Text-Mining of Hand-Over Notes for Care-Workers in Real Operation

Toward an Employee-Driven Innovation

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Abstract. Hand-over note in elderly care facilities is a very important media for the employees to share information about non-routine task procedures in the daily operation. Reviewing these memos regularly will help the facility find potential risk factors and inefficiency in routine protocols. However, hand-over notes are typically hand-written memos and conducting periodical review is not easy for an average employee with heavy workload. To capture this field community intelligence, we have conducted text-mining on hand-over text. This paper describes results of hand-over note text-mining cases that lead to employee driven re-design of service processes for better care service.

Keywords: Nursing-care service · Text-mining · Data-mining · Employee driven innovation

1 Introduction

The long-term care insurance cost in FY 2009 rose to 7.7 trillion yen, showing a continuously rising trend [1], which becomes more and more serious as a social burden. In addition, the Long-Term Care Insurance Act sets a low service unit price yielding to a low profitability of the care facility business. The profitability of many of these businesses is less than 5 %. Moreover, healthcare workers face huge amount of workloads. And thus, improving productivity while maintaining quality of service remains an urgent task.

The heavy workload in care facilities is widely known and a variety of supporting system with information technology such as PDA and RFID are proposed. Various points of care systems for nursing have been proposed and assessed [2, 3]. They are useful to record routine work as official evidence such as vital data.

However, the expertise of highly experienced care workers resides in how good one can response to a non-routine operation or an unexpected irregular incident. And this know-how is mostly recorded in hand-written hand-over notebooks and not captured in conventional information technology systems. The experience and intuition of care workers gathered over many years of their employment are extremely important to provide high quality service in care facilities. However, these experience and related

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know-how including implicit knowledge and intuition are subjective, making it difficult to share.

To curate this implicit field community intelligence, we have developed a hand-over support system called DANCE (Dynamic Action and kNowledge assistant for Collaborative sErvice fields) for elderly care facilities [6]. The System is now in a full-scale real operation in a care facility for more than a year [7] and has replaced the conventional hand-written notebook based hand-over protocol. Our proposed system utilizes mobile devices and is based on a point-of-care recording technology, which uses a database containing ActionLog [4] to record information at each point-of-care when a task is conducted, with Social Infobox [5] that provides related information from a collated knowledge base.

Every hand-over comment and operation is now logged in a machine-readable medium, which makes it easier for the employee to utilize for Employee-driven innovation (EDI) [8, 9].

In this paper the authors report a case study where the authors conducted text mining on the hand-over text to support EDI.

2 Hand-Over Text in Elderly Care Facilities

To cope with potential risk factors to prevent accidents and improve service quality, employees of elderly care facilities have to share various kinds of informal information, for example, requests from residents' family or resident's daily mood and condition. Notebook is commonly used to write down this information as a hand-over memo (Fig. 1).

Fig. 1. Hand-over memo written in a notebook

A typical hand written hand-over memo starts with a header line addressing the supposed receiver of the information followed by its body that describes how the author encountered an irregular incident or instructions for handling the abnormality.

3 Method

The DANCE system was installed in an elderly-care facility called Wakoen after a co-design project with several employees of the facility to develop a mobile communication system among employees for elderly-care services [6, 10].

Wakoen is a health institute for long-term and short-term care for elderly people. The facility has 3 floors with 150 beds for long-term care and 40 seating capacity for short-term care with 120 employees. About 10 to 20 employees work at the same time on each floor in daytime or night-time shift.

The system started to operate as the primary media for hand-over messages from February 1, 2014, followed by three months of test operation and replaced the conventional notebook based hand written hand-over message protocol.

The system runs separately in each floor. The biggest floor (Group A) for long-term care and a floor specialized for dementia (Group B) and another floor for short-time care (Group C).

To assess the impact of the system installation, the authors have compared the number and the length of messages before and after the system installation as shown in Figs. 2 and 3.

