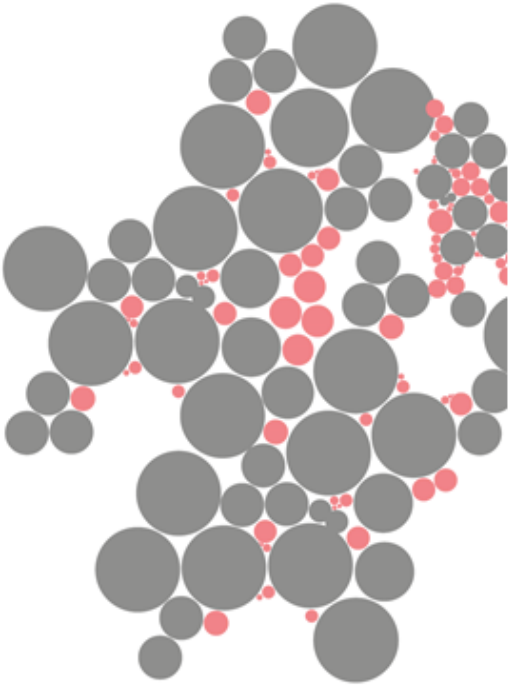

Using a quality dashboard at tactical level to improve patient safety in Medisch Spectrum Twente

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Abstract

Objective

The aim of this study is to gain insight to what extent the use of a quality dashboard can assist staff at tactical level in a hospital to improve patient safety within departments. Therefore, the following research question has been formulated: *To what extent can the Hospital Safety Dashboard assist staff at tactical level in Medisch Spectrum Twente to improve patient safety within their department?*

Methods

Data for this study has been collected by carrying out a literature study about dashboard-use in hospitals, conducting a questionnaire and conducting semi-structured qualitative interviews. There were 45 responses to the questionnaire of employees working at tactical level. Additional written comments were encouraged. Interviews were held with eight team leaders, two quality and safety advisors, a business manager and a medical manager.

Results

Use of the dashboard varies among the research population. There exists differences in departments and in professions. Main ingredients for intention to use include accuracy of results and sufficient applicable indicators. When these ingredients are available, monitoring can adequately be done. For analysing and managing, other information systems have to be consulted. Showing the outcomes of indicators to operational level as manner of giving feedback creates little affinity towards the dashboard at these employees and therefore is of limited added value in this area.

Conclusion

The Hospital Safety Dashboard can primarily be used to identify underperforming indicators. Other analyses have to be done to determine the underlying causes and subsequently be able to set up improvement actions. Other strengths of the dashboard are the increased negotiability of patient safety in MST, and the dashboard gives more insight about the necessity of registration of patient safety related data at operational level.

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Introduction

Patient safety is one of the most important issues in Dutch hospitals [1]. In 2008, an estimated of 5,7% of 1.3 million patients suffered from potentially avoidable injury [2]. Therefore, many of the Dutch hospitals implemented a Safety Management System (SMS) to enhance and assure patient safety in their organization [1]. Due to the fact that risks in healthcare are not as visible as in other industries, a reliable system which registers adverse events is required to gain insight into the nature and extent of incidents [3][4]. After identification, care processes can be adapted to minimize the risks of these incidents. Eleven key themes were determined for the SMS based on patient safety research, where improvements can be made with respect to unintentional preventable harm [5].

Medisch Spectrum Twente (MST) lacked a system that continuously measures hospital-wide safety indicators. Therefore, as part of their SMS, MST implemented the Hospital Safety Dashboard (HSD) to keep track of patient safety data. The HSD is a quality dashboard that meets the following definition: "Health IT that provides a visual display of quality indicators (metrics) to enable professionals at the strategic and/or tactical level to identify areas of practice for improvement" [6]. A team of experts determined the norm for the key indicators for each theme to measure patient safety in their area. These key indicators were formed into a framework by a team of data-, ICT- and quality & safety advisors [7]. The HSD was ready to be used in June 2014.

Healthcare organizations are increasingly introducing dashboards to measure and improve patient safety and quality of care [6]. A dashboard provides data in a useful format so users can efficiently set up initiatives to improve patient safety [8]. A literature review on dashboards for improving patient care by Dowding et al. from February 2015 reports that there were generally favourable impacts of the implementation of dashboards in healthcare [6]. However, Dowding et al. found no studies about the impact of dashboards on clinical workflow and the effect on the professionals on tactical level with respect to improving patient safety [6]. These insights are important to determine the effect of quality measurement indicators on potential improvement of service delivery [9]. Furthermore, it is unknown how staff understand and interpret such information, and how this impacts their decision making [6].

A combination of qualitative and quantitative research is carried out to assess to what extent the HSD assists staff at tactical level to improve patient safety in the MST. Outcomes of indicators in the dashboard are compared with clinicians experience. This is done by carrying out a literature study about dashboard-use in healthcare in combination with a questionnaire and semi-structured qualitative interviews with health professionals at tactical level.

Background

In January 2008 the campaign 'Prevent damage; work safely' was started at the IGZ patient safety congress with the aim to prevent unintentional preventable harm in hospitals [2]. Each hospital in Dutch healthcare was required to implement a Safety Management System (SMS) to contribute to the improvement of patient safety in Dutch healthcare. The Inspectorate For Healthcare (IGZ) monitors the implementation of a SMS in different hospitals in Dutch healthcare [2]. According to Medisch Spectrum Twente (MST), a SMS is a combination of practical activities and guidelines to identify risks, and to implement improvements in care processes and adjust if necessary. The goal of the SMS is providing guidance of patient safety in clinical practice. Patient safety in MST is defined as: "The (near) absence of (the risk of) damage caused to the patient, which is the result of not acting in accordance with the professional standard of care workers and/or shortcomings of the care system" [10].

A SMS is hospital wide implemented and influences every employee in each layer of the organization. There are thirteen aspects that define a Safety Management System which can be seen in Table 1. This composition is based on the NTA 8009:2011 which was used as a stepping stone to form the SMS in MST. This norm is currently replaced by the NTA 8009:2014 [11].

Aspects	**Explanation**
Safety culture	All employees in a hospital have to contribute to the safety culture. Examples are talking about safety, reporting of incidents and insightful work according to clear guidelines and protocols.
Leadership	Managers play a crucial role in the SMS. They have to guarantee patient safety despite organizational, technical and procedural changes. Risks have to be managed next to staff and finances.
Communication	A clear communication structure is necessary in order to inform all stakeholders about risks for patients. This communication structure also has to include open communication of patient safety policy towards patients an external parties.
Risk awareness of employees	Employees have to be aware of the risks of their own actions and actively have to contribute to patient safety. Managers have to make sure duties, competencies and responsibilities concerning patient safety for employees are identified.
Management of third parties	Next to clinicians and nurses, there may (temporarily) work other stakeholders in the hospital. For example, suppliers, contractors, IT specialists or students. It is important that these third parties adhere to the applicable patient safety regulations.
Participation of patients	Managers have to involve patients in the formulation and execution of their patient safety policy. Next to this it has to be clear for patients where patients can file their complaints or where they can report incidents.
Prospective risk assessment	The risks that exist have to be known in order to reduce patient harm. A prospective risk assessment identifies risks in advance of care processes.
Risks in business operations	Operations concerning procurement, storage and inventory of medication must be properly regulated. As well as the purchase, instruction, introduction, use, sterilization, cleaning and maintenance of medical equipment.
Risks associated with change	In case of technical, procedural and/or organizational changes, it is important that safety of patients is ensured continuously.

Retrospective risk assessment	Each department requires a properly functioning reporting system. Staff at tactical level can use this information to identify main risks in their department.
Monitoring	Tactical level provides performance monitoring of patient safety. They have to check compliance of measures for improvement and the functioning of the SMS periodically. Findings are reported to the Board of Directors.
Continuous improvement	Tactical level has to identify opportunities for improvement. Once an improvement is made, they evaluate the effects of the improvement and ensure that knowledge/experience is distributed internally.
Responsibility Board of Directors	An important condition for successful patient management policy is visible personal commitment of the board of the hospital. The Board of Directors is ultimately responsible for the patient in the hospital and for the implementation of the SMS.

Table 1: Different aspects of a properly functioning SMS [11]

The Dutch Institute for Accreditation in Healthcare (NIAZ) grants accreditation for a SMS in case this is sufficiently implemented in a hospital. Achieving accreditation means that a third party gives a written guarantee that a product, process or service meets specific requirements. The accreditation of NIAZ is hospital-wide and consists of different components which have to be of a sufficient level. One of these components is the Safety Management System. NIAZ did not award MST a hospital-wide accreditation certificate due to the lagging implementation of the SMS on October 28th, 2013. IGZ indicated in an inspection report of June 21st 2013 that measures would be taken in case accreditation would not be granted by NIAZ. Therefore, MST came under increased surveillance of IGZ on November 19th, 2013 [12]. This increased surveillance lasted until May 19th, 2014. At this time MST had met the most important conditions to qualify for accreditation of its SMS [13]. The accreditation by NIAZ of the SMS was achieved at January 29th, 2015. The NIAZ concluded that MST fully complied with all requirements of a hospital SMS [14].

An attempt to improve the assurance of patient safety was the implementation of a quality dashboard. A quality dashboard is defined as: "Health IT that provides a visual display of quality indicators (metrics) to enable professionals at strategic and/or tactical level to identify areas of practice for improvement" [6]. The Board of Directors decided upon implementation of this dashboard. Such innovations put the strategic level in a difficult position due to the fact that they are caught between the will of external parties, which hunger management and control, and the operational core which mostly want to protect their autonomy [15].

