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Impact of Work Organization on Technology Use: The Case of Hydration Process with a Smart Drinking Glass

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Abstract. This paper presents preliminary results from a larger project led with the French company Auxivia. The latter offers a smart drinking glass (SDG), supporting monitoring daily water intakes of elderly people and helping identify residents to encourage. Contexts and work organizations can deeply differ from a nursing home to another and can impact the use of the SDG. Based on a comparison between two nursing homes, we unveil the impact of both work organizations on the integration of technology requirements. We discuss the results by providing recommendations to improve the integration of SDGs in various work organizations.

Keywords. Smart drinking glass, Work organization, Technology requirements, Acceptability, Adapted design, Nursing homes

1. Introduction

Scientific literature has highlighted the risks related to the dehydration of elderly people [1-7]. It has been shown that the thirst sensation is blunted in this population [7-8]. Hence it is essential for elderly people, as for their formal or informal caregivers, to know if the daily water intake is sufficient or not.

In order to prevent dehydration, a few companies have developed tools which allow to track the water intake over a given period of time [9]. The French company called Auxivia is one of them, which offers a smart drinking glass (SDG) specifically for elderly people. Thanks to its connection to a personal tag, the glass allows to monitor the volumes drunk by each person. In nursing homes, especially if the elderly is not autonomous, those data can be used by the staff to judge whether the person needs more or less liquid intakes. The process of hydration monitoring through SDGs involves four requirements (R1, R2, R3, R4):

- R1: the SDG must be charged. The caregivers have to put the glass on a charger and meet the time charge before using it anew. Only a few hours of charging enable to use the SDG for one week.
- R2: ensure the pairing between the glass (which is not assigned to a specific resident) and a personal tag (assigned to a resident). The tag must be kept close

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to the person. With this aim in mind, several solutions can be considered: worn tag (necklace or wristband) or installed on furniture (table or coaster).

- R3: the glass detects and records water intakes. To be exploitable, the data must be transferred to a computer platform. A pairing between the glass and a data collector is needed. To ensure the data are properly collected, the glass must remain less than five meters from the data collector for 30-45 minutes.
- R4: a resident who is monitored must *always* drink in a SDG. If (s)he drinks in regular glasses, the water intake will not be measured. Therefore, the collected data will not reflect the overall water intake.

The SDGs logistics is the same as for regular glasses: distribution, dishwashing (they can be washed by the dishwasher) and storing.

The aforementioned SDG requirements may be sometimes difficult to meet in certain nursing homes because of the various existing work organizations (WOs). As with any technology, the implementation initial WO impacts the SDGs logistics and vice versa [10]. Thus, this paper explores how two initial WOs impact the acceptability of the tool by the staff and the integration of the SDG requirements. With this goal in mind, we performed work system analyses of two nursing homes' WOs.

2. Material and method

The present study is part of an Auxivia company project aiming to improve the implementation of their SDG in nursing homes. Auxivia SDGs are implemented in fifteen nursing homes, all located in France. Our observations were carried out in three of them, selected according to WO criteria that may impact the hydration process (nursing home size, fixed or random seat at the restaurant, formal hydration process or not). This article relates preliminary results from two nursing homes, representing two very different WOs.

Nine hours of observation were spent in each nursing home, by the same observer and with the same observation table. The observed items concerned both the hydration process (i.e. regardless of the SDG: distribution, collection and washing of the glasses, staff involved, division of tasks) and the use of the SDG (including constraints for the staff depending on their role, and usability or use problems).

Lastly, interviews were conducted with the staff. They complemented our observations and were based on the same items. Six interviews were conducted in the nursing home A (the nurse coordinator, the housekeeper, a psychomotor therapist, a hospitality aide, two caregivers) and six in the nursing home B (the assistant director at the care unit, the general practitioner, a nurse coordinator, a nurse, two caregivers).

The collected data were used to compare nursing homes item by item.

3. Results

3.1. Nursing home A

3.1.1. Context and initial WO

The 63 rooms (representing 63 residents) are distributed over four floors. The ground

floor provides a central restaurant, where most of the residents eat, and a smaller restaurant dedicated to a specific unit for people with memory or behavior disorders (12 residents). The two restaurants are about 50 meters apart from each other. Cooking, setting the tables and dishwashing are outsourced to a hospitality aide from an external company. Cooking and dishwashing are performed in the basement.

The glasses (connected or not) are brought and distributed by the caregivers at several places: residents' rooms, common spaces on the four floors, central restaurant, and small restaurant. To bring the glasses at each floor, caregivers use two lifts (often overused leading to long waiting times). Then glasses are brought back to the ground floor by the caregivers, to be washed by the hospitality aides in a dishwasher for communities. Lastly, hospitality aides store them in a cabinet at the central restaurant.

Despite the rather small size of the nursing home A, the circulation of the glasses is large and complex because: (1) the glass can be used at many places; (2) distances (and time) between places are significant, and (3) the process involves both caregivers and hospitality aides.

3.1.2. Use of the SDG

Ten residents are monitored by the means of SDGs. Thirty glasses have been initially put into circulation for these ten residents to guarantee there is always a glass available for each resident.

SDGs are distributed, washed and stored as the regular glasses. In comparison to regular glasses, hospitality aides have an additional task: to put the glasses on the charger after they have been washed, and to wait for the green light before using them anew. The charger and the data collector are close: therefore, when charging the glasses, hospitality aides meet both requirements R1 and R3 at the same time.

