

Nursing Informatics

Sun. Nov 22, 2020 9:30 AM - 11:00 AM Room E-2 (Congress center 5F - Conference Room 53)

[AP2-E2-1-01] Governance for Realization of Medical, Nursing and Administration Data Integration System

*Yoshiaki Fukami^{1,2}, Yoshimasa Masuda^{1,3} (1. Graduate School of Media and Governance, Keio University, Japan, 2. Department of Management, Faculty of Economics, Gakushuin University, Japan, 3. The School of Computer Science, Carnegie Mellon University, United States of America)

Keywords: Electronic Health Records, Integrated Care, Data Linkage, Architecture Management

Coordination of medical, nursing, and administrative data is important for the realization of comprehensive community care. Tamba city has succeeded to develop an immunization implementation determination system with utilizing data of vaccination ledger at clinics through sending closed network. Tamba City in Japan has forged ahead with the development of a medical and healthcare information sharing system among the municipal office, clinics, pharmacies and nursing care services to promote a comprehensive care community. We discuss governance forms that will realize the establishment of a regional comprehensive care system through analysis of the case analysis of Tamba City, which continues to develop, introduce, and update the continuous medical, nursing and administration data integration system with Assessment meta-model in Architecture Board in AIDAF. The lack of a commonly adopted data architecture is an impediment to utilization and must be addressed along with the non-technical challenges. The development of a coordinated governance structure is necessary to achieve discussion and consensus building to resolve such areas.

Governance for Realization of Medical, Nursing and Administration Data Integration System

Yoshiaki Fukami^{a, b} and Yoshimasa Masuda^{a, c}

^a Graduate School of Media and Governance, Keio University, Japan

^b Department of Management, Faculty of Economics, Gakushuin University, Japan

^c The School of Computer Science, Carnegie Mellon University, USA

Abstract

The coordination of medical, nursing, and administrative data is important for the realization of comprehensive community care. Tamba City has succeeded in developing an immunization implementation determination system utilizing vaccination ledger data at clinics sent through a closed network. Tamba City in Japan has forged ahead with the development of a medical and healthcare information-sharing system to be used among the municipal office, clinics, pharmacies and nursing care services to promote a comprehensive care community. We discuss governance forms that will realize the establishment of a regional comprehensive care system through a case analysis of Tamba City, which continues to develop, introduce, and update the continuous medical, nursing and administration data integration system with the Assessment meta-model in Architecture Board in AIDAF. The lack of a commonly adopted data architecture is an impediment to utilization and must be addressed along with nontechnical challenges. The development of a coordinated governance structure is necessary to achieve discussion and consensus-building to resolve such issues.

Keywords

Electronic Health Records, Integrated Care, Data Linkage, Architecture Management

Introduction

The human condition is not simply dichotomized into health and disease. As the term "lifestyle disease" suggests, the cause of a disease may be hidden in our daily lives, or some older people may not have a disease but will continue to be frail. Nevertheless, in many countries and regions, medical and health information are considered different from each other, and measures to use the data are constructed disparately as electronic health records Electric Health Records (EHRs) and personal health records Personal Health Records (PHRs).

Various medical services are provided to people who are not ill, such as vaccination and care for the elderly, and many of these services are publicly subsidized. In addition, many residents have access to medical institutions only for health checkups.

Immunizations and regular health checkups are very important measures in elderly care. However, whether the condition is maintained in an undiagnosed state or some disease state, the

efficiency and effectiveness of care will be realized by sharing records obtained while healthy with health and care service providers.

Medical and nursing care services must be provided in an integrated manner on a continuous basis, from the prevention of frailty in the presymptomatic stage to long-term home treatment due to lifestyle-related diseases.

It is important to establish a regional comprehensive care system in which local medical institutions and care service providers work together to provide care. Community-based integrated care has been promoted in Japan for a long time [1]. There are several similar concepts in the world, such as integrated care [2-5].

The computerization of data generation and storage in the medical field has been taking place since the 1960s. Technological advances in computer innovations have opened the way for advancements in electronic medical records (EMRs) and health care [6]. An EMR is a real-time patient health record with access to evidence-based decision-support tools that can be used to aid clinicians in decision-making [7].

More specifically, an EHR is a longitudinal electronic record of patient health information generated by one or more encounters in any care delivery setting and the reporting of episodes of care across multiple care delivery organizations within a community, region, or state [7]. EHR design is essentially a consolidation of data held by diverse medical institutions, since not everyone is tested and consulted at a single medical institution for a lifetime.

From the perspective of protecting privacy, the sharing and exchanging of personal information between medical and nursing care service providers was not initially envisioned. This has led to fragmented medical and care data. The accumulation of fragmented medical history data does not contribute to the improvement of medical service quality [8].

In some countries, such as Australia, efforts are being made at the government level to overcome this lack of mutually available medical care data [9-10].