The dashboard MST implemented is called the Hospital Safety dashboard, or in short 'the HSD'. This dashboard contributes to the SMS in a variety of ways. The HSD is a tool to make patient safety better negotiable by increasing the resources to communicate patient safety related issues from the management to the doctors and nurses. Improvement in communication may lead to more risk awareness of employees which improves the safety culture within the hospital. It also allows better insight in patient safety and monitoring hospital-wide as well as on department-level. The HSD gives a representation of patient safety for external parties (e.g. NIAZ, IGZ and potentially health insurers). Prospective risk assessments are carried out in case of technical, procedural and/or organizational change. But not all risks may be prevented this way. In case of technical, procedural and/or organizational changes, retrospective risk assessment using data in the HSD can help identify the main risks in departments. It also helps identifying already existing risks in departments and

stimulates continuous improvement. The next chapter explains what a dashboard is and how it functions.

Dashboard

Rasmussen, Bansal & Chen suggest three types of dashboards; the strategical, tactical and operational dashboard [16]. A *strategic dashboard* is described as a tool to monitor the steps taken to reach a certain strategic object. A *tactical dashboard* serves as an instrument as a result of strategic initiation for monitoring advancement and relationships of trends. Whereas an *operational dashboard* functions as tool to monitor business processes, business activities and various other complex issues. The HSD is being used on tactical and strategical level.

A dashboard translates an organization's strategy into objectives, metrics, initiatives and tasks, customized to each group and individual in the organization [17]. This enables managers to measure and monitor processes and key activities to achieve their goals. Key goals of using a dashboard include [17]:

- Monitoring. Critical business processes and activities using metrics trigger alerts in case potential problems arise;
- Analysing. The cause of potential problems can be explored using up to date and relevant information;
- Managing. Management of processes and people to optimize performance, improve decisions and steer (part of) the organization in the right direction.
- Feedback. Dashboards can be used to communicate information across the hospital for decision making and collaboration

These kind of dashboards are commonly being used in the business sector. However, in case of the health care sector it is increasingly being used, but not as common as in the business sector [6]. Therefore, information with respect to the use of dashboards in health care is limited. Due to the common use of dashboards in the business sector, literature about the use of dashboards in this sector is being applied at the use of the HSD.

Success factors of a dashboard

Malik described two different acronyms which are stepping stones of building a dashboard [18]. These acronyms are SMART (Synergetic, Monitor KPIs, Accurate, Responsive and Timely) and IMPACT (Interactive, More data history, Personalized, Analytical, Collaborative and Trackability). The first acronym SMART consists of the basic elements of a dashboard. These elements are shown in Table 2.

Synergetic	Dashboard must be ergonomically and visually effective in displaying different aspects in a single screen view
Monitor KPIs	Key Performance Indicators (KPIs) required for effective decision making must be displayed for the domain to which a dashboard caters
Accurate	In order to gain full user confidence, the information presented must be entirely accurate
Responsive	A user alert must be displayed in case a predefined threshold is exceeded
Timely	The most current information possible must be displayed for effective decision making

Table 2: SMART [18]

With the elements of SMART a proper dashboard can be displayed and underperforming indicators can be identified. However, according to Malik there are some more demands a dashboard has to meet to ensure effective organizational management. These demands are summed up in the acronym IMPACT which are shown in Table 3.

Interactive	The user must be able to drill down to detail information
More data history	Users of the dashboard should be able to review historical trends of indicators
Personalized	The visibility of KPIs should specifically be for each users' domain of responsibility, privileges, data restrictions and so on
Analytical	Guided analysis of the results in the dashboard must be able to perform what-if analysis.
Collaborative	The dashboard should facilitate users' to message one another when remarkable observations have been done in the dashboard
Trackability	Users should be able to customize the metrics he or she would like to track

Table 3: IMPACT [18]

The Hospital Safety Dashboard

The HSD was developed with the aim to identify possible areas of improvement in care processes where subsequently improvement measures can be taken. This is an advanced instrument in comparison with instruments used in other hospitals in the Dutch healthcare system [7]. The goal of the dashboard is to ensure a continuous focus on safety. The dashboard is a tool which can be used in the Plan, Do, Check, Act- cycle of Deming [19], which is presented in Figure 1. The Plan-phase consists of identifying and analysing the problem and determine why an indicator is underperforming. Whereas the Do-phase consists of the development of solutions and implementing of the best alternative to improve the outcomes of this particular indicator. The Check-phase evaluates the result of the chosen solution and in this phase is being decided whether the desired goal has been reached. When this is indeed the case, the Act-phase can be initiated. When results are not as expected, the Plan-phase is initiated again and the hypothesis has to be revised. The Act-phase consists of the implementation of the full scale solution and attain continuous improvement.

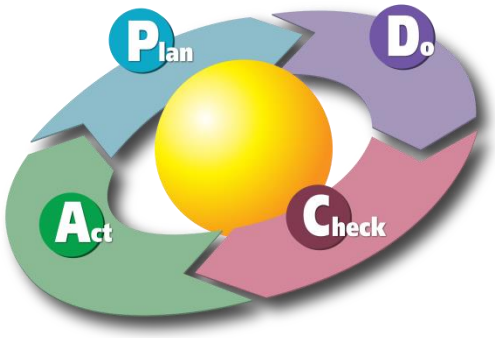

Figure 1: PDCA cycle of Deming

Based on patient safety research of the Dutch Institute for Health Services Research (NIVEL) and the Institute for Health and Care Research (EMGO), eleven substantive themes were identified were great improvement can be accomplished when it comes to reducing unintentional preventable harm in hospitals [20]. Eleven expert teams were made responsible for development and implementation of these safety themes in MST. These safety themes are as followed:

- Prevention of wound infection after surgery
- Early recognition and treatment of the critically ill patient
- Early recognition and treatment of pain
- Medication verification at admission and discharge
- Safe care for sick children
- Swapping of and in patients
- High risk medication: preparation and administration of parenterals
- Preventing sepsis and treatment of severe sepsis
- Frail elderly
- Prevention of renal failure in intravascular use of iodinated contrast agents
- Optimal care for Acute Coronary Syndroms

A team of data-, ICT- and quality & safety advisors developed the framework of the dashboard. Each theme was divided into several safety indicators. Expert teams checked and modified the key indicators in their safety theme. The teams also defined the registration process and the inclusion criteria for patients. The end of the process were fully defined indicators per theme, authorized by the expert team. The dashboard gives a hospital-wide overview of outcomes of indicators spread across the safety themes. A screenshot of the hospital wide-overview is shown in Figure 2. In total, there are 55 indicators spread across eleven safety themes. Each indicator consists of a numerator and denominator which results in the *realisation*. A percentage is displayed of the current status of the indicator, which consists of data of the current calendar year. This data is obtained from different internal databases in which healthcare professionals register patient safety related events. Next to the realisation is the *norm*. When available, these norms are equivalent to the norms that are set in order to achieve a certified SMS. The third item visible in the overview is the *result*. This is defined as the difference between realisation and the norm. In case the realisation meets or exceeds the norm in a positive way, the difference is marked blue. When it does not comply with the norm, the difference is marked red.

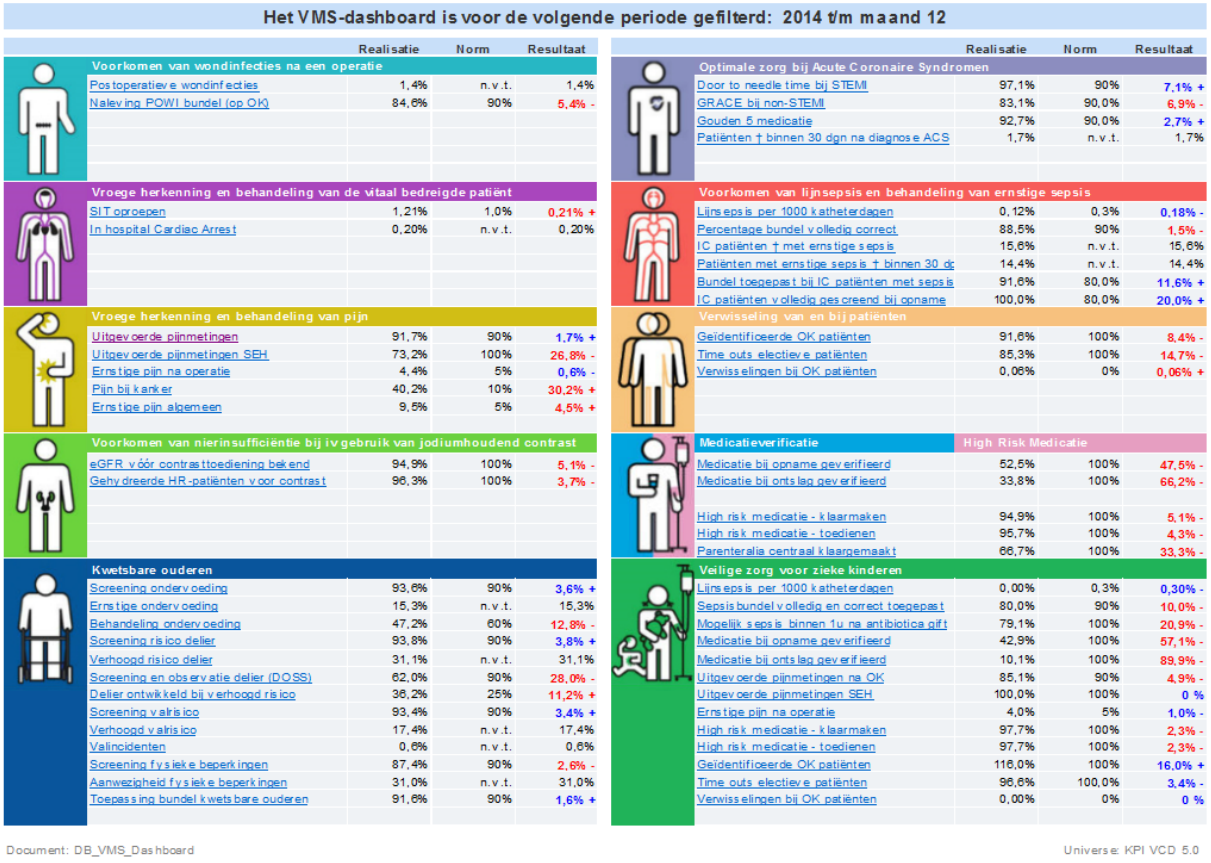

Figure 2: Hospital Safety Dashboard; hospital-wide

Each indicator can be explored into further detail. Here is presented how the numerator and denominator are defined and what their corresponding value is. This page also shows from which database the information is extracted as well as the origin of the norm. Next to that there is a bar graph visible which presents the results of the indicator with a monthly interval as is shown in Figure 3. Outcomes of indicators can also be seen at departmental level. In this page is visible what the monthly outcomes are of each of the departments.

