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Implementation, Adoption and Use of the Kanta Services in Finland 2010–2022

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Abstract. Nationwide implementation and adoption of the Prescription Centre and the Patient Data Repository services required 5.5 years since May 2010 in Finland. The Clinical Adoption Meta-Model (CAMM) was applied in the post-deployment assessment of the Kanta Services in its four dimensions (availability, use, behavior, clinical outcomes) over time. The CAMM results on the national level in this study suggest 'Adoption with Benefits' as the most appropriate CAMM archetype.

Keywords. Implementation, adoption, use, Kanta Services, Finland, Clinical Adoption Meta-Model

1. Introduction

Healthcare systems are currently facing several challenges, such as population aging, economic constraints and rapid technological change, which call for comprehensive reforms. Internationally a prevailing solution offered for these challenges is to deploy large-scale information and communication technology systems [1,2]. However, adopting new national health information (HIS) or health information exchange (HIE) systems are often challenging ventures: a large-scale, complex and costly endeavor, taking many years to develop and build, involving multiple public and private stakeholders and that has impact on millions of people [3–7].

HIS integrates the data collection, processing, reporting, and use of the information necessary for improving health service effectiveness and efficiency through better management at all levels of health services [8,9]. HIE essentially includes the electronic transfer of patient data and health information between healthcare service providers or institutions [10–13].

Current literature is still dominated by reports of single organizations and the punctuality of their HIS implementation [14–17]. Moreover, most HIS/HIE system and healthcare reforms are not properly followed up and their outcomes are rarely evaluated [2,17].

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This research aimed to assess the implementation and adoption of the *Act on Electronic Prescription* (61/2007) and the *Act on Processing Customer Data in Health and Social Care* (159/2007). The assessment utilized log-based register data on use of the national healthcare Kanta Services since May 2010 in Finland.

2. Methods

The Kanta Services is the name of Finland's centralized, shared, and integrated electronic data system services introduced in phases since May 20, 2010 [18–20]. The implementation processes and adoption efforts in healthcare were prospectively followed-up by utilizing records accumulated in the Finnish Institute for Health and Welfare's (THL) national operative coordinating unit from May 2010 to December 2016. Use of the Kanta Services from May 2010 to December 2022 was followed-up by rigorously utilizing log-based register data on descriptive performance indicators' time series provided by the Social Insurance Institution of Finland (Kela).

We used Clinical Adoption Meta-Model's (CAMM) four dimensions (availability, use, behavior, clinical outcomes) over the fifth dimension of time [21,22]. According to the CAMM, a data system will become available, it will be used which in turn will lead to changes in behavior, that will produce clinical or health outcomes over time.

In the 'No Deployment' archetype of the CAMM, the HIS fails to reach end-users. In the 'Low Adoption' archetype, the HIS is deployed and available, but with minimal or rapidly declining use. In the 'Adoption without Benefit' archetype, a HIS is deployed, available and used by end-users, but it fails to achieve the intended behavior changes or the expected outcomes. In turn, the 'Behavior Change without Outcome Benefit' archetype occurs when an adopted HIS produces the expected behavior change but fails to produce the expected outcomes. The 'Adoption with Benefits' archetype is characterized by a clear progression of HIS availability that leads to ongoing HIS use, which then causes observable changes in clinical and health behavior that, in turn, result in improvements in measured outcomes. In the 'Benefit without Use' archetype, the expected behavior changes and/or outcomes occur without HIS use.

3. Results

3.1. Availability of the nationwide healthcare Kanta Services

The first certificate of interoperability acceptance for healthcare and pharmacy data systems for the electronic Prescription Centre services was granted in May 18, 2010, and in public healthcare, it took 859 days to reach the 50% national population coverage and 1,258 days for the 100% point.

The first certificate of interoperability acceptance for healthcare data systems for the electronic Patient Data Repository was granted in October 28, 2013, and in public healthcare, it took 376 days to reach the 50% point and 760 days for the 100% point.

The mean implementation and adoption time varied considerably (Table 1).

Table 1. Mean number of years from the start of the first implementation and adoption project to the start of the last implementation and adoption project (min. and max. times in years in brackets) of the healthcare Kanta Services in Finland in 2010–2015. PHCs refers to public primary healthcare centres.