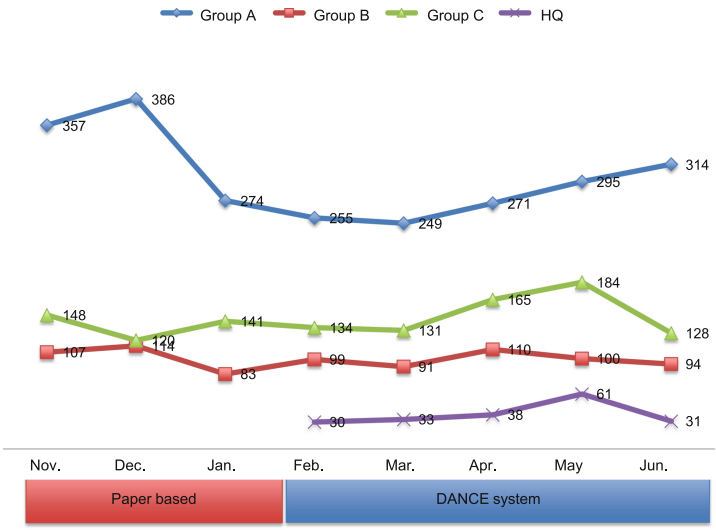

Fig. 2. Number of messages per month.

The total number of sent messages from February to June (5 months, 150 days) was 2813, on average, 18.8 per day, which breakdowns to 1384 for Group A, 494 for Group B and 742 for Group C. The head quarter also sent 193 messages. The total number of employees who sent at least one message was 133 (some employees belong to more than one floor).

With the system, 50.9 % of all messages had less than 50 characters and 93.8 % of the messages were less than 125 character long. Average length was 60.1 and the longest

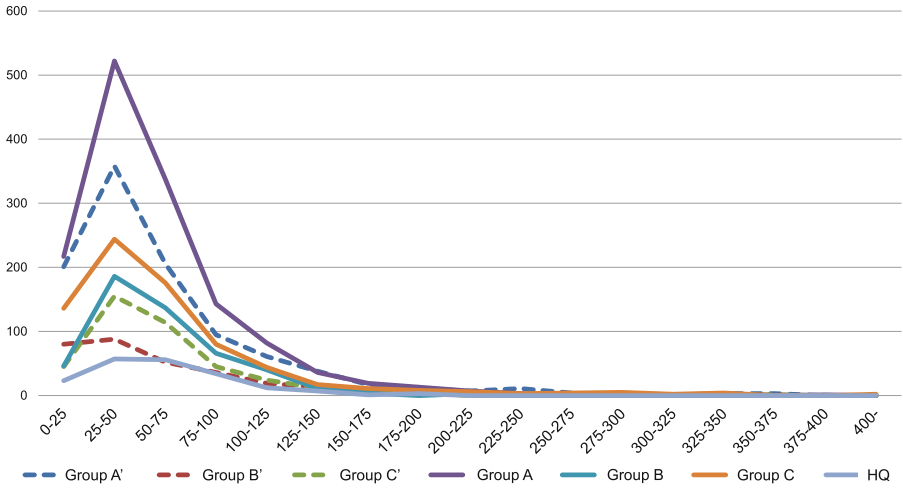

Fig. 3. Message length distribution (A', B', C' are paper based memo)

message had 434 characters. Before the system installation, 53.6 % of paper based messages had less than 50 characters and 94.9 % of the hand-written messages were less than 150 character long. The average length was 60.7 and the longest hand-written message had 362 characters.

There is a drop in the number of messages in January, which is before the system installation, in Group A, but the authors were not able to detect negative effects directly related to the system installation.

4 Results

Hand-over messages from February to March (8 weeks) were used for the text-mining. The authors held several workshops for the employees and explained general features of what text mining can do. Through this workshop, the employees made several requests on how they want to narrow down the data to abnormal incidents.

For each message in the DANCE system, employees can specify if the message is about certain residents or just a generous remainder. 1944 messages, which equals to 69.1 % of the whole, were about specific residents. As shown in Fig. 4, the number of messages per resident is not evenly distributed. Instead, most of the messages are about very small number of residents.

Based on the employees' discussion, the authors created co-occurrence networks of the top ten most referred residents of each floor. For example, if resident_A is a top ten resident, then the authors collected all the messages of resident_A and created a co-occurrence network from this set of messages. By showing these networks, several issues were suggested by the workshop participants. In the following sections, the authors report some examples where the text-mining results triggered discussions that actually lead to re-design of their daily operation.