Uitgevoerde pijnmetingen
Resultaten KPI - Totaal

Rapportageperiode: 2014 t/m maand 12

Medisch Spectrum Twente

Alle voor u geautoriseerde Specialismen **Alle voor u geautoriseerde Afdelingen**

	Aantal teller	Aantal noemer	Realisatie	Norm	Resultaat
Totaal	299.810	326.917	91,7%	90,0%	1,7% +

	Definitiedocument PIJN
teller	Aantal uitgevoerde gestandaardiseerde pijmetingen (VAS) bij klinische patiënten - per opname en opnemend specialisme. Exclusie: G3, K1-V, IC periode. Bron: Mediscore ZPI
noemer	Aantal pijnscores volgens protocol (elke ligdag 3 metingen, opname- en onslagdag 1 meting). Bron: Mediscore ZPI
herkomst norm	VMS gids

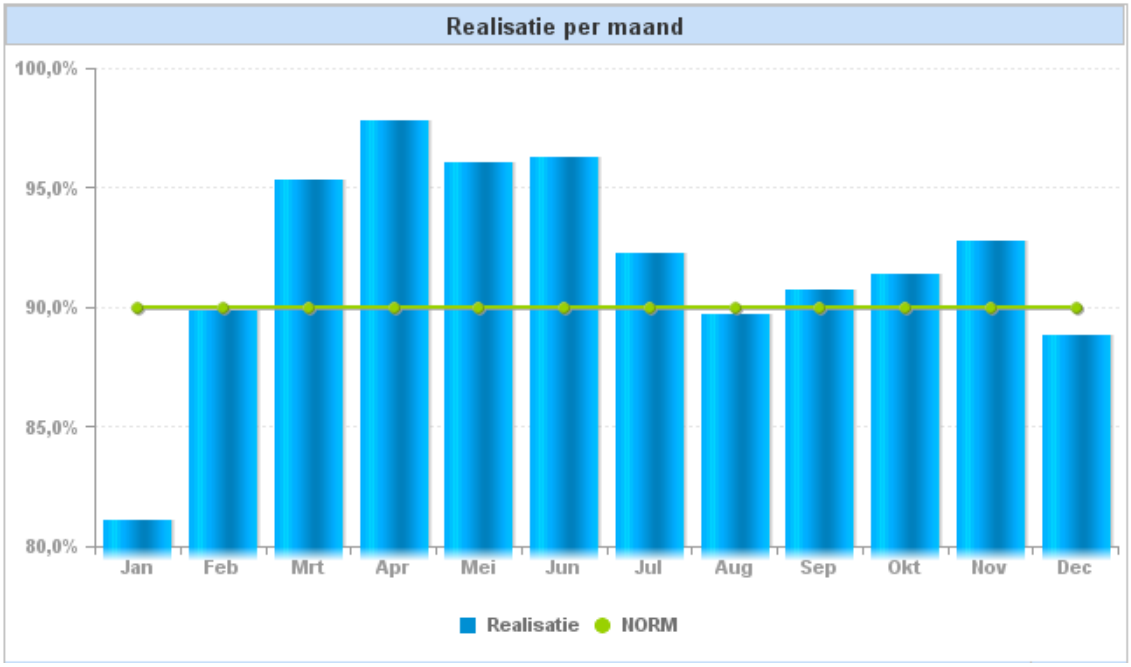

Figure 3: Hospital Safety dashboard; indicator-level

Innovation in professional bureaucracy

As mentioned earlier, dashboards are commonly used in the business sector [18]. However, using dashboards in hospitals is still in its infancy [6]. Differences in use and potential pitfalls may exist due to the fact that hospitals have a different organization structure than a regular business company. Therefore, the organization structure of a hospital is illustrated. According to Mintzberg [15], hospitals have a structural configuration called the 'professional bureaucracy'. This configuration states that the main component in the organization structure is the operational core, in this case the doctors. The power of this group derives from two facts: their work is too complicated to be controlled by managers and there usually is a high demand for their services. Managers might not have direct control over their operational core. However, they fulfil a couple of roles that give them power within the organization. First, the dissolution of disturbances in the organizational structure. For instance the determination of which professionals perform which treatments. The strategic management will in this case rarely come up with the solution. This is rather a task for the tactical management who will negotiate a solution on behalf of the people in their department. People at tactical level are the policy makers of their department and are therefore responsible for their choices. The second important role which mainly applies to strategical management is the maintenance of contacts, being a public relations spokesman and the negotiation with external parties like the government and interest groups. It is expected from them that they convince external parties to support them both financially as morally. [15]

Mintzberg states that despite the fact that the main component of the structural configuration of a hospital is the operational core and therefore have a power position. Though this group still depends on management. Physicians often despise administrative work and would rather just perform their usual profession. The physician has two options: he can do the administrative work himself, or he can leave everything up to managers and hand in some of its decision-making power. Mintzberg concludes that the power accrues to staff that devote to administrative work. However, these people only maintain their power as long as professionals are convinced that their interests are served effectively. [15]

A condition for users to appropriately use a technology is the fact that the technology itself should work flawlessly. Potential shortcomings affect use and therefore the goal of a technology may not be reached. Therefore, technology can only be of added value in an organization if both functionality of the technology and use of the technology are correct [21]. The use of such an innovation as the Hospital Safety Dashboard intervenes at multiple levels of the organization. Therefore, different disciplines have to co-operate in order for it to become a success [22]. The professional bureaucracy is mainly suitable to produce standard output, but not suitable to easily adopt new methods. Bureaucracies are designed to provide help for current needs. It is not a structure to meet needs that have not occurred before. As long as the environment is stable, the professional democracy will not experience many complications. Dynamic circumstances call for change. New skills methods to apply those skills and creative co-operate efforts are needed of multidisciplinary teams. Due to the different power positions of different groups, it is difficult to successfully implement hospital-wide innovations. To achieve a successful implementation, all stakeholders have to see the added value of the innovation in order to co-operate well. [15]

Users

MST is divided in eight different groups which are all led by a business manager. The re are different departments within each group. The business manager is responsible for each of these departments jointly with a medical manager. This combination is called dual management. The business manager and medical manager are accountable to the Board of Directors regarding the organizational and medical overarching aspects of their department. This form of leadership is chosen so physicians have sufficient share in policy formulation within each of the departments which is supported by the theory of Mintzberg [15]. The co-operation of these stakeholders is globally displayed in Figure 4.

