interact with. Both leverage API technology similar to that used by social media websites or flight booking applications to standardize how query requests are handled between clients and servers. This gives applications the ability to access data in other applications quickly and easily. By using a stripped down API design, FHIR gives developers the freedom to create plug-and-play applications that can communicate with EHRs and supply information directly into provider workflows using tools they're already familiar with. This means developers can "build once and deploy many times"; for clinicians, patients and providers it means compatibility with more applications. By using an EHR or data warehouse that is SMART compliant, providers can give patients and care teams access to an ever-growing ecosystem of SMART-enabled applications to support better patient engagement, better research, and better health outcomes.

Unlike document-centric standards like C-CDA, FHIR breaks data down to discrete elements and exposes these as services, meaning elements like patients, medications, and diagnostics can be accessed and modified using unique resource URLs. With FHIR, a clinician wanting to access, for example, an immunization record, can search for that single record instead of having to surface a whole case file.

4. Optimal Solution: Smile CDR as an Integration Platform for SMART on FHIR Data Sharing With Apple Health *continued*

SMART uses OAuth2, an open standard for granting websites/apps access to information, for authentication and integration. This is the same technology used by Facebook, Google and others to allow third-party apps/websites to authenticate a new user's identity using an existing profile, while allowing the user to manage what the application/website can do with that profile (e.g. logging into Candy Crush with your Facebook profile and allowing it to post your in-game achievements on your Facebook wall).

SMART and FHIR both use Representational State Transfer (RESTful) architecture, meaning all necessary information needed to respond to a query is contained within the query. Consequently, any server can respond to such a query without needing additional information, accelerating the onboarding process for new data exchange partners.

Why Apple Health is Different

In some ways, we've been here before. As we explored in "Existing Solutions," previous attempts at creating a complete, patient-centric health record were ambitious but ultimately failed to achieve widespread adoption. Nevertheless these previous solutions, along with current patient portals, were and continue to be based on the laudable premise that putting users in control of their own health data will lead to stronger engagement and better outcomes, especially when it comes to compliance with chronic disease care plans.

Unlike previous efforts, however, Apple Health benefits from being very much in the right place at the right time: offering a truly interoperable solution

based on the latest open standards and in full control of a rich ecosystem and trusted platform (the iPhone) that are deeply embedded in users' lives. The iPhone, with its large and dedicated user base, constitutes a great platform to scale the adoption of the Apple health records feature.

The initial set up would involve searching for your provider within the app, and then verifying your identity by logging into the patient portal using OAuth2. This establishes a trusted link between your provider and the app, which can now securely update your health record in the background and send your phone notifications when any changes are made. After performing this set-up with all providers, the app will aggregate different types of health information like lab results, immunization records, procedures, allergies and vitals from multiple institutions on one screen on your iPhone. Furthermore, as this set-up is ultimately mediated by the user's patient portal credentials, the Health app can also help increase familiarity with provider patient portals.

Where Smile CDR Fits In

Smile CDR, as the commercial implementation for HAPI (the open source FHIR API for Java), is the best choice for full FHIR stack integration with Apple.

OAuth2, a prerequisite for SMART on FHIR, is built into Smile CDR, leaving the door open for future integration with any conformant OAuth2 provider—not just Apple. It is OAuth2 (along with FHIR's discrete data model) that enables the granular user permissions mentioned in the previous discussion of FHIR.

4. Optimal Solution: Smile CDR as an Integration Platform for SMART on FHIR Data Sharing With Apple Health *continued*

Having the full FHIR stack means Smile CDR provides a wider breadth of resources, a greater depth of support, and a higher degree of flexibility for the immediate implementation of future ideas. With the full FHIR stack opening up access to the entire FHIR ecosystem, providers can stay on the cutting edge of the newest innovations.

Implementation is also reliable and scalable: Smile CDR maintains and is powered by HAPI FHIR, the reference implementation of the FHIR specification in Java and the most widely adopted stack globally for FHIR implementations. By the same token, Smile CDR is used by some of the largest companies in the world in their FHIR implementations to handle thousands of transactions per second for tens of thousands of concurrent users.

Beyond Apple Health

There is an abundance of apps available today that allow users to enter or track their health information, but these apps are often stand-alone or siloed applications with their own repositories. Should the popularity or usability of the app fade, patient data associated with the app isn't recoverable or transferable. An Apple Health and Smile CDR combination can offer users the ability to persist healthcare data in a format that can be accessed by both legacy and new apps. In addition, Smile CDR can store healthcare data from organizations like hospitals and clinics, thus enabling and combining the patient's self-captured health data with their clinical data across multiple providers.

5. Leading Diagnostics Company Uses Smile to Accelerate Health Records Integration

This leading diagnostics company is one of the largest clinical laboratory networks in the world. As an early adopter of new interoperability solutions seeking to deepen patient engagement and improve outcomes, they took the initiative in 2018 to make patient health data accessible via Apple Health.

Their position was similar to many other healthcare organizations in that:

- They had a patient portal that users could sign into to view clinical data.
- All clinical data was stored in a non-FHIR database.

