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# Business intelligence dashboards facilitating nursing management practices: An Australian local health district qualitative study

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## ABSTRACT

**Objective:** To reflect upon the potential of digital processing of Business Intelligence (BI) to facilitate nurse management practices across operational, financial and workforce areas. That is, beyond the usual safety and quality monitoring and improvement.

**Background:** Nurse managers are responsible for nursing service delivery within their unit/division/directorate(s), taking a crucial role in the accountability of the functioning of the health system. While use of nursing dashboards as BI supports safety and quality nursing management practices, there is a need to understand BI's potential to enable nursing practices to broader nursing management, such as financial and workforce areas.

**Study design and methods:** This study followed the Consolidated Criteria for Reporting Qualitative Research (COREQ) checklist. In this qualitative research, in August 2022, four nurse (unit) managers and two nurse leaders, with years of work experience ranging between 2 and 18 years, participated in one-on-one semi-structured interviews. Interview participants shared their experience of BI implementation in operational, financial, and workforce areas of nursing management. The participants were purposively selected from the medical and surgery units in two hospitals: a major metropolitan hospital and another, a principal tertiary referral hospital.

**Results:** Thematic analysis, following an inductive analysis of the interview data, generated two overarching themes. One, BI contributing to enabling of nursing management and two, BI requiring continuous improvement.

**Discussion:** Nursing dashboard implementation as BI in operations, finance and workforce areas provided efficient and timely access to consolidated, visually meaningful, and relevant data. The dashboard showed potential for supporting nursing management practices, such as proactive data analysis, data-informed work conversations with staff, and better decision-making in areas such as budgeting, staffing and patient flow management. However, the implementation of BI needs to be a continuous improvement process, with greater focus on educating and collaborating with end-users. The study implies nursing dashboards should be implemented with metrics of broader nursing management practices in alignment with the needs of the end-users and the relevant health system.

**Conclusion:** There is a case for using BI in work areas beyond safety and quality to support nurses in broader nursing management practices. Future studies exploring nurses' long-term experiences with BI and co-designing with end-users of BI would be beneficial to facilitating nursing management practices.

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**What is already known about the topic?**

Nurse managers are accountable for the functioning of the health system across a wide spectrum of work areas, for example, consumer-centred care, financial issues, team performance management, and the well-being of staff.

Use of BI, particularly dashboards on safety and quality, has been demonstrated to enable effective nursing management through presentation of timely, relevant, and consolidated data.

As BI in health organisations rarely cover work areas beyond safety and quality, for example, finance, people, and culture; there is limited understanding of BI's potential to support nurses towards broader nursing management practices.

**What this paper adds**

- The qualitative study provided empirical evidence of how utilisation of BI in work areas beyond safety and quality, that is, finance, operational and workforce management, can facilitate nurses for better work rapport and higher-level decision making.
- Nurse managers' experience with dashboards highlights that BI implementation in broader nursing management practices needs to be more end-user centred and a continuous improvement process.
- Greater support to nurses is possible if health organisations implement BI with a robust feedback process and ongoing education packages to address the needs of the end users.

**Keywords:** Nursing Dashboard; Nursing Business