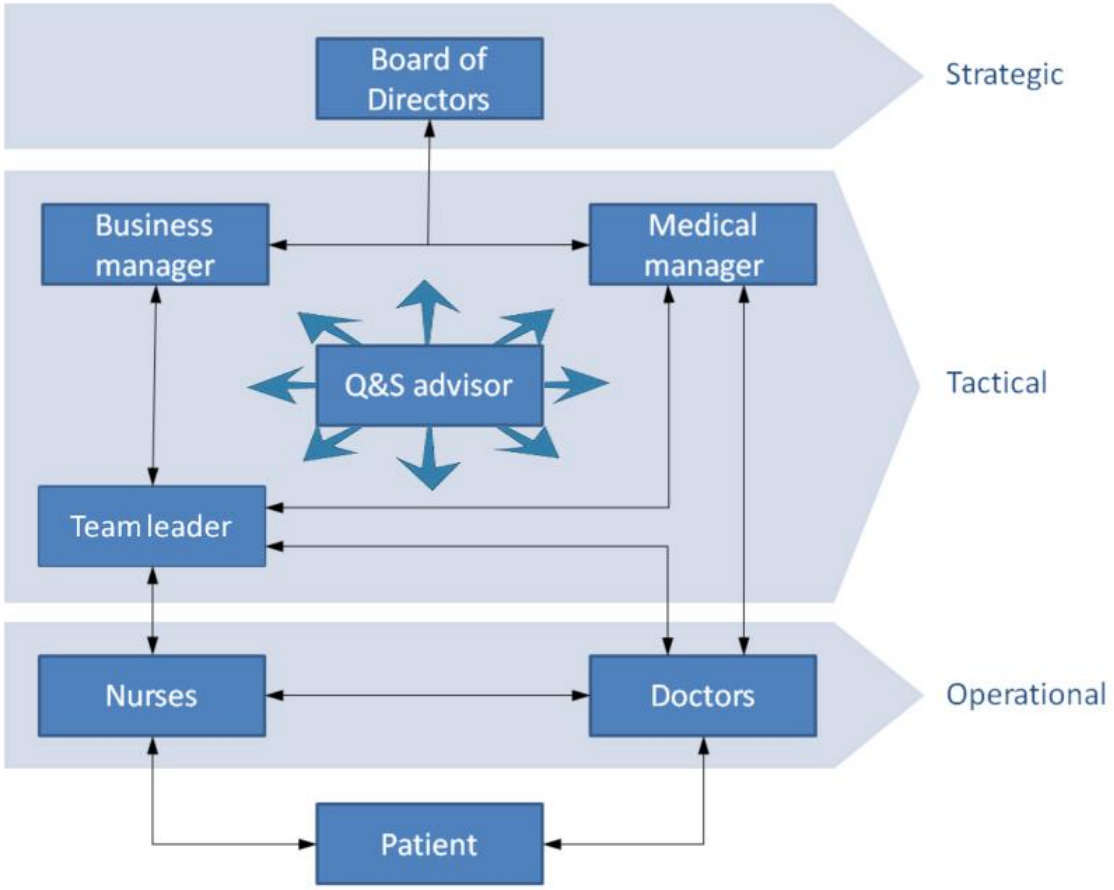

Figure 4: Role distribution

The general role distribution in the use of the dashboard is as followed (This role distribution may vary between departments since there is no generalized way of working with the dashboard):

Board of Directors

The Board of Directors use the HSD to get a hospital-wide overview of patient safety within MST. This functions to clarify to the outside world that the hospital meets a sufficient degree of patient safety and supports the priority of patient safety in MST. They also implemented the dashboard at tactical level so they can keep improved track of patient safety data and they can set up improvement measures where needed, increase safety culture and to increase awareness about the importance of patient safety.

Business manager

The business manager leads a group and its primary focus lays at the financial, staff and organizational side. This person decides on tactical and operational matters if need be and is final responsible for a group. He makes sure that quality and safety remain high on the agenda in his group. The dashboard is a tool to stimulate the safety culture within his group. In case of big changes proposed by other managers, he is the one that makes the final decision and is responsible for the consequences.

Medical manager

The medical manager oversees the implementation of the agreed policy within their department and enforces colleagues to participate. Medical managers are trained as clinician and are performing medical practitioners. They act on behalf of their colleagues in their unit as representative and participates in policy-making in his department. The primary focus of the medical manager stays on the provision of care.

Team leader

The team leader monitors, assesses, develops and improves quality and safety of patient care. Therefore, he is an important user of the dashboard. He stimulates a quality and safety-conscious culture within his department. The dashboard is one of the tools to give feedback about patient safety within his department. Naming and showing the dashboard within a department is part of creating a quality and safety-conscious culture. Because the team leader communicates within a department about patient safety, he is an important player in the use of the dashboard on tactical level.

Quality & Safety advisor

The Q&S advisor supports the management team in the use of the dashboard. This person interprets the results in the dashboard and filters the data that is not relevant for the involved managers. Examples are data where the department has little to no influence on (i.e. fall incidents of elderly in the maternity department), when data that is not subject to change or results were they doubt whether it matches with reality. This information is submitted to the relevant managers which can start tracking down the main causes why the data are subject to change. The Q&S advisor can be consulted in case of uncertainty about the realization of the results in the dashboard.

Doctors and nurses

Doctors and nurses do not have direct access to the HSD. However, they play an important role in the success of the dashboard. All of the outcomes in the dashboard are registered by them and therefore they play a crucial role in the establishment of the results in the dashboard. The se groups are also the ones who have to implement adopted care processes in case improvements can be made.

Methods

Staff at tactical level in Medisch Spectrum Twente can use the HSD to gain more insight in patient safety in their department. It is yet unknown to what extent this population use the data in the HSD to gain insight of- and improve patient safety in their department. This research aims to inform the Board of Directors about the current use of the HSD. The goal of this study is to gain knowledge and insight about how a dashboard helps staff at tactical level to improve patient safety in their department.

Research question: **To what extent can the Hospital Safety Dashboard assist staff at tactical level in Medisch Spectrum Twente to improve patient safety within their department?**

The sub questions in Table 4 have been formulated in order to give a well-reasoned answer about the main research question:

Sub question	Data collection
1. How is the dashboard being experienced at tactical level?	First set of interviews, questionnaire, second set of interviews
2. How did the introduction of the HSD influence the future use of the dashboard?	Literature research, first set of interviews, questionnaire
3. Which problems occur when staff on operational level register patient safety related data which are presented in the HSD?	First set of interviews, questionnaire, second set of interviews
4. How does the HSD correlate with elements of SMART and IMPACT in order for proper dashboard use?	Literature research, questionnaire, second set of interviews

Table 4: Data collection of the different sub-questions

Sub-question one serves to gain knowledge about the current use and experience of the dashboard and to gain insight to what extent the research population is convinced it is a lasting addition in their workflow. Sub question two to four serve to identify factors that potentially have had impact on the current use of the dashboard. The second sub-question aims to identify possible complications in the initial phase that have influenced the future use of the HSD. Sub-question three serves to gain knowledge about how the outcomes in the dashboard are established and which complications are experienced during this process. The last sub question compares the elements of Malik's SMART and IMPACT to the HSD in order to detect possible shortages and possible improvements of the dashboard. Altogether, this will give an answer how the dashboard can be used on tactical level and which improvements can be made to strengthen its functionality.

Data collection

Data sources

A literature study was carried out to explore the currently available information regarding the use of a dashboard on tactical level in hospitals. The internal database of MST was used in order to gain insight in the organization structure of the MST and to obtain more information about the HSD. Data within the HSD was used in order to be aware how different departments score regarding safety

indicators that relate to their department. In anticipation of interviews, data in the Consumer Quality Index (CQ-index) regarding patient perceived safety was studied to be aware about patients' point-of-view of patient safety in MST overall and in different departments.

Interviews (part 1)

Semi-structured qualitative interviews were conducted at two moments in time. The first set of interviews was held before carrying out the questionnaire. These included interviews with five team leaders, a quality and safety advisor and a business manager. The goal of these interviews was to explore the current use of the dashboard and which problems were encountered with the dashboard. Another target of these interviews was to gain insight in communication structures between different managers and how they share information with doctors and nurses regarding patient safety. Advisors quality and safety working at the staff service and a manager information management were spoken about the development and establishment of the dashboard.

Questionnaire

A questionnaire was composed based on information gathered from the previous phases and inspired by the four domains of the unified theory of acceptance and use of technology (perceived ease of use, perceived usefulness, subjective norm & facilitating conditions) by Venkatesh et al. [23]. The goal of this questionnaire was to assess how managers experience the HSD. This includes how much effort they put in the use of the dashboard, in what way the dashboard helps them to improve patient safety within their department and which bottlenecks exist in using the dashboard properly.

After setting up the questionnaire, the questionnaire was assessed by three team leaders in order to check it for completion and correctness. After their approval, the questionnaire was sent to the management within the different groups and departments, which include the business managers, medical managers and team leaders. The research population was approached by mail of the Board of Directors. Participants were requested to complete the questionnaire in two weeks. A reminder was sent after one week. The questionnaire was set up using LimeSurvey [24] and consisted mainly of statements. Participants indicate the extent to which they endorse statements using a 5-point Likert scale [25] (1=strongly disagree, 5= strongly agree). Beforehand, the participants were made aware of the function and importance of the results in order to enhance response. Additional written comments were encouraged.

Interviews (part 2)

The second set of semi-structured qualitative interviews was held after the questionnaire was completed. These interviews were conducted with one business manager, one medical managers, four team leaders and one quality and safety advisor and were inspired by outcomes of the questionnaire. The focus of these interviews was at the communication with the rest of the healthcare team about improvement actions, in what way the information in the dashboard is being used to identify and improve defaulting areas regarding patient safety in their department and what additional information is needed in order to steer patient safety in their department and to give feedback to operational level. Next to this, interviews were held with doctors and nurses regarding their communication with the management when it comes to patient safety and what the role of the dashboard is in this process, their registration efforts with respect to indicators projected in the

dashboard and their ideas about how these processes can be further improved. Semi-structured qualitative face-to-face interviews were conducted at a time and place which suited the participant and lasted approximately 30-45 minutes. Interviews were recorded and analysis was done by expert view.

Results

Use of the dashboard

Different approaches of use of the dashboard were mentioned by interviewees. The use of the dashboard itself, the way of giving feedback and the time spent using the dashboard varies strongly. This applies to different departments as well as different functions within a department. The following table shows how much time the different staff at tactical level who give feedback about patient safety within their group spend using the dashboard within a monthly interval:

Function	**Frequency of checking the outcomes in the HSD** *Per month*	**Average time spent on interpreting the outcomes in the HSD and giving feedback within department** *Per month in minutes*	**Percentage of managers that spend less than five minutes per month interpreting the outcomes in the HSD and giving feedback within department**
Business manager (n=6)	1,5	37,5	16,6% *(n=1)*
Medical manager (n=9)	0,78	9,0	44,4% *(n=4)*
Team leader (n=30)	1,77	32,2	30,0% *(n=9)*

Table 5: Time spent on HSD per function

Table 5 shows that the monthly frequency of use and the time spent on the dashboard for the business manager and the team leader are quite similar. However, medical managers spent significantly less time using the dashboard. Four out of nine medical managers that filled out the questionnaire indicate that they use the dashboard five or less minutes per month. Interviews confirmed that medical managers are not the primary users of the dashboard. One of them indicated: *"We discuss patient safety during our team meetings. In case I can exert influence on the matter myself, than I will do this and enforce others to do so as well. However, I myself do not look at the results in the dashboard."* This percentage is also relatively high in the team leader group with nine out of thirty persons that use the dashboard less than five minutes per month.