Elderly care is provided not only by beneficiary health insurance but also by administrative services and subsidies. To effectively implement regional comprehensive care, it is necessary to not only coordinate data among medical and nursing care service providers but also integrate system operations, including administrative data. Since personal data managed by the government are strictly handled, there are high barriers to

hall using the service of a mobile virtual network operator (MVNO). At the same time, IC cards are distributed to those who are vaccinated (エラー! 参照元が見つかりません。). At the time of vaccination, the person to be vaccinated is authenticated with an IC card by the reader of the tablet. Then, the target vaccine and its availability are displayed to prevent mistakes in vaccination [14].

The immunization determination system has succeeded in decreasing the number of vaccination accidents. This success encouraged stakeholders, the healthcare and social welfare personnel in Tamba City, to extend the system into a regional comprehensive care support platform [18].

Governance of single-function system introduction by a small number of stakeholders

The system is introduced at the request of the medical association for the municipal office to eliminate the situation wherein doctors bore the inoculation costs for children whose care was not covered by the government. Clinic doctors required only that single function, and it was necessary to protect personal information but not vaccination procedures.

The system design and the operating procedure were examined by a regular round-table conference between the City Hall Health Division and the medical association. The health division of the municipal office formulated proposals with the system vendor in response to the request from the medical association.



Figure 4- User interface of the Immunization Implementation Determination System

Some doctors were resistant to introduction of the system because some doctors, especially older physicians, might have difficulty handling tablets. Therefore, the user interface of the system was designed to allow doctors to operate it with only a few taps (エラー! 参照元が見つかりません。).

Table 1- Changes in the number of vaccination accidents

Year	Hyogo Pref.	Tamba city
FY2015	280	12
FY2016	309	4
FY2017	427	0
FY2018 (by November)	282	1

The system was successfully introduced by the medical association through gathering requests from the doctors of clinics

and the municipal office and system vendor responding to those requests.

The immunization determination system has succeeded in decreasing the number of vaccination accidents (エラー! 参照元が見つかりません。). This success encouraged stakeholders in the form of healthcare and social welfare personnel in Tamba city to expand the system into a regional comprehensive care support platform.

Extension to a Regional Comprehensive Care System

Establishment of a multi-stakeholder collaboration structure

In the immunization implementation plan, clinicians only access data from the municipal office when a vaccination is delivered and displays the examination results. On the other hand, information sharing among medical and nursing staff is implemented in the regional comprehensive care system.

Tamba City, the medical association, the dental association, the pharmacists' association, the four hospitals, the social welfare council and the system vendor established the MCC promotion organization to develop and operate the regional comprehensive care system.

The adoption of a configuration complete with a closed network and devices owned only by the city hall produces a robust system from the viewpoint of personal information protection. On the other hand, only municipal staff can handle accumulated data. This means that analysis by external medical and public health specialists is not possible. In the future, it is expected that operational rules will be established in the MCC, including who can access what type of data. This will increase the degree to which outside experts can be involved in analysis and policymaking. However, centralized and closed designs that protect the privacy of personal information prevent the additional use of accumulated data that may offer benefits for residents.

Network construction with tablet distribution and closed network connection

Expansion to a regional comprehensive care system will be implemented through the distribution of computer tablets to dental clinics, pharmacies and visiting care offices.

The system is developed to provide a history of vaccinations, the results of medical examinations and prescriptions to electronic charts in hospitals, clinics, visiting care offices and pharmacies. The municipal office also plans to add the Municipal Medical Checkup Center, established in 2019, to the closed network.

All data are provided with tablets owned by the municipal office through the MVNO closed network in the same manner as immunization records in compliance with personal information protection laws and are shared through tablets owned by the municipal office. Clinicians working at the core hospitals in the Tamba region access computers for electronic medical charts by way of exception.

Unified analysis of existing convertible data

In expanding applications to regional comprehensive care, it was necessary to realize interoperability of data among participating institutions for integrated data analysis.

The first implementation was the import of prescription histories that already had machine-readable data compatible with national standards specifications.

Prescription data are obtained through the QR code of the computerized prescription system. Japan has a universal insurance system; most drug prescriptions are covered by health insurance. Since insured medical treatment needs to be registered electronically, prescription data are automatically generated as structured data. Moreover, the data are compatible with the Japanese national standards of the New Standard Interface of Pharmacy-system Specifications (NSIPS), which allow the in-pharmacy system to respond to electronic prescriptions, and the Japan Association of Healthcare Information Systems Industry (JAHIS), which is an industry organization of medical information system vendors, has developed a standard data specification for digital personal prescription records.

By comparing the two types of prescription data, it is possible to confirm the difference between a doctor's prescription and the actual medication and to realize more effective medical guidance and analysis of drug efficacy.

