Towards the activity based hospital

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Abstract

In Swedish healthcare and at Sahlgrenska University Hospital productivity needs to increase. Many activities are performed all over the hospital, but not performed in a standardised way. The very first step to create standards for activities is to standardize the name of the activities and put them in a structure. There are standards, several official standards for both naming and carrying out health care activities, but there is no standard that includes the supporting work that is not strictly patient care. This paper describes an initiative at Sahlgrenska University Hospital using design science to develop a common terminology and structure for describing and defining all work activities performed at medical and surgical care units.

Keywords: Productivity, Hospital management, TDABC

Introduction

Sahlgrenska University Hospital is one of the largest hospitals in Sweden and provides emergency and basic care for the inhabitants of the Gothenburg region and highly specialised care for West Sweden, with about 700,000 and 1.7 million inhabitants respectively (Sahlgrenska University Hospital, 2018c). It is also Sweden's centre for certain specialised care, e.g. in paediatrics, and is one of six teaching hospitals with medical education in Sweden. The hospital has about 142 care units and 284 clinics (Sahlgrenska University Hospital, 2018b). In 2017, Sahlgrenska University Hospital averaged 1,685 available beds, had an annual turnover of SEK 15,993,000,000 (EUR 1,631,286,000), employed almost 17,000 co-workers, had 96,369 inpatient visits out of which 71.6% were unplanned, had 1,389,410 outpatient visits out of which 16.1% were unplanned, and had 202,401 non-psychiatric emergency care visits (Sahlgrenska University Hospital, 2018a). As all other large hospitals in Sweden Sahlgrenska University Hospital has difficulties of meeting the demand from the population. The demand further increases every year with an aging population. The healthcare system in Sweden is funded by taxes and the margin for raising them is slim.

The conclusion is therefore that the productivity needs to increase to cope with the future demand. However, the productivity is decreasing in public healthcare in Sweden,

which has been highlighted e.g. by The Swedish Agency for Health and Care Services Analysis (2013), and a public inquiry into Swedish healthcare efficiency (Stiernstedt, 2016). This calls for radical changes of the system. We have in previous studies shown that there is a great productivity potential on a micro level, when specific activities are analysed using work study techniques (Hermansson & Almström, 2016). The question though, is how to scale the improvements made in one activity at one ward to give effect for the whole hospital.

The first realisation is that the same activities are performed at several places around the hospital, for example to distribute meals to the patients on wards. However, "distribute meal" is not made in a standardised way at all units at the hospital, on the contrary, every care unit has invented their own way of doing it. There is a great potential to standardise these repetitive supporting activities.

However, standardisation is not easily done when the most fundamental factor is missing: There is not a standardised terminology for what to call all activities. For direct patient activities, like different treatments, there are often an official standard based on patient safety regulations. For example there is the International Classification of Nursing Practice, which is part of the World Health Organisation's Family of International Classifications and is a tool for describing and comparing nursing care work and outcomes (Baernholdt & Lang, 2003). There are also the Swedish National Board of Health and Welfare's National information structure (2017), which describes the healthcare process on a general level, and Language for Special Purposes for Healthcare (2011), which consists of health-related classifications, the board's term bank and the international concept system SNOMED CT. These different official regulations provide standard names for many, but not all, patient related activities, but for all the supporting activities, which constitute a large majority of the total work time (The Swedish Agency for Health and Care Services Analysis, 2013), there are no standards.

The purpose of the project studied in this research is to create a standardised terminology for activities. The task is monumental, there are some 650 organisational units at the hospital, and potentially all of them have developed their own way of performing and naming activities. It is not certain that all units follow the official naming standards for patient activities. The first part of this endeavour is an R&D project to develop a general structure for all activities and to develop a practical method for collecting the activity data from all organisational units. The resulting structure and method will be tested on ten different wards at the hospital.

The R&D project is led, and to the largest part carried out, by hospital staff with the assistance of researchers associated with Chalmers University of Technology (Chalmers). The research task is to both aid in the design process of the solutions for the activity structure and in the method for data collection, as well as study the design process with the ambition to generalise it. The ambition is to frame the research approach as design science research (J. van Aken, Chandrasekaran, & Halman, 2016). The initiative uses the CIMO logic (Context, Intervention, Mechanisms, Outcome) (Denyer, Tranfield, & van Aken, 2008). This paper uses the same logic as structure for presenting the research. The goal is to contribute to operations management through the generalisation of the structure and the method, for use at other hospitals and possibly other large and complex organisations.