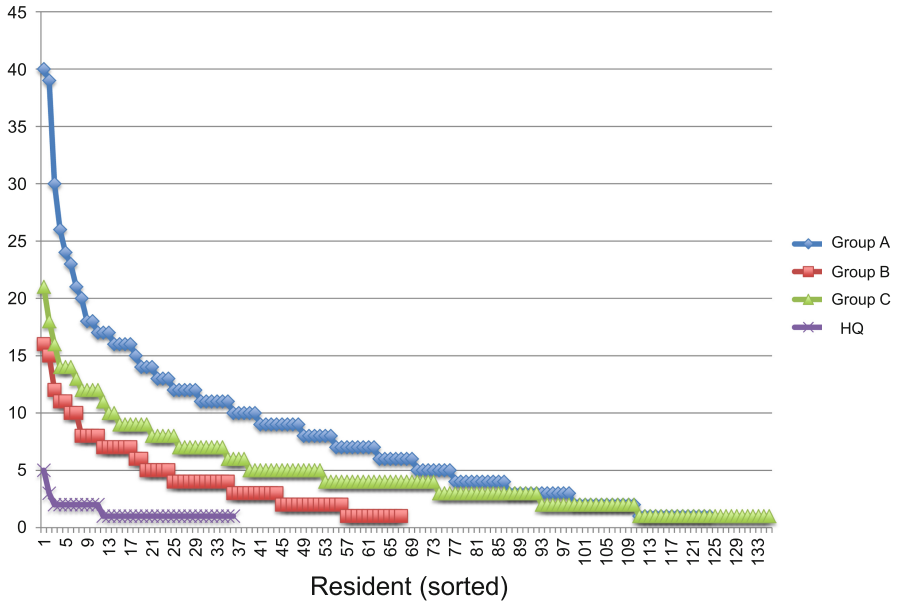

Fig. 4. Number of messages per residents

4.1 Case 1: Service Quality Improvement

In Fig. 5, the participants of the workshop noticed a sub-network of words such as 'visit,' 'husband,' 'eat' and 'become silent.' In general, one should be careful about family related terms because careful follow-up of family's request is very important to provide high quality elderly care service. These keywords helped them to back track to frequently sent messages such as "her husband provided food to her in the absence of care workers." This resident referred in Fig. 5 had difficulty in swallowing and needed assistance in eating by care staffs. However, her husband helped her eating in the absence of care staffs. This is a potential risk factor that may cause an incident.

After a discussion among employees of different roles, they decided to allow her husband to provide food to the resident but only at the dining room in the presence of care staffs so that they can adjust the posture of the resident before eating. This consensus was shared among every employee after the workshop. This employee driven re-design of a service process yield better customer satisfaction.

4.2 Case 2: Refinement and Standardization of Treatment

Network shown in Fig. 6 was closed up because 'bathing', 'assist equipment' 'transfer assistance' appeared frequently in the same sub-network.

By reviewing the hand-over messages of this resident, the participants found four conflicting messages: "From today, she only needs assistive equipment while bathing", "put the equipment on her at her room", "she does not need the equipment out of the tab", "put the equipment on her while assisting transfer from her bed to the stretcher.