As of January 2020, to reduce medical expenditures in the region, we calculate the generic drug selection rate of drugs prescribed for patients with lifestyle-related diseases such as diabetes and high blood pressure. The analysis is done only by municipal officials.

The prescription data are analyzed by city officials, and the results of the analysis are made available to the Tamba Medical Care Collaboration (MCC) member companies and organizations.

Progress in expanding data sharing and utilization

In addition to prescription data, as of January 2020, data sharing across categories, such as medical institutions, pharmacies, and nursing homes, has not yet been achieved with prescription data. Additionally, even in the same medical institution, data exchange between regional core hospitals and clinics, that is, EHR interconnection, has not been realized except for prescription data.

Both vaccination records and the results of medical examinations are managed solely by the municipal office. Therefore, the data are structured based on the system design of the city hall.

The next step that can be considered is the analysis of such machine-readable data managed by the city hall and utilization of the analytical results.

To do so, a multi-stakeholder collaborative architectural governance system must be developed to integrate the data resources that diverse stakeholders have built separately to develop new services and improve operations, wherein multi-stakeholder corporation is the MCC. Therefore, the design of the mechanism that enables collaboration among multiple stakeholders means an update of the MCC governance system.

The integrated analytical use of data in fields where machine-readable and transformable data exist, i.e., data that do not require coordination costs between stakeholders, has been realized from the beginning of the system's implementation.

To stimulate the use of regional comprehensive care systems, it is necessary to establish a form of governance that can advance the discussions needed to increase the amount of data that can be used.

Discussion

If regional comprehensive care does not consist solely of the provision of medical and nursing care services but also includes the provision of services, subsidies, and tax benefits by

local governments, it should be linked to the basic resident register as well.

Therefore, we have proposed a target architecture (Figure 5) designed so that the database managed by all stakeholders, including the Basic Resident Register, is connected within the closed network operated by the government, and the necessary information can be provided to caregivers and beneficiaries when needed. Moreover, to develop it as an integrated system that covers all aspects of community welfare, it will need to be coordinated with all City Hall departments and the City Council [14]. This target architecture must be agreed upon among stakeholders and then implemented.

The implementation of the system is preceded by the sharing and analysis of prescription history, an area where data from different that do not require the integration of technical specifications or coordination of interests.

Sharing and analysis of prescription history, an area where data from different sectors can be converged, preceded to implement. The IIC of the MCC is needed to play a role in realizing resolutions to integrate various kinds of data to promote the development of an integrated system that realizes rational and effective regional comprehensive care. The ICC should take on more of a greater role in internal coordination and decision-making for collaboration with external stakeholders according to the assessment meta-model in architecture board to establish a procedure for consensus-building as well as organizational form.

The authors proposed the “Assessment Meta-model in Architecture Board” in Figure 2 for RQ on the basis of the Assessment meta-model (Figure 1). The case study of Tamba City demonstrates an effective method of architecture management as follows:

- (1) It is sufficient to realize the matching or conversion function through system design rather than coordination among stakeholders if standard data models exist.
- (2) There is a need for consensus-building on the procedures of data utilization and development of common data models.

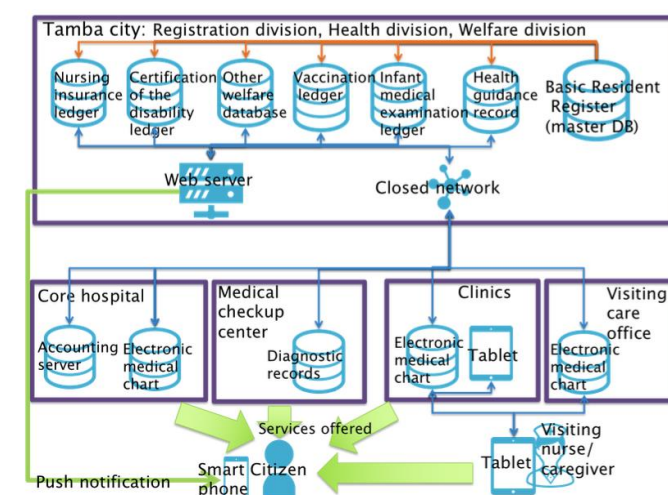


Figure 5- Target architecture of the Regional Comprehensive Care System

Conclusion

In this paper, we analyzed the case of Tamba City to develop and implement the immunization determination system and regional comprehensive care system according to an assessment metamodel in the architecture board of AIDAF.

When introducing the immunization determination system, setting a few specific objectives among a small number of stakeholders has led to the success of a challenging project of cross-cutting medical and administrative data collaboration. The fact that the municipal office owns all the terminals and networks and took the initiative in system design and implementation is another major success factor.