According to the research population, the dashboard is frequently being used in monthly recurring team meetings between the business manager, medical manager, team leader and the Q&S advisor. One of the subjects in this meeting is quality and safety. Topics that are being discussed include for instance reported incidents, CQ-index and the results of the dashboard. Improvement measures will set up in case the cause of an underperforming indicator is traced. These causes are for instance identified by observation rounds, audits or patient data research. One of the respondents mentioned the following: *"In a number of my departments improvements have been implemented in practice directly as result of the indicators. For example, administering speed of antibiotics and pain medication."*

The information within this dashboard also serves to give feedback to physicians and nurses within departments. However, it varies strongly whether doctors and nurses are familiar with the dashboard according to the research population. In some of the departments, a screenshot of the dashboard is printed and shown at a prominent place. There are also other departments who don't use this approach. Sometimes the dashboard is named during meetings with physicians and nurses,

in other cases it isn't. Therefore, it is hard to determine how physicians and nurses experience the dashboard. One of the interviewees indicated that registering information will be improved in case the dashboard is often mentioned. This creates more insight in why the registering has to be done. However, it is also mentioned that nurses and physicians see the indicators more as a target than as means to improve patient safety. Next to this is mentioned that doctors are generally sceptical. Different interviewees also indicated that the dashboard appeals little to one's imagination. *"The dashboard mainly shows numbers that creates little empathy of what actually is going on."*

Continuation

The research population was asked whether they thought the use of the dashboard will be an important part of their work in the future. This question was asked to determine if they have confidence in the use of the system. This gave the following results as can be seen in Table 6.

"The information that the dashboard provide will be an important part of my work in the future"	**Percentage**	
1. Strongly agree	6.7%	*(n=3)*
2. Agree	35.6%	*(n=16)*
3. Neutral	42.2%	*(n=19)*
4. Disagree	9.9%	*(n=4)*
5. Strongly disagree	4.4%	*(n=2)*
6. No answer	2.2%	*(n=1)*

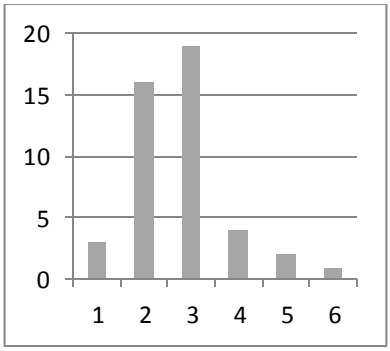

Table 6: Dashboard use in the future

The main reasons why people would did not believe the dashboard would be an important part of their work was the lack of indicators that is applicable on their department. *"I will use our own composed dashboard, and barely look at the HSD. There is only one indicator that we will adopt from the HSD."* Other people indicated that they think it will be of added value. However, certain conditions were mentioned in order for this to become reality. This mainly includes the increase of reliability of the results. One person mentioned: *"I truly believe in the added value of the dashboard. However, my department does not succeed to get the numbers to correspond with reality due to all the sub-systems that are being used. I would like to see some professionalization. The dashboard itself is a wonderful tool, but it is not always reliable and correct."* Another person stated: *"In case all results in the dashboard are reliable, I would even add the application to my 'start menu' so it automatically starts every morning when I turn on my computer. I cherish the hope that this will once be reality".*

However, people in the research population indicated that the dashboard can be a useful tool to influence patient safety in a positive way, despite the fact that some of the results are not according to reality. One person stated that patient safety is more open for discussion as a result of the dashboard. *"It's a helpful tool to make the Safety Management System themes more negotiable and therefore stimulates the safety culture in MST."* Another person mentioned that the dashboard increases awareness in nurses why certain subjects have to be registered. *"The dashboard is a possibility to give feedback to nurses in order for them to be more aware why certain subjects are registered."*

Initial phase of the HSD

The Board of Directors decided upon implementation of the dashboard in MST and stimulates the use on tactical level. When asked about the involvement of the Board of Directors regarding the goal and use of the HSD, respondents of the questionnaire quite unequivocally state that sufficient attention has been paid as can be seen in Table 7.

"The Board of Directors paid sufficient attention to the use and purpose of the HSD"	**Percentage**	
1. Strongly agree	4.4%	*(n=2)*
2. Agree	55.6%	*(n=25)*
3. Neutral	35.6%	*(n=16)*
4. Disagree	4.4%	*(n=2)*
5. Strongly disagree	0.0%	*(n=0)*
6. No answer	4.4%	*(n=2)*

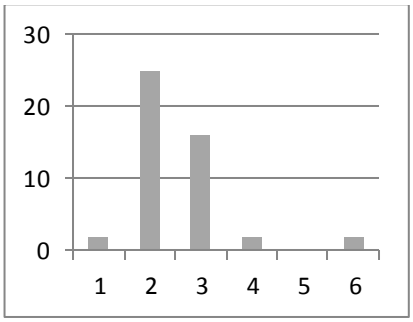

Table 7: Sufficient attention from the Board of Directors

The main goal of the dashboard according to the Board of Directors is setting up improvement measures in case indicators are underperforming. Table 8 shows that approximately two out of three respondents have the same idea of the objective of the dashboard as intended by the Board of Directors.

The main goal of the HSD in my opinion is:	**Percentage**	
Accreditation by NIAZ*	6,67%	*(n=3)*
Improving registration processes	4,44%	*(n=2)*
Hospital-wide overview of patient safety	20,00%	*(n=9)*
Setting up improvement measures at underperforming indicators	64,44%	*(n=29)*
Otherwise, namely:	4,44%	*(n=2)*

Table 8: Main goal of the HSD

**: Dutch institute for accreditation in healthcare*

The question about whether the dashboard was introduced properly gave the following answers:

"In my opinion, the introduction of the HSD went well"	**Percentage**	
1. Strongly agree	2.2%	*(n=1)*
2. Agree	35.6%	*(n=16)*
3. Neutral	33.3%	*(n=15)*
4. Disagree	24.4%	*(n=11)*
5. Strongly disagree	0.0%	*(n=0)*
6. No answer	4.4%	*(n=2)*

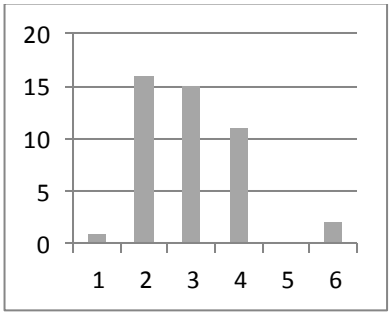

Table 9: Introduction of the HSD

Table 9 shows that opinions vary when it comes to the success of the introduction of the dashboard. It was indicated that just after implementation some deficiencies were present with respect to the results in the dashboard. *"I have heard some of it through the Q&S advisor. I know it was introduced in a short period of time and it took a while before the right data was shown in the dashboard. This certainly could have gone better"*. Another respondent stated that there was no formal introduction to the dashboard. One of the interviewees was involved in drafting the indicators of the theme

'Children'. This person claims that formulating an indicator does not happen overnight, but a lot of time has to be spent on preparing a good indicator. The HSD consists of 55 indicators divided into eleven themes. As a result of formulating all these indicators in a short time span, not all of the indicators were fully developed at the time that they were presented in the dashboard. This resulted in incorrect displayed outcomes in the dashboard in the initial phase of the dashboard. Other respondents indicate the same situation in the beginning phase of the dashboard. *"During the introduction of the dashboard, it was still in development. This meant that the dashboard wasn't functioning well in the beginning."* Another states that there existed quite a lot of imperfections and flaws at the introduction of the dashboard.

Staff on tactical level was asked whether the measuring of hospital-wide indicators using the dashboard was a step in the right direction. This gave the results shown in Table 10.

"Measuring indicators hospital-wide has proven to be a step in the right direction"	**Percentage**	
1. Strongly agree	15.6%	*(n=7)*
2. Agree	66.7%	*(n=30)*
3. Neutral	15.6%	*(n=7)*
4. Disagree	0.0%	*(n=0)*
5. Strongly disagree	2.2%	*(n=1)*
6. No answer	0.0%	*(n=0)*

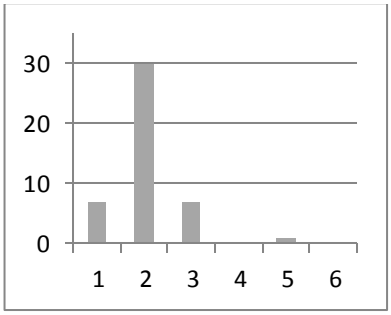

Table 10: Hospital wide measuring, a step in the right direction?

These results state that the majority of the research population agrees with the step to implement the dashboard. However, people stated that the dashboard is not performing optimal. There are still some flaws and imperfections. *"I experience difficulties when it comes to using the dashboard properly. It is a good step, now we have to decide the right direction."* The majority of the research population indicated that they feel committed to the results shown in the dashboard as can be seen in Table 11.