Smile CDR worked with this client to develop an integrated solution using Smile CDR's core capabilities which could:

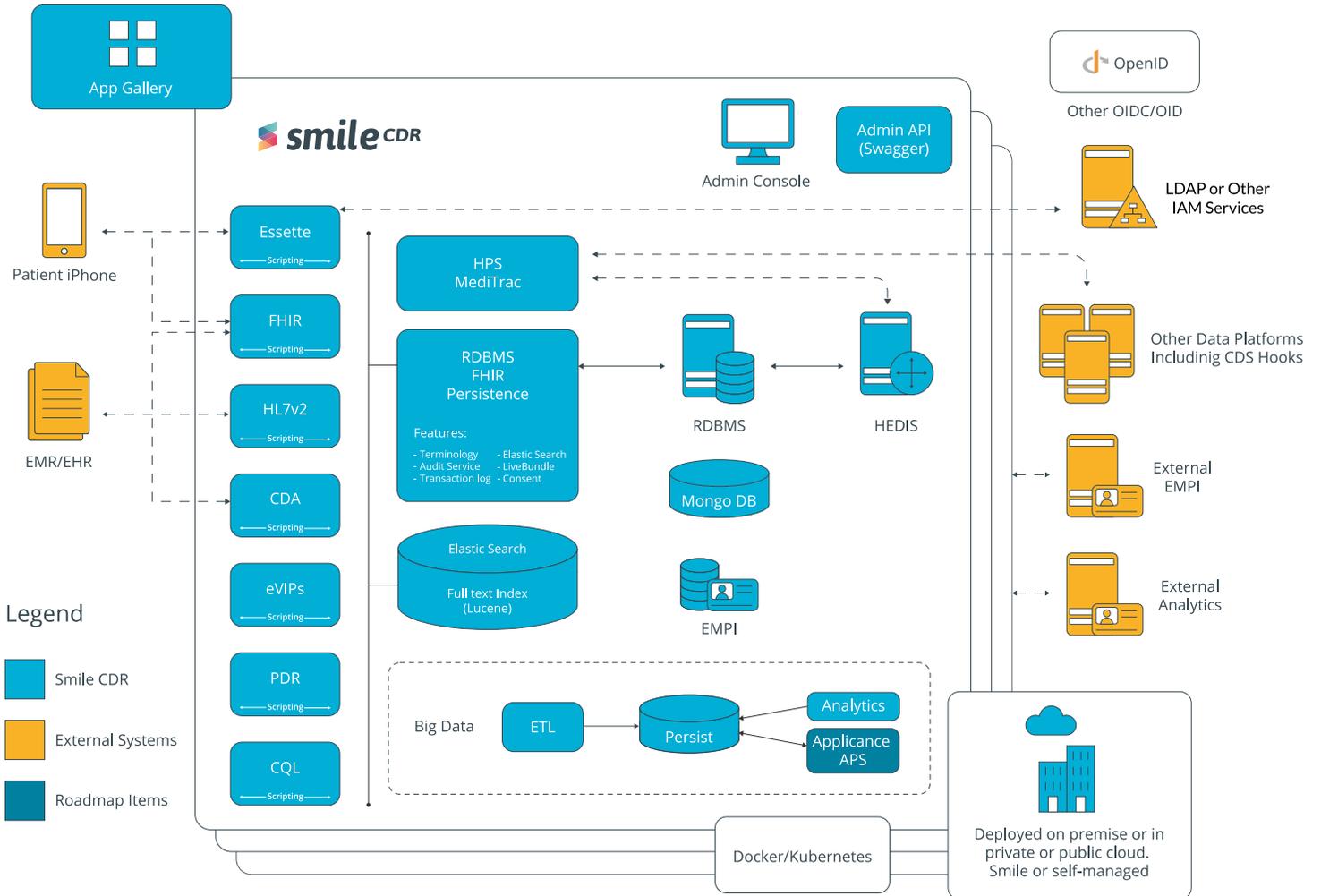
- Take FHIR queries and talk to the non-FHIR database, then return it back to the application using FHIR.
- Support the SMART profile of OpenID connect (an authentication layer that sits on top of OAuth2)

In essence, this client used Smile CDR as a platform to accelerate their integration with Apple Health. They knew that a custom build would absorb time and resources while saddling them with long term support costs. They also knew that since Apple's developer toolkit is FHIR- based, engaging a vendor with a role in standards governance would be a significant advantage. By building on the Smile CDR platform, whose modules provided 2/3rds of the necessary features, they saved valuable time and resources while ensuring compliance with standards going forward. With Smile CDR as an active technology partner, this client was able to leverage Smile CDR's years of FHIR expertise to accelerate their learning curve. Using only a small development team, around 25-35% of the size normally required, our client was able to go-live with their Apple Health integration in less than 6 months.

A key aspect of the partnership was Smile CDR's role in guiding the project via extensive advice and training: a senior developer was allocated to the project to provide on-demand assistance during the development process. Our client's team found the upfront training provided by Smile CDR during kickoff particularly useful as it helped address common pain points before they came up.

By partnering with Smile CDR, our client felt that the deployment process was faster, required fewer resources, and was far less painful for their development team. Overall, this new patient centred service went to market quickly and is fully integrated with Apple Health

Smile CDR Architecture Overview



Why Smile CDR?

In the rapidly shifting healthcare landscape, combining the changes pioneered by consumer-focused tech brands with a robust patient-centric ethos will be essential to getting in front of the coming disruption. Integration with Apple Health helps you put patients first through improved engagement and interoperability.

At Smile CDR, our world-class team places us at the leading edge of delivering new innovations while also being available as a resource for consultation and client support. As the commercial implementation of HAPI FHIR, Smile CDR ensures a solution that will be conformant with any future standards changes. With a proven track record of successful implementations and standards governance, Smile CDR provides a robust and flexible solution for healthcare providers looking to achieve seamless integration with Apple Health.



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