Design Science Research

Design science research involves the investigation and evaluation of potential situations and systems, either completely new ones or new versions of existing ones (Romme,

2003). This is done by developing design propositions to solve existing problems or issues and create desired systems and situations. Design science research emphasises participation, discourse as tool for intervention and experimentation of the proposed design. Its primary concern is designing solutions that work. A design initiative will typically produce three designs (J. E. van Aken, 2004): an object-design (the intervention), a realisation-design (the implementation plan) and a process-design (the method used to design the solution). Design science applied to operation management problems has the potential to bridging theory and practice in a more efficient way than traditional explanatory operations management research approaches (Holmström et al, 2009).

Context, Intervention, Mechanisms, Outcome

Denyer et al. (2008) build on the basic logic of prescription "if you want to achieve Y in situation Z, then perform action X" (J. E. van Aken, 2004; p. 227) and propose the CIMO model (Context, Intervention, Mechanisms, Outcome) for framing design science research, which is used in this paper. In short, if you have [Context] use [Intervention] to create [Outcome] through [Mechanism]. A problem or issue always exists in some context. The nature of the context is what characterises it in terms of the human actors that influence behavioural change, the technical system and the social system, e.g. factors such as organisational power, system interdependencies and interpersonal relationships (Denyer et al., 2008). Interventions are used to change present practices, influence behaviour and are the key component of any design proposition. They result in outcomes and carry hypotheses for what outcome an intervention will achieve. Mechanisms are triggered by an intervention in a certain context and are the relationship between intervention and outcome. They are the key to why an intervention is expected to bring about a particular outcome. The outcome of an intervention will change depending on context, because the underlying mechanisms generate different outcomes in different contexts, but the intervention-outcome combinations are generalizable.

Standardized activity terminology at Sahlgrenska

Context

The top management at Sahlgrenska University Hospital has come to the conclusion that all activities need to be mapped at the hospital in order to build a foundation for future standardization of supporting activities which in turn will be the foundation for the future planning and control of the hospital's operations. A project team was formed with the active support of the top management to carry out a pilot project with the purpose to develop a structure and a method to standardize the activity terminology at the whole hospital. An experienced project manager from the hospital lead a project team consisting of the authors of this paper, two Human Resource specialists with nursing background, and one engineer from the Analysis department.

The activity terminology at the hospital is very complex since the names and definitions of activities have been formed locally at every unit with influence from many directions over time. The official naming standards (see Introduction) are implemented in different laws, regulations and guidelines, which in turn are stated by different authorities and health care administrations. Hospital information structure, including on how to conduct work, in terms of guidelines, routines, and instructions is organised and flows as follows (see **Fel! Hittar inte referenskälla.**).

The Swedish Parliament establishes laws and authorities, e.g. the Swedish Board of Health and Welfare (Socialstyrelsen), the Swedish Work Environment Authority (Arbetsmiljöverket), and the Swedish Medical Products Agency (Läkemedelsverket), establish directives and regulations that need to be adhered to. A law, directive or regulation passes down through the Swedish Association of Local Authorities and Regions to Region Västra Götaland and adapted and interpreted into a region-common guideline. This is then passed down to Sahlgrenska University Hospital where it is again adapted and interpreted into a hospital-common guideline. Then it is again passed down to the division, subdivision, and care unit level where they are adapted and interpreted at each step into guidelines or routines. Depending on its applicability, the guideline or routine may or may not skip steps and/or may or may not be shared across units. Both within the same division or subdivision or between.

In such a decentralised and decoupled model of organising information, in particular establishing and maintaining work routines, it is not difficult to imagine the activity terminology to be diverse.

Intervention

First the project team concretised the purpose of the initiative to form the base of communication to participating care units. It was built on the established notion of the importance of patient documentation. Being able to describe what to do and what has been done is central to establishing, following, re-evaluating, and finalising a patient's care plan, providing direction for the individualised care of a patient (Ballantyne, 2016). Hence, the purpose that was communicated was to create a system for activities to increase shared understanding of what described activities entail, which is necessary to ensure that patients get the same high standard of care regardless of where activities are conducted and by whom. It was also related to existing development initiatives at the hospital and Region Västra Götaland: "Workshifting" (transfer of work activities from one profession to another, increasing the amount of qualified work) and "The Healthcare Information Environment of the Future" (the replacement of existing medical software into an integrated system).