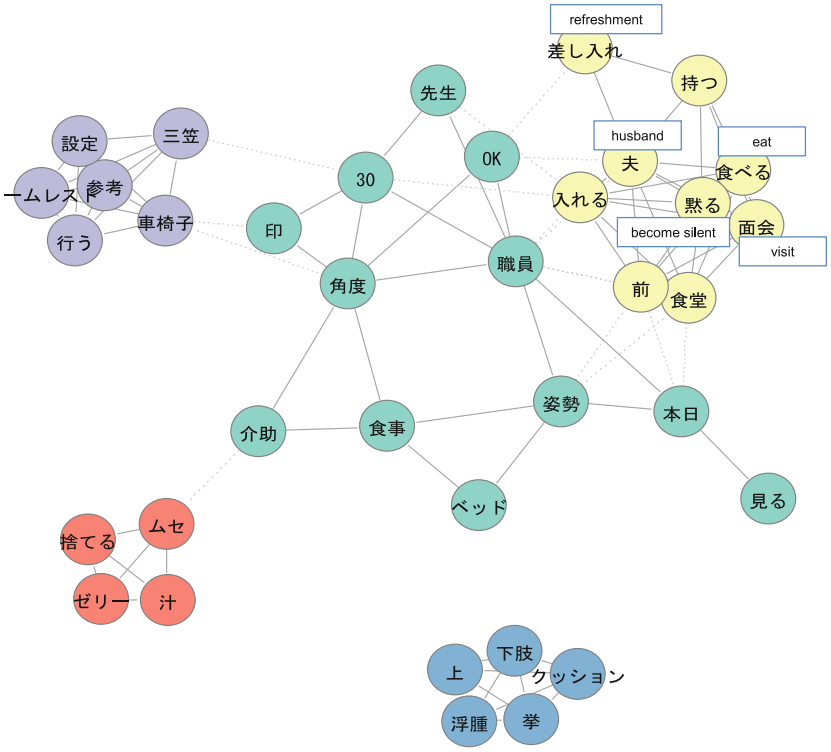

Fig. 5. Co-occurrence network with the term “husband”.

Bath her with the equipment. Take the equipment off after supporting her getting out of the bath tab and wash her feet. After that, no assistive equipment is needed.” Besides these conflicting messages, several employees answered to the workshop participants that care staffs were complaining that it was not clear to them which information was correct.

A meeting with care-staffs and nursing staffs were held after the workshop to understand what happened and to discuss effective measures. The situation was as follows: the resident complained that her leg hurts as an aftereffect of a fracture. But the doctor authorized the care staff that assistive equipments were not necessary because the fracture had healed. But because of the resident’s complain, some care-staffs concluded that she needed the equipment during transfer. But the resident may lose her muscle if she rely too much on assistive equipments. After confirming the latest condition of the resident, the employees reached to a consensus that the resident does not need the equipment any more and a new hand-over message was shared saying “the resident’s fracture healed and she does not complain pain any more. No assistive equipment required. But transfer from bed to wheel chair requires three staffs.”