However, some difficulties to stick to the requirements have been noticed, especially R4 (always drink in a SDG). The difficulties are often related to the spatial configuration or to the diversity of staffs involved in the hydration process, or both. Table 1 details the impact of those characteristics on the adherence to these requirements.

The care staff asserts that SDG are not always available. Hence, they use regular glasses, so that the technology requirements are not met, and the measure of the daily water intake is distorted. Accordingly, the long and complex circulation of the glasses impacts the integration of technology requirements in the WO.

3.2. Nursing home B

3.2.1. Context and initial WO

Unlike nursing home A, each floor ("living unit") accommodates 17 to 20 residents. Each one has its own restaurant, and a kitchen equipped with a standard dishwasher and cupboards to store the glasses.

Glasses can be used in the residents' rooms, in common spaces (including the restaurant) located at the same floor, and they are washed and stored in the floor kitchen. As a consequence, all glasses (connected or not) always remain on the same floor, in places not further than a few dozen meters apart from each other.

In this WO, only the caregivers are in charge of distributing the glasses, bringing them back to the kitchen, putting them in the dishwasher and storing them. Thus, the circulation of the glasses is short and simple because: (1) there is only one place for the meals, (2) distances are reduced, and (3) only the care staff takes action in the process.

Table 1. Impact of the nursing home A's characteristics on the use of the SDG.

Characteristics of the organization	Observations in nursing home A
Diversity of places	Some glasses have been broken or lost, others remain a long time in the rooms or in common spaces at the floors. As a consequence, glasses are rarely available in the storage cabinet. Because glasses are not dedicated to a particular place, the caregivers often take more than needed to prevent running out. As a result, SDGs are missing on other floors. The personal tags are glued to a necklace; sometimes, they are not worn because the care staff forget them or because the resident refuses them. Then the water intakes are not recorded.
Diversity of operators	Because of a lack of information or training and due to turnover, caregivers do not really know the SDG requirements, or they do not know which residents are monitored. They frequently give a regular glass to the monitored residents, causing the water intake not to be recorded.
Both diversity of places and diversity of operators	Meal trays are provided to the small restaurant. According to caregivers, the SDGs should be provided with the trays by the hospitality aides; but according to the latter, the caregivers must fetch them at the central restaurant. Then there is a misunderstanding about the rules related to the circuit of the SDG. As a consequence, SDGs are often missing at the small restaurant.

3.2.2. Use of the SDG

Most of the residents (about 50) of three living units are monitored by the means of the SDG. As in nursing home A, three glasses per resident have been initially provided by Auxivia. The distribution, washing and storage processes are the same as for regular glasses.

Nevertheless, the use in nursing home B differs from nursing home A. Table 2 shows the impact of the characteristics of the glass circulation on the adherence to the technology requirements.

Caregivers access a SDG more easily than in nursing home A. In this situation, technology requirements are more often met. In this WO, the short and simple circulation of the glasses impacts the use of the technology, by facilitating the compliance with the requirements.

Table 2. Impact of the nursing home B's characteristics on the use of the SDG.

Characteristics of the organization	Observations in nursing home B
Proximity of various places	The charger and the data collector are both installed in the kitchen, as well as the dishwasher and the storage cupboard. These elements are not further than three meters from each other. As a result, the SDGs always remain within a limited area. When the caregivers look after a SDG, either they see it right away or they have a relatively short distance to walk and fetch one at the residents' rooms. The personal tags are glued under the restaurant table and tables in the residents' rooms as one resident always eat at the same place. But the caregivers have difficulties to ensure that the monitored residents are always close to their personal tags when they drink. As a consequence, water intakes can be recorded for another resident.
Only the caregivers are involved in the process	All caregivers have the same rules in mind. The newcomers arrive in a small team, so that they soon reproduce their colleagues' activity. The communications are fast, the technology requirements are rapidly learned by the operators.

4. Discussion

For the care staff, the integration of the Auxivia technology requirements appears to be more difficult in case A than in case B. The two WOs impact differently the use of the SDG and the integration of the technology requirements. The acceptability of the SDGs depends partly on the matching between their requirements and the actual WO: in the present study, nursing home B's organization suits better the SDGs' requirements than nursing home A's.

A thorough analysis of the WO upstream of the implementation is therefore crucial to ensure a more efficient integration of the technology.

Yet, manufacturers cannot design a tailor-made tool for each WO. To ensure that the technology is adapted to various organizations, one approach could be to set different profiles of WOs, and to define the needed adaptations of the technology to these profiles. For instance, when the technology is implemented in a long and complex glass circuit, as in case A, three solutions can be considered in order to help the staff better understand and adhere to all the steps: (1) provide more glasses, knowing that it would increase the costs to nursing homes; (2) emphasize support, information and training towards the care staff; (3) introduce the tasks related to the SDG in the job descriptions.

Despite the differences we observed in the meeting of technology requirements between A and B, results do not mean that the use of the technology is better in one nursing home than in the other, as it depends on a wide range of requirements and tasks. In this article, we focused on the acceptability of a few ones by the staff. A forthcoming paper will further develop the overall efficiency of the SDG.

Competing interests

The authors declare that they have no competing interests in conducting and in reporting this study.

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