Which units to investigate in this pilot project was then delimited: Only care units, not emergency rooms, operating theatres, clinics, laboratories, consulting units (such as physiotherapy) or supporting administrative units (such as medical secretary units, HR, economy). In order to limit the pilot to the most common type of units. In addition, only care units that provide care for adults, i.e. not paediatrics. For the sake of starting simple since paediatrics involve a lot of adaptions of activities to suit children of different ages. The pilot was also delimited to focus on medical and surgical care, not psychiatric care. They are the two largest disciplines which increased the probability of finding units to collaborate with. Similar to paediatrics, psychiatrics involve a lot of treatments particular to that discipline. It was decided to limit the pilot to ten care units and to visit care units from all divisions. After creating a shortlist of applicable care units subdivision managers were informed in the formal communication and management channels of the initiative. This allowed for the care units to be contacted formally through e-mail. It also allowed for the use of informal channels, reaching out to previous collaborators to the team members and care units with a reputation of being interested in participating in development initiatives. The care units visited are presented in Table 1.

Table 1. Care units visited and their areas of treatment and treated diseases

CARE UNIT VISITED	AREAS OF TREATMENT AND TREATED DISEASES
Geriatric care unit	Hip fracture and other orthopaedic and medicine diagnoses
Gynaecological and oncological care unit	Ovarian, uterine, cervical, and vulvar cancer
Infection care unit	Heart, brain, blood, lungs, and ([multi-]resistant) bacterial infections as well as tropical diseases
Medical emergency care unit	Chest pain, congestive heart failure, cardiac dysrhythmia, infection, and poisoning
Medical, geriatric and emergency care unit	Coronary heart disease, congestive heart failure, cardiac dysrhythmia
Surgical care unit	Breast cancer, malign melanoma, endocrine disease, and morbid obesity
Surgical care unit	Intestinal related diseases
Surgical emergency care unit	Stomach pain and other stomach and intestinal problems
Transplantation care unit	Heart, lung, liver, kidney, pancreas, intestine, and multi-organ transplantation

The benefit to these types of care units to participate was formulated and later communicated at first contact and at the start of every care unit visit. Emphasis was put on the opportunity to audit, investigate or reflect on their own work organisation in terms of activities carried out at the care unit. It enables the creation or definition of work roles based on the activity list that is produced during inquiry. As mentioned previously, it also enables the possibility of starting workshifting. Lastly, it allowed them to be able to influence the definition and description of activities for their discipline at the hospital.

The project team created a first draft of the activity list based on several existing lists: The HR department's list for resource planning and scheduling of personnel, the Chalmers researchers' list from previous studies (Almström & Hermansson, 2016), and the project manager's lists from the workshifting project. It was decided to start mapping at a general level and limit the initiative to that level. The initial headlines were Direct patient work, Indirect patient work, Service work, and Miscellaneous activities. The most general level was denominated Level 1 Activity categories and the next Level 2 Activities. The headlines, and activities under each headline, were reformulated to all begining with a verb to emphasise that action is required to perform an activity. The team used activities from the previous lists and complemented with additional activities during the combination of the lists for the first draft. The initial headings were broken apart and new headings were created for large activities (e.g. Do the rounds, Clean, Examine patient, Treat patient) in order to improve Level 1 activity categories granularity. Variants of Level 2 activities were kept as examples in order to avoid the scope to move into more detailed levels. The examples remain as potential future Level 3 activity variants. Level 1 activity categories were designed so that they were unlikely to be expanded during care unit visits, apart from the categories Examine patient and Treat patient where addition of new activities was expected. The ambition was to keep Level 1 activity categories discrete, i.e. that Level 2 activities in a particular category are not part of other categories. Where Level 2 activities did occur under other categories they would need to be linked in the database structure to point toward the same ID, description, and examples. If descriptions or examples need to differ, a new Level 2 activity would need to be created with a separate ID.