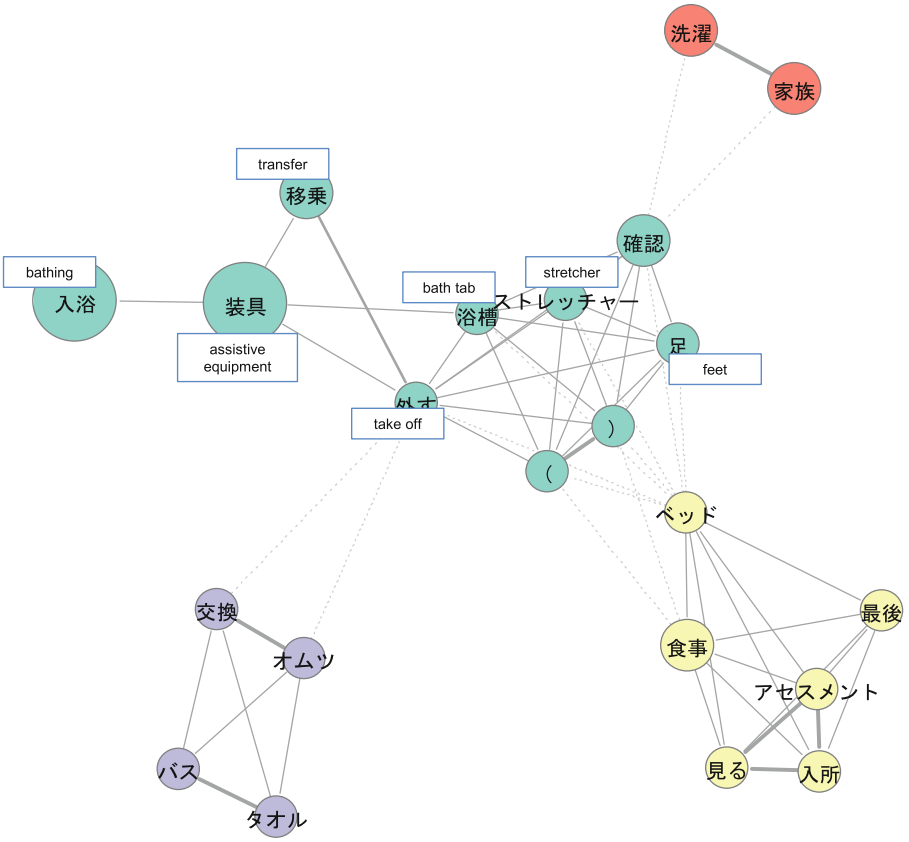

Fig. 6. Co-occurrence network about assistive equipments.

4.3 Case 3: Improvement of Operational Efficiency

Figure 7 has “juice”, “fridge”, “keep” as frequently occurring terms. There were 11 messages saying “juice from resident’s family in the fridge. Give it to the resident when requested”.

Because the resident had the ability to recognize that his family brought him some juice and that the care staffs were keeping them, it was sufficient to make a special space in the fridge for him and taking the juice out from the fridge per request. No hand-over messages concerning his juice were necessary after that.

5 Discussion

In this paper the authors report several use-cases of text-mining of hand-over messages where the employee actually designed a new service process based on the hand-over text-mining analysis. This shows that text-mining can be used to design better service

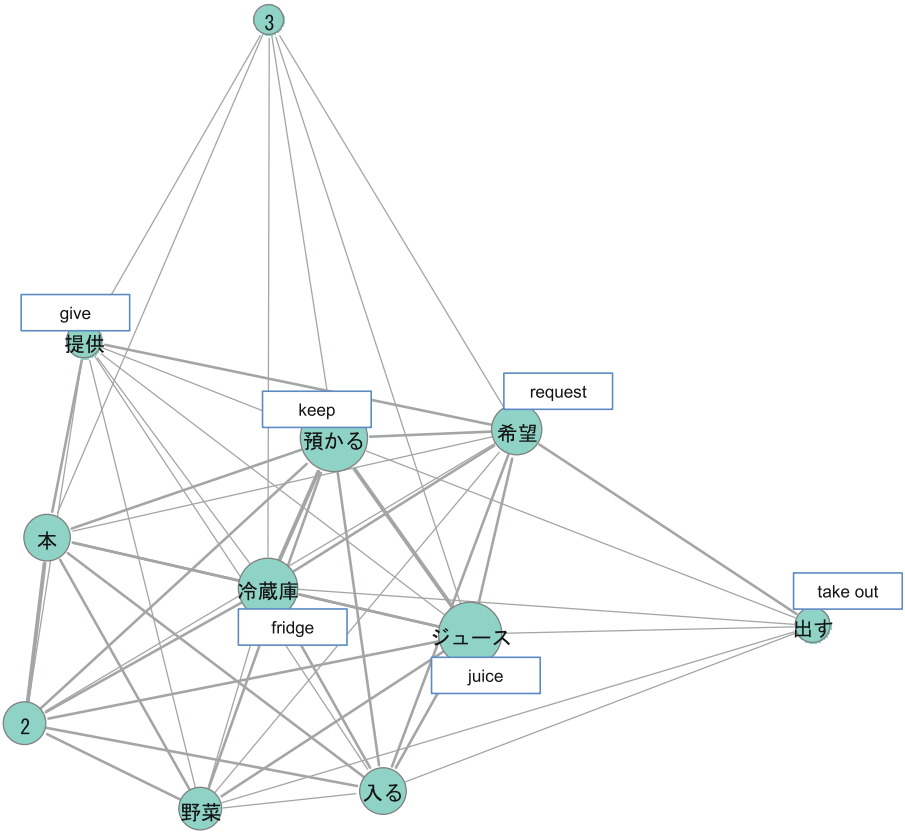

Fig. 7. Co-occurrence network about resident's juice.

based on evidence that was previously non-visible in conventional reports such as accident reports or near accident reports and can be used in employee driven innovation.

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