As the objectives are broadened and the number of stakeholders increases, the cost of consensus-building increases. The municipal office and other stakeholders have established MCC and launched IIC to enhance the system based on consensus-building. Even then, in the field, where there are already machine-readable and transformable data, implementation and utilization can be accomplished relatively quickly. The lack of a commonly adopted data architecture is an impediment to utilization and must be addressed along with non-technical challenges.

The RQ-based analysis revealed the following the status of system implementation and operation indicates that the IIC needs to play the role of an architecture board and conduct an adoptive enterprise architecture cycle.

Acknowledgments

This work was supported by JSPS Grant-in-Aid for Early-Career Scientists Grant Numbers JP18K12858.

References

- [1] Morikawa M. Towards community-based integrated care: trends and issues in Japan's long-term care policy. *Int J Integr Care*; 2014 [cited 2020 Jun 18]. Available from: <https://www.ijic.org/>
- [2] Hardy B, Mur-Veemanu I, Steenbergen M, Wistow G. Inter-agency services in England and The Netherlands: A comparative study of integrated care development and delivery. *Health Policy*. 1999; 48(2):87-105.
- [3] Leutz WN. Five Laws for Integrating Medical and Social Services: Lessons from the United States and the United Kingdom. *Milbank Q*; 1999 [cited 2020 Jun 22]. 77(1):77-110. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2751110/?report=abstract>
- [4] Kodner DL, Spreeuwenberg C. Integrated care: meaning, logic, applications, and implications - a discussion paper. *Int J Integr Care*; 2002 Nov 14 [cited 2020 Jun 22]. 2(4). Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1480401/?report=abstract>
- [5] Kodner DL. All together now: a conceptual exploration of integrated care. *Healthc Q*. 2009 October; 13:6-15.
- [6] Turk M. Electronic Health Records: How to Suture the Gap Between Privacy and Efficient Delivery of Healthcare. *Brooklyn Law Rev*; 2015 [cited 2020 Feb 13]. 80(2):565-97. Available from: <https://brooklynworks.brooklaw.edu/cgi/viewcontent.cgi?article=1015&context=blr>
- [7] Aceto G, Persico V, Pescapé A. The role of Information and Communication Technologies in healthcare: taxonomies, perspectives, and challenges. *Journal of Network and Computer Applications*. 2018; 107:125-54.
- [8] Blechman EA, Raich P, Raghupathi W, Blass S. Strategic Value of an Unbound, Interoperable PHR Platform for Rights-Managed Care Coordination. *Commun Assoc Inf Syst*; 2012 [cited 2019 Feb 25]. 30:83-100. Available from: <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.228.6528&rep=rep1&type=pdf>
- [9] National E-Health Transition Authority of Australia. Interoperability Framework v2.0; 2007. Available from: <http://www.nehta.gov.au/implementation-resources/ehealth-foundations/ehealth-interoperability-framework>
- [10] National E-Health Transition Authority of Australia. eHealth Reference Model. 2014.
- [11] Toma T, Masuda Y, Yamamoto S. Vision Paper for Enabling Digital Healthcare Applications in OHP2030. *Smart Innovation, Systems and Technologies*. 2019; 186-97.
- [12] Masuda Y, Viswanathan M. Enterprise Architecture for Global Companies in a Digital IT Era: Adaptive Integrated Digital Architecture Framework (AIDAF). Springer; 2019.
- [13] Masuda Y, Shirasaka S, Yamamoto S, Hardjono T. Architecture Board Practices in Adaptive Enterprise Architecture with Digital Platform. *Int J Enterp Inf Syst*. 2018; 14(1):1-20.
- [14] Fukami Y, Masuda Y. Success Factors for Realizing Regional Comprehensive Care by EHR with Administrative Data. In: Chen Y-W, Zimmermann A, Howlett RJ, Jain LC, editors. *Smart Innovation, Systems and Technologies*. Springer; 2019. p. 35-45.
- [15] Fukami Y, Masuda Y. Stumbling blocks of utilizing medical and health data: Success factors extracted from Australia-Japan comparison. In: 8th International KES Conference on Innovation in Medicine and Healthcare. Springer; 2020.
- [16] Yin RK. Case Study Research: Design and Methods. Fifth Edit. Sage Publications; 2014.
- [17] Masuda Y, Shirasaka S, Yamamoto S, Hardjono T. An Adaptive Enterprise Architecture Framework and Implementation. *Int J Enterp Inf Syst*. 2017; 13(3):1-22.
- [18] Fukami Y, Masuda Y. Stumbling blocks of utilizing medical and health data: Success factors extracted from Australia-Japan comparison. In: Chen Y-W, Tanaka S, Howlett RJ, Jain LC, editors. *Innovation in Medicine and Healthcare*. Singapore: Springer; 2020. 192:15-25.

Address for correspondence

Yoshiaki Fukami
Keio University
5322 Endo, Fujisawa city, Kanagawa 252-0882, Japan
Email: yofukami@sfc.keio.ac.jp