Visits were conducted by different combinations of 2-3 project team members meeting with 2-3 care unit staff, typically experienced registered and assistant nurses and occasionally a care unit manager. The whole activity list was gone through and the care unit personnel were asked if they performed an activity or not or if they performed it differently. After going through all existing activities in a category they were asked if they could recall any activity they conduct that was not listed. The project team members engaged in asking follow-up questions and for unit staff to describe their activities in more detail to help identify new activities or examples of activities. The project team reconvened between every, or every other, visit to re-evaluate and update the activity list. The activity list was kept in a basic hierarchical information structure to later be easily entered into a database structure for more elaborate cross-coupling where it is possible to create filters and tag activities with different information, e.g. which units or professions perform an activity.

Mechanisms

There are four mechanisms at play in the design. The first draft of the activity list is the mechanism used to get a conversation started. Based on project team members' experience it is difficult to get care unit personnel to start brainstorming activities from a blank slate and the first draft serves as a starting point for them to problematize around and expand on. The use of humble inquiry (e.g. Schein, 2013) when meeting care unit personnel serves as a mechanism to build a relationship of open communication. Signalling curiosity and interest, letting them do most of the talking and asking (open-ended) follow-up questions to coax out rich descriptions of activities and their connected activities. The third mechanism is interpretation by the activity mapping team of the activities suggested and brought up during care unit visits. It is necessary for activities to be described at the proper level, since activities often tended to be described at varying levels of detail. Too specific variants of Level 2 activities are registered as examples. The final mechanism is the cataloguing of the activities in the activity list. It serves as the tool for structuring information, creating a shared understanding of the Level 1 activity categories and the Level 2 activities, and sharing that understanding with participants.

Outcome

The outcome of the activity mapping is an initial activity structure of two levels: "Level 1 Activity categories" and "Level 2 Activities" and an activity list with 19 Level 1 activity categories and 107 Level 2 activities, the large majority of which have several examples of variants. These examples are future Level 3 activity variants. The denomination and description of these activities are shared and made available across care units. There is also a catalogue of which activities are carried out at which (type of) care units. The Level 1 activity categories of the activity list is presented in Table 2.

Table 2 - Level 1 activity categories and examples of Level 2 activities

LEVEL 1 ACTIVITY CATEGORY	EXAMPLES OF LEVEL 2 ACTIVITIES
a. Examine patient	Observe patient status
b. Treat patient	Redress bandage
c. Assist patient	Perform patient hygiene
d. Do the rounds	Prepare for the rounds
e. Talk with patient	Inform and motivate patient
f. Plan patient care	Hold patient care planning meeting

g. Report between shifts	Prepare for report between shifts
h. Communicate about patient	Communicate with another caregiver
i. Document and read information about patient	Document and read in journal
j. Handle pharmaceuticals	Prepare pharmaceuticals
k. Handle food and drink	Order meals
l. Handle material and equipment	Maintain equipment
m. Clean	Final cleaning of patient room
n. Handle information not relating to an individual patient	Attend meeting, Handle e-mail
o. Handle economic issues	Make budget
p. Handle personnel issues	Train new co-worker
q. Direct and develop operations	Perform development work
r. Take break	Take meal break
s. Wait and handle interruption	Handle faulty equipment

Discussion

The initiative presented above has managed to bridge the established information structure for the participating care units and created the beginnings of a shared activity structure at Sahlgrenska University Hospital. The initial object-design of the activity list has been tested and evaluated at 10 care units. The Level 1 activities and examples of Level 2 activities are presented in English translation in Table 2 above. The Level 2 activities are too numerous to fit in this paper, and there is no point of publishing a complete translation since many terms are not straight forward to translate from Swedish without a deep knowledge of both medical terms as well as the healthcare systems. The testing has also rendered a general activity structure consisting of specific hospital activities: The Level 1 activity categories, the Level 2 activities, and the examples of Level 2 activities which, if formalised, would constitute Level 3 activity variants. To structure activities in such a hierarchy is well established in other industries, for example the manufacturing industry. Commonly used in combination with a pre-determined time system, e.g. MTM-SAM (International MTM Directorate, 2004), to plan manual work activities, which is a well-established method in the manufacturing industry in Sweden. In MTM-SAM the smallest activities are called elements, elements are put into standard sequences, and sequences can form standard building blocks to speed up the planning process. These three levels of generic activities can be used to time-efficiently construct many different higher level activities by using standardised sets of activities for different types of organisational units. The activity structure and different levels is presented in Figure 1.