Kanta Services to be implemented	**Hospital districts** Mean (min.–max.)	**University-hospital-specific catchment areas** Mean (min.–max.)	**National** Mean
Prescription Centre			
Pharmacies, years	0.6 (0.1–0.2)	1.3 (0.9–2.0)	2.4
PHCs, years	0.6 (<0.01–2.0)	2.0 (0.9–3.4)	3.4
Pharmacies+PHCs, years	1.1 (0.02–2.4)	2.3 (1.8–3.4)	3.4
Patient Data Repository			
PHCs, years	0.6 (<0.01–1.6)	1.5 (1.1–2.0)	2.0
Both Kanta Services			
PHCs, years	3.0 (1.6–5.1)	4.3 (3.6–5.1)	5.5
Pharmacies+PHCs, years	3.6 (2.5–4.3)	4.6 (4.4–5.1)	5.5

3.2. Use of the national healthcare Kanta Services in Finland since May 2010

Citizen users have accessed the web based My Kanta Pages since May 2010, sent electronic repeat prescription (eP) renewal requests to healthcare organizations since November 2015, and have made visits on behalf of their children since October 2016 (Table 2). In addition, citizen users have recorded consents, consent restrictions, organ donation testaments and living wills into the Patient Data Management Service.

Table 2. Performance indicators by healthcare Kanta Services in 2022 and cumulatively 2010–2022 in Finland (numbers in millions). ePs refers to electronic prescriptions.

Kanta Service Performance indicator	**2022** Millions	**2010–2022** Millions
My Kanta Pages		
Sign-ins	37.2	179
Repeat eP renewal requests	3.4	18.7
Visits on behalf of children	2.5	12.2
Prescription Centre		
ePs	28.2	274
Dispensation documents	76.7	580
Patient Data Repository		
Documents	477	3174
Service events	230	1581
Persons	6.5	6.5
Information notices	0.24	7.9
Consents	0.24	4.8
Consent restrictions	0.12	0.16
Organ testaments	0.05	0.88
Living wills	0.04	0.28

Healthcare professionals (community pharmacy professionals since 2017) have recorded ePs, and community pharmacy professionals medication dispensing documents into the Prescription Centre since May 2010 (Table 2). Healthcare professionals have recorded documents related to service events into the Patient Data Repository since November 2013, and information notices into the Patient Data Management Service.

3.3. Behavior of healthcare professionals

Healthcare professionals quickly learned to issue and use ePs, and pharmaceutical professionals in community pharmacies learned quickly to record paper-based and

telephone prescriptions into the Prescription Centre after the 'big bang' change in January 2017, when ePs became mandatory in Finland.

The Kela launched free-of-charge Kelain web-based service in September 2016 to support the start of mandatory ePs in January 2017. The number of registered healthcare professional Kelain service users rose rapidly to 18,000 and the number of ePs issued via Kelain service rose to 0.301 million in 2018.

3.4. CAMM archetypes and the Kanta Services in Finland

The Kanta Services already reached end-users in a clinical setting in May 2010, and, thus, escaped the CAMM 'No Deployment' archetype. The Kanta Services' implementation and adoption matured and escaped the archetypes 'Low Adoption', 'Adoption without Benefit', 'Behavioral Change without Outcome Benefit' and the 'Benefit without Use'. Based on the results of this study, the most accurate CAMM archetype is 'Adoption with Benefits'.

4. Discussion and conclusions

The results of this research suggest that it is possible to implement and adopt two large-scale national HIS/HIE in 5.5 years covering all public primary healthcare centres, community pharmacies and hospitals together with most private healthcare service providers in a country with 5.5 million inhabitants.

An implementation strategy combining top-down and bottom-up approaches [2,11,23–26] employed in Finland proved an appropriate strategy for the implementation and adoption of the two healthcare Kanta Services.

The Prescription Centre services were implemented and adopted first and thereafter the Patient Data Repository services [18,19]. Public healthcare providers implemented and adopted the Kanta Services first and thereafter private healthcare service providers. The initial hospital district based implementation strategy for the Prescription Centre services informed the strategy to a certified Kanta Services compatible HIS/HIE strategy for the Patient Data Repository services. The THL's operative coordination unit – with appropriate legal mandate in the permanent legislation – supported the large-scale implementation processes of the two healthcare Kanta Services in close cooperation with the Kela.

The results from a previous study showed that the implementation of HIS/HIE systems in Finland has successfully passed several milestones in terms of the CAMM archetypes [27]. The case of Kanta Services in Finland suggested that the healthcare-specific CAMM theoretical construct can be used on the national level HIS implementation assessments. Results of this study repeat the observation. In addition, results of this study suggest that the most appropriate CAMM archetype is 'Adoption with Benefits'.

Even rigorously utilizing log-based register data of the Kanta Services, however, must accompany parallel and independently conducted HIS/HIE research (e.g. general public and/or professionals' surveys) in order to gain insights and experiences of the whole [28]. Together, 'log-based data' and the 'research-based in-depth data' arms likely complement each other, and form a rich database for further elaboration of outcomes, benefits and harms, and other effects to inform development of new functionalities and better user interfaces for both citizen and professional users.

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