"I feel responsible for the results shown in the dashboard for my department"	**Percentage**	
1. Strongly agree	26.7%	(n=12)
2. Agree	46.7%	(n=21)
3. Neutral	15.6%	(n=6)
4. Disagree	2.2%	(n=1)
5. Strongly disagree	0.0%	(n=0)
6. No answer	8.9%	(n=4)

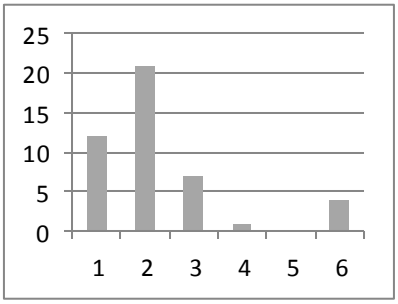

Table 11: Commitment to dashboard on tactical level

Realization of results in the HSD

There are multiple databases in which doctors and nurses register patient safety related events which are presented in the HSD. For instance, performed pain measurements are registered in 'system A' and fall incidents of patients at the age of seventy and above are registered in 'system B'. The outcomes presented in the dashboard are extracted from these databases. Therefore, registration efforts of doctors and nurses are of great importance in order to be able to use the outcomes in the HSD. *"Registering of indicators takes time and will be increasingly important, we*

have to acknowledge that this is part of our job". The people in the research population were generally satisfied when asked about the registration efforts of people in their department as can be seen in Table 12.

"People in my department register patient safety related data properly"	**Percentage**	
1. Strongly agree	11.1%	(n=5)
2. Agree	64.4%	(n=29)
3. Neutral	13.3%	(n=6)
4. Disagree	4.4%	(n=2)
5. Strongly disagree	0.0%	(n=0)
6. No answer	6.7%	(n=3)

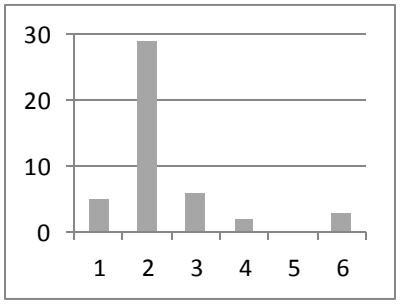

Table 12: Registration efforts of doctors and nurses

One respondent stated: "*It is difficult to determine whether registration procedures are always performed as they should be. Nevertheless, I do not have any doubts about the moral and safety-thinking of our staff"*. Although it is difficult to conclude whether registration processes are carried out as expected, there are some thresholds when it comes to register patient safety related data properly. The following obstacles were mentioned:

- Registration in different systems. Multiple systems have to be used to register data of different indicators;
- Double registration. In some cases multiple systems have to be used to register data that also has to be registered elsewhere;
- Slow operating systems;
- System failures. Sometimes, the registration has been carried out but has not been saved.

People who filled out the questionnaire were asked whether the time that it costs to register patient safety related issues goes at the expense of their work directly related to the patient. Table 12 shows the result of this question.

"The time people in my department spent on registering patient safety-related issues goes at the expense of their work directly related to the patient"	**Percentage**	
1. Strongly agree	20.0%	*(n=9)*
2. Agree	33.3%	*(n=15)*
3. Neutral	17.8%	*(n=8)*
4. Disagree	17.8%	*(n=8)*
5. Strongly disagree	6.7%	*(n=3)*
6. No answer	4.4%	*(n=2)*

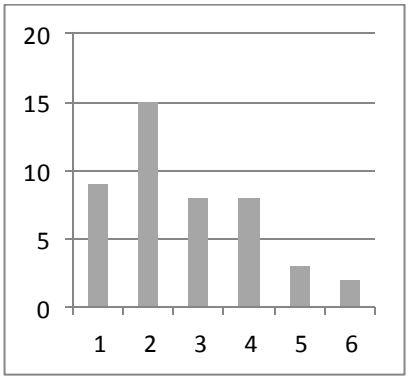

Table 13: Time spent on registration process

Table 13 shows that the majority of the respondents indicate that the registering process is too time-consuming. *"Unfortunately, the (double) registering in our extensive IT landscape has gone too far in the eyes of some employees. It is certainly true that there is less attention for the patient. The work behind the computers costs too much time, what goes at the expense of care. This unfortunately has been confirmed by personal observations"*. Another person indicated: *"Registering is necessary in*

order to gain insight. However, the time investment is not always in relation with what is done with the outcomes. As a result, some employees experience a lack of support to register properly."

SMART

Synergetic

With synergetic is meant that the dashboard is ergonomically and visually effective in a single screen display [18]. In the questionnaire was asked whether the indicators within the dashboard were clearly displayed. The answers of this question are visible in Table 14.

"In my opinion, the indicators in the HSD are clearly displayed"	**Percentage**	
1. Strongly agree	6.7%	*(n=3)*
2. Agree	57.8%	*(n=26)*
3. Neutral	24.4%	*(n=11)*
4. Disagree	8.9%	*(n=4)*
5. Strongly disagree	0.0%	*(n=0)*
6. No answer	2.2%	*(n=1)*

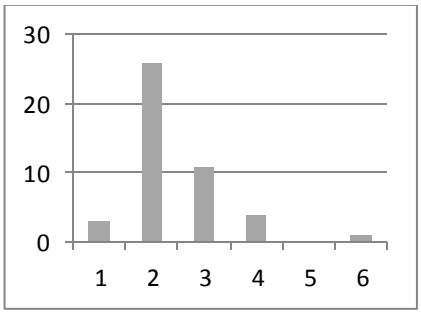

Table 14: Clear overview of indicators

The overview of indicators is presented clearly according to the majority of the research population. However, there are people who use the dashboard overview to give feedback within their department by presenting a print of the dashboard. Some of them indicate that the outcomes can be interpreted by them, but it triggers little imagination to people on operational level. Therefore, it varies between tactical and operational level whether this overview is clearly displayed.

Next to the clear display, the dashboard should be ergonomically effective which means that navigating to the right information in the dashboard should be simple. The answers to the question whether this was the case are shown in Table 15.

"When using the HSD, I can navigate quickly to the information which I'm looking for"	**Percentage**	
1. Strongly agree	0.0%	*(n=0)*
2. Agree	24.4%	*(n=11)*
3. Neutral	42.2%	*(n=19)*
4. Disagree	28.9%	*(n=13)*
5. Strongly disagree	0.0%	*(n=0)*
6. No answer	4.4%	*(n=2)*

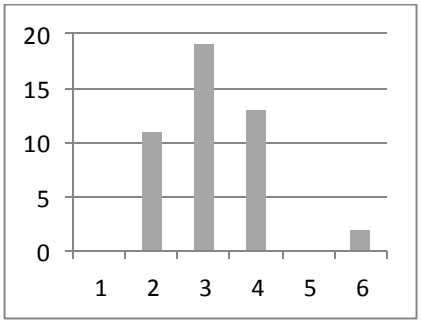

Table 15: Navigating in the HSD

The opinions whether navigating in the dashboard is easy vary between the respondents of the questionnaire. Some say it is *"Less effective as it could be"* or *"Chaotic"*. Another person indicated that the system works slow and is not always filled with information. Positive points about navigating in the dashboard were not encountered. However, the number of people that agree and disagree are quite similar.

Monitor KPIs

The KPIs shown in the dashboard required for effective decision making should be presented for the domain it is being used [18]. The dashboard shows all 55 indicators spread across the eleven safety themes. Different departments influence different indicators. This causes a variety of use between different departments. It is indicated from in different departments that additional indicators are used next to the dashboard. These indicators cannot be seen in/added to the dashboard.

Accurate

Accuracy is one of the fundamental characteristics of a dashboard [18]. The outcomes in the dashboard have to give an indication of reality in order for the management to be able to improve patient safety within their department. Table 16 shows that not everyone in the research population believes that the dashboard gives an overview according to reality.

"In my opinion, the results of the indicators shown in the HSD correspond well with reality"	**Percentage**	
1. Strongly agree	2.2%	*(n=1)*
2. Agree	35.6%	*(n=16)*
3. Neutral	35.6%	*(n=16)*
4. Disagree	15.6%	*(n=7)*
5. Strongly disagree	6.7%	*(n=3)*
6. No answer	4.4%	*(n=2)*

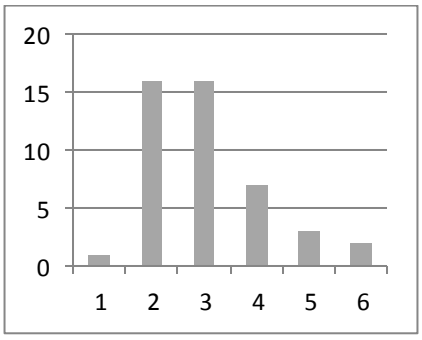

Table 16: Results of indicators in comparison with reality

One person indicated that results shouldn't have to be exactly like reality. "*Results do not exactly have to correspond with reality, that's why it is called an indicator. But some of the indicators (e.g. medication verification) are so poorly developed, it is impossible to infer anything."* Next to underdeveloped indicators it can be the case that indicators are not well defined for certain patient groups. An example from the first-aid department: *"I cannot perform a pain score in patients which are under the influence of GHB."* (GHB is a powerful synthetic drug that has euphoric and sedative effects) Another example is that some personnel refuse to perform certain measurements. An example at the gynaecology department: *"I won't perform a pain score at a woman who is in labour".* Another respondent indicated that he has chosen to not use the dashboard at all due to the lack of reliability. *"Because the data in the dashboard is not 100% reliable, it does not work as it should/could work. I do not use it because I do not trust the numbers"*. Someone else states: *"The system itself works fine, but there is little utility left if data are not correct. Possibility exists that you steer in the wrong direction, because the data is incorrect"*. However, it is difficult to determine whether indicators correspond to reality. People in the research population compare data in the HSD with their own department data to see whether it corresponds to reality or not.