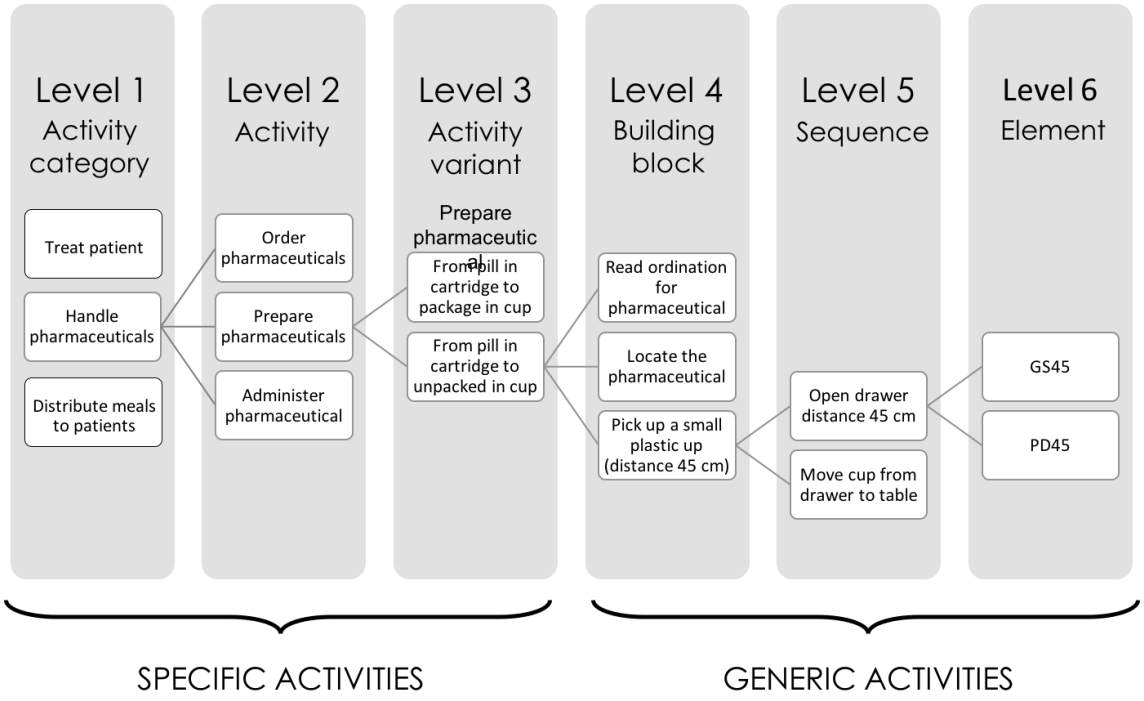

Figure 1 - The levels of the activity structure with the example activity Prepare pharmaceutical

The realisation-design is summarised in Table 3 below where the design proposition is generalised. Lastly of the three designs in the initiative, the process-design is outlined in detail in the Intervention section of the previous Activity Mapping at Sahlgrenska University Hospital chapter.

The primary contribution of this research is to the improvement of the operations at Sahlgrenska University Hospital. However, this hospital is not unique when it comes to activities and the potential for implementing the same structure and method at other hospitals, in Sweden and abroad, is great. The scientific contribution of this paper is to the design science research field by generalising the three designs of the initiative: The solution itself and the procedure to carry out fundamental operations management. Fundamental in the sense that activity mapping, by providing a base of activities, is necessary to conduct in order to enable other important initiatives such as TDABC (Time Driven Activity Based Costing) (Kaplan and Porter, 2011), resource and production planning, and standardisation of work.

Table 3 - Generalised design proposition for a terminology of supporting activities at care units

CONTEXT
Large hospital with specialised care organised based on medical specialisation
Decentralised management responsibility of work organisation
Fragmented information system
INTERVENTION
Combined, iterative exploration and inquiry of staff and managers at care units
Collation of identified activities by a dedicated activity mapping team
Define and describe activities at different activity levels
Structure and catalogue activities in a database
MECHANISMS

Humble inquiry of staff to gather rich descriptions of activities and connected activities.
Interpretation and association by dedicated activity mapping team.
OUTCOME
Common denomination of the same activities carried out across care units
Catalogue of what activities are conducted at which (type of) care units

Future research

To have a standardised vocabulary for activities is only the first step on the roadmap towards increased productivity in healthcare. The next step would involve improvements and standardisation of how the activities are carried out. It also lays the foundation for automation and digitalisation of activities.

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