Another respondent indicated that he didn't show the results of the indicators in his department of which he was convinced they were incorrect. *"This only confuses employees and this goes at the expense of the overall reliability of the dashboard."* Therefore, he suggested that in case it is obvious an indicator does not correspond with reality, it should not be shown in the dashboard at all.

Responsive

Malik states that a dashboard should have the feature to get user-alerts in case an indicator exceeds a certain threshold [18]. This is currently not available in the HSD. No recommendation was done to add such a feature to the dashboard in the research population

Timely

The information presented in the dashboard should be up-to-date to guarantee effective decision-making [18]. The information in the dashboard is real-time being imported from the different databases. Therefore, the HSD meets this demand.

IMPACT

Interactive

The dashboard should allow the user to drill down to get details, root causes, and more [18]. The goal of the HSD is to keep track of patient safety and improve patient safety where possible. Therefore, sufficient information must be available to steer indicators and therefore patient safety. Whether this is the case according to the research population is shown in Table 17.

"In my opinion, there is sufficient information available for each indicator in order for me to properly deal with an underperforming indicator"	**Percentage**	
1. Strongly agree	0.0%	*(n=0)*
2. Agree	26.7%	*(n=12)*
3. Neutral	33.3%	*(n=15)*
4. Disagree	28.9%	*(n=13)*
5. Strongly disagree	6.7%	*(n=3)*
6. No answer	4.4%	*(n=2)*

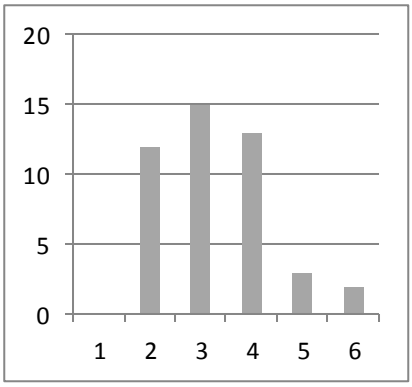

Table 17: sufficient information to steer

There exists a variety of opinions on this matter. *"Question is, what is sufficient information? It gives outline information that is sufficient to discuss it, but it does not give all information to make adjustments where needed. Other analysis have to be done in order to deal with an underperforming indicator"*. More people indicated that additional detailed information is necessary to determine the actual cause of an underperforming indicator. *"There should be an option to zoom on patient level so research can be done concerning anomalies in files of patients."* And *"Professionals can be better informed about potential flaws in case more detailed information is available in the dashboard."*

Often, observation rounds and department-specific data are used to look in-depth to determine the reason why an indicator is underperforming. Sometimes this is in addition to the dashboard and sometimes the entire dashboard is not being used because some people rely more on their own generated data to get clues for research and improvement.

More data history

Historical trends for a given indicator should be present [18]. A historical trend of the indicator with hospital-wide input is available as well as the historical trend per indicator per department. Not much was mentioned during interviews and in the questionnaire about this particular point. However, someone mentioned that the hospital wide overview includes all data of the current calendar year. *"The dashboard gives a cumulative overview of indicators across MST starting at January. In case an indicator scores poorly over a span of two months, the outcomes of indicators remain the rest of the year distorted."* In other words, an indicator may currently score appropriate, this will however be shown otherwise in the dashboard overview.

Personalized

The visibility of KPIs should specifically be for each users' domain of responsibility, privileges, data restrictions and so on [18]. The dashboard was initiated by the Board of Directors to clarify to external parties that the hospital meets a sufficient degree of patient safety. This is reflected in the first overview of the HSD. All indicators spread across the different safety themes are displayed. Someone in the research population indicated the following: *"The first screen visible is the MST overview of all indicators. Most departments only use a selection of the presented indicators. In order to increase ease of use, it could be helpful if one could select indicators which apply to their department."* Different departments have different indicators which are applicable on them. The lung department for instance has about twenty indicators, while gynaecology only has about five. This has as result that the use of the dashboard is not equally relevant for all departments.

Analytical

The dashboard should allow to perform a guided analysis such as a what-if analysis [18]. The people in the research population were asked whether the PDCA cycle could be properly executed. This gave the outcomes shown in Table 18.

"The PDCA cycle can properly be executed with the information in the dashboard with the aim to improve the outcomes of indicators"	**Percentage**	
1. Strongly agree	6.7%	*(n=3)*
2. Agree	46.7%	*(n=21)*
3. Neutral	22.2%	*(n=10)*
4. Disagree	17.8%	*(n=8)*
5. Strongly disagree	4.4%	*(n=2)*
6. No answer	2.2%	*(n=1)*

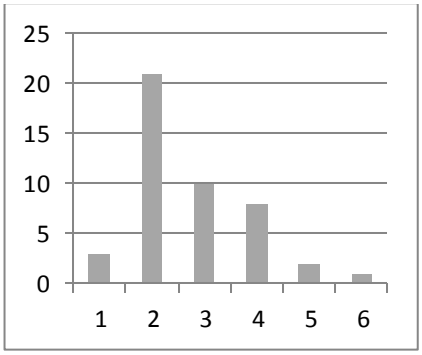

Table 18: Execution of the PDCA cycle

Generally spoken, it seems to be the case that the PDCA cycle can be performed quite well. However, answers to this question often came with conditions. *"This can properly be executed in case the dashboard is further optimized."* It is also indicated that all of the data in the dashboard has to be accurate before this can properly be done. Someone else mentioned: *"The outcomes of the indicators can be improved, but does that really say something about the process and about the correctness of measuring?"*

To be able to perform the 'Plan'-phase of the PDCA cycle, the cause of an underperforming indicator has to be known in combination with the measure which has to take place to improve the indicator. "*It differs per indicator whether the underlying cause of the underperforming indicator can be detected."* It is also mentioned that tracing the cause of an underperforming indicator costs a lot of time. *"Tracing costs a lot of time and it requires access to different applications, it should be able to do this much more effective".* It is further mentioned that the cause cannot easily be determined. *"Often, you have to go 'deep' to find out why an indicator is performing worse. This frequently means that you have to look on operational level to find out the cause."* In short, detecting the underlying cause and coming up with an improvement action can be executed quite well, but this differs per indicator whether this can be done or not.

One of the respondents mentioned an additional feature that could help in the ´Check´-phase of the PDCA-cycle. *"Improvement measures that have been deployed to improve the outcome of an indicator cannot not be saved in the dashboard. It would be nice if this could be entered into the system so you can have a better understanding why outcomes change. In case outcomes improve drastically, these measures could maybe also be valuable for other departments."*

Collaborative

The dashboard should have the ability for users to exchanges notes regarding specific observations on their dashboards [18]. This is a feature that is not available in the dashboard. From the research population no recommendation was done to add such a feature to the dashboard.

Trackability

The user should have the ability to customize the metrics he or she would like to track [18]. Again, the dashboard does not have this feature. However, from the research population the question arose to implement this option. "*It would be nice if there was MST- broad software to create your own software to build your own dashboard which is formed using MST data systems. The aim should be to get as much insight in patient safety as possible with minimal effort. This way the dashboard will be effective for everyone who wants to make use of it. Including outpatient clinics who currently do not use any of the indicators displayed in the dashboard."*

Discussion

This research was carried out in response to the lack of knowledge about the use of a quality dashboard on tactical level in hospitals. Semi-structured qualitative interviews and a questionnaire were conducted in an effort to determine current use, existing flaws and potential improvements. The questionnaire was conducted with the aim to include as much stakeholders as possible and to involve a sufficient extent, whereas the interviews served to gain more in-depth information about the dashboard. The literature study showed that a dashboard has four main functions: monitoring, analysing, managing and giving feedback [16]. Research showed that the dashboard mainly serves for monitoring results in the dashboard. Monitoring using the dashboard can be adequately done in case results are accurate. However, other analyses, for instance observation rounds or patient data research, have to be done to induce investigation and set up improvement actions. The main function of the dashboard related to managing improvement actions are the displayed trends of indicators to detect possible improvement or decrease in outcomes. Outcomes of indicators in the dashboard can be used to give feedback to operational level about the current status of patient safety in their department. However, directly using the dashboard display as manner of feedback creates little affinity towards the dashboard at operational level. The majority of the respondents think they will (continue to) use the dashboard in the future. However, conditions are that the numbers in the dashboard are accurate and the person in question has to have enough applicable indicators in his or her opinion.

Mintzberg states that all stakeholders have to see the added value of an innovation in order for proper use [15]. The majority states that measuring indicators using the dashboard is a step in the right direction and staff at tactical level generally feels responsible for the shown outcomes. However, dashboard-use by medical managers, who are performing medical practitioners, is significantly lower than other users. This can be explained by the power position of the medical manager according to Mintzberg [15]. However, under-use of the dashboard exists through the whole research population.

A possibility of under-use of the dashboard may be due to the fact that not all basic elements of SMART and IMPACT are fulfilled. Accuracy of the results seems to be in need of improvement. Three possible options exist which may cause this inaccuracy: failing registration efforts on operational level, underdeveloped indicators, or the dashboard fails to import the correct data from the different databases. Registration systems on operational level possibly influence the accuracy of the outcomes in the dashboard display. This can be a consequence of the fact that there exist multiple systems in which doctors and nurses register patient safety related events. Sometimes the same data has to be registered in more than one system. Systems are claimed to be slow and are known to have failures. Consequences could be that data are not saved, or personnel is reluctant to register data due to the time consuming effort. This will eventually affect the outcomes of the indicators. Another cause of inaccuracy are underdeveloped indicators due to inadequate framing of the right data. These already existed in the initial phase of the dashboard. This may be due to introducing the dashboard in a short time-span at the moment improvements were necessary when MST came under increased surveillance of the IGZ. Consequence may be that this caused distrust in the functionality of the dashboard and therefore influenced the current use of the system. Other causes of inaccuracy may be that indicators are underdeveloped because they are not well-defined for certain patient groups. This can cause that certain departments cannot register data properly, while other departments can accurately register this data.

In case the outcomes are accurate, the dashboard outcomes give enough information to discuss patient safety, but not enough to make adjustments. More detailed information is needed, and therefore other analyses are done to improve outcomes. This causes that the dashboard mainly functions for identifications of flaws concerning patient safety within the safety themes. According to the research population, the results have to be more accurate and the ability to zoom in on patient level should be available. The ability to drill down on patient level is not available. However, this ability is recommended by literate [18]. This can be a feature of added value. Though, this can make the dashboard extremely complex and composing this feature will take a lot of time and will be hard to implement in the current dashboard. Nevertheless, this could possibly help detect certain patient groups that potentially cause the deviation in outcomes.

Variation exists between departments whether data in the dashboard is used as a method of giving feedback to operational staff. Therefore, not all physicians and nurses are aware of the existence of the dashboard. It was mentioned that showing the dashboard results in a department creates little affinity towards the dashboard by employees, so they are up to date about the current situation. Next to this, it was mentioned that doctors are generally sceptical which is common when it comes to implementing health IT in hospitals [26]. A multidisciplinary approach on tactical and operational level is needed to be able to use the dashboard for giving feedback about patient safety. According to Mintzberg, one of the most important aspects of innovation in health care is the fact that stakeholders should be convinced the innovation is of added value [15]. Operational level seems to be reluctant when it comes to receiving feedback directly from the dashboard because the information in the dashboard does not trigger the imagination. The following three options could create more affinity towards the dashboard at operational level. The first is an alternate way of giving feedback, which results in an easier way of interpretation of the results. A fast and easy interpretable presentation of the current situation of indicators creates more affinity towards the dashboard and therefore employees will be better aware of patient safety within their department. The second option is to increase awareness of the importance of patient safety in MST. This potentially stimulates registration efforts of operational staff due to the increased knowledge of the goal and possible improvements of patient safety. A third option could be to emphasize on possible consequences in case outcomes of indicators do not meet the norm. For instance, the credibility of patient safety towards third parties. These options possibly increase the belief that the dashboard is of added value at operational level. And therefore feel more involved in patient safety. However, changing the workflow or mind-set on operational level will stay difficult to accomplish due to the power positions at this level. Mintzberg states that changes are not made by government regulations or directors that proclaim major changes, but changes are mainly realized due to slowly changing professionals on operational level. These will be the result by custom admission of employees, the curriculum of professional education institutions and subsequently the willingness of professionals to keep these skills up to date [15].

This research informs about the use of a quality dashboard on tactical level in MST. These results inform the Board of Directors of MST how the dashboard currently is experienced and what can be undertaken to further improve the dashboard to make it more relevant, stimulate use and subsequently improve outcomes of indicators to increase patient safety within MST. These results cannot be generalized to each dashboard use on tactical level in hospitals due to the fact that there is not one way of using such a dashboard. Variables for instance include openness of use of a dashboard, relevance of using a dashboard and structure of the dashboard. Therefore, these results

are mainly applicable to MST. However, lessons can be learned from advantages of using a dashboard, user-experience on tactical level and factors that stimulate or discourage the use of a dashboard.

Recommendations

Put use of the dashboard on the agenda – The dashboard has to be on the agenda continuously in order to keep stimulating use of this technology [27]. This applies to the diffusion and dissemination phase [22]. It is indicated that the dashboard should once again be put on the agenda including a clear explanation why the dashboard could help improve patient safety. Literature states that the Board of Directors guards the continuation of these kinds of processes [27]. Those who have been involved in the innovation need continuing evidence that this new way of working is the better one [26]. Because the dashboard is a tool to improve patient safety, this and other instruments to improve patient safety should be continuously on the agenda so the management on tactical level stays focused on improving patient safety within their department. A proper way of keeping people engaged in the dashboard could be to keep them up-to-date about improvements or possible additions in the dashboard by mail of the Board of Directors. Another option is to share success stories about the dashboard to give new insight in the use of the dashboard by using the intranet of MST.

Stimulate registration of indicators – An important function of the dashboard on strategical level is to ensure the safeguarding of patient safety in MST towards third parties. In addition to the IGZ and NIAZ, the dashboard could also be used in negotiations with health insurers to prove that MST meets a certain standard of patient safety. This could also be a stimulus for doctors and nurses to register patient safety related data properly. In case more information is available to health insurers, it might be the case that certain treatments will no longer be reimbursed due to potential lack of safety.

Remove hospital-wide overview of indicators – The dashboard could become more user-friendly if the hospital-wide overview is removed as start screen to make it a more personalized dashboard. Increased user-friendliness stimulates use of the IT system [28]. The cumulative hospital-wide scores are not relevant on tactical level, but especially useful at strategic level. Literature supports that indicators which cannot be influenced by the user should not be shown [18]. People at tactical level should directly see the indicators they influence and their non-cumulative corresponding monthly outcomes. Furthermore, it is easier to present the results of indicators to personnel on operational level this way. Next to this, departments also use their own indicators to gain insight into patient safety within their department. A possible pitfall when only using the indicators of the SMS themes in the dashboard is tunnel vision [9]. The risk exists that people will focus on the indicators in the dashboard while other indicators may be lost from sight. Therefore, it might be a valuable addition to add department-specific indicators into department-specific dashboards. This will give a clear view of patient safety level per department.

Implement messaging system in dashboard – The dashboard could be optimized by adding the functionality to send messages to different stakeholders of the dashboard. For instance, alerts can be send to people within ones department to keep people posted, executed tasks related to improvement of indicators could be messaged to keep people up to date, and successful improvement actions can be send to other departments who may struggle with similar problems.

Limitations

Results of this research are based on opinions of people in the research population. Therefore, these results are open for discussion and results depend on questionnaire respondents and interviewees. User-experience was hard to determine due to the fact that the relevance of the dashboard differs within departments. A distinction in interviews was made between departments who influenced many indicators and departments with influence on a small amount of indicators.

At tactical level, eight team heads, two Q&S advisors, one medical manager and one business manager have been interviewed to acquire results for this research. Scheduling interviews with medical managers and business managers was rather hard. This was due to the fact that most medical managers beforehand indicated that they did not use the dashboard and thought the interview would not be worth their time. Interviewing business managers was difficult because there are seven business managers that use the dashboard. Six of them did not have time for an interview or did not respond to their mail. A questionnaire was set up to tackle this problem. This way the entire target population could be reached, and therefore be able to give their opinion and feedback about the dashboard.

The success factors of a dashboard are derived from operational dashboard-use in the business sector due to the lack of available literature of dashboard-use in healthcare. It is assumed that most of these success-factors are similar. Consequences could be that success factors have been overlooked or certain success factors could be less applicable in the health-care sector.

The percentage of team leaders that do not use the dashboard for more than five minutes per month is relatively high. This can be explained by the fact that the questionnaire was sent to all team leaders working at MST because it was not known which team leaders use the dashboard, and which do not. People working at outpatient departments have little to do with the dashboard, but some of them filled out the questionnaire, which could have led to bias in the results.

Q&S advisors are not part of the respondents of the questionnaire. On the first hand, the selection criteria for the respondents of the questionnaire was every person that uses the dashboard to give feedback within their department. Therefore, the Q&S advisor was not part of the research population. However, it was found that the Q&S advisor plays an important role in the feedback process. Two interviews were held with Q&S advisors. However, the extra feedback in the questionnaire could have been a useful addition to the results of this research.

Future research

A suggestion for further research is to determine in what way the executive staff experiences feedback with respect to patient safety in MST. Executive staff has to feel involved in patient safety within their department in order to improve it. From the management on tactical level arose the need to be able to give structural feedback within the department with information that is easy interpretable on operational level. The dashboard provides in the opportunity to give structural feedback, but it takes time to interpret the information and is difficult for doctors and nurses to quickly grasp what the information means. This information has to appeal to the imagination. For instance, this can be done using coloured posters where underperforming indicators are shown red with a sad face next to it. This method is currently being used by someone in the research

population. Hypothesis is that this method may improve the drive for nurses and doctors to get rid of the red posters and therefore improve patient safety.

Conclusion

This research has aimed to determine how the Hospital Safety Dashboard can assist staff at tactical level in Medisch Spectrum Twente to improve patient safety within their department. It has turned out that the use of the dashboard varies in between different departments as well as between different members of staff on tactical level. A combination of sufficient relevant indicators in his or her opinion that apply on one's department, and the belief that the outcomes of indicators are correct must be in order for personnel on tactical level to be able to improve outcomes of indicators in the dashboard.

The dashboard was introduced in a short time-span which resulted in imperfections and flaws in the initial phase. Despite this, the staff sees the potential added value of the dashboard and feel committed to the results that are shown for their department. However, the flaws and imperfections in the initial phase of the implementation are not all solved. Therefore, the dashboard needs professionalization in order to increase usage.

The dashboard improves patient safety by stimulating the safety culture in MST. The dashboard makes the safety themes of the SMS better negotiable and increases the openness for discussion. Next to this, it enables to give better insight for staff at operational level about why registering has to be done. Given that the results are correct, the dashboard shows underperforming indicators and can therefore properly function to identify areas of improvement. However, this info is not sufficient to determine the underlying cause of such an indicator. Additional information is needed to be able to set up improvement measures in order to improve outcomes of indicators. When further improvements have been done, the dashboard shows great potential to become a standardized tool to improve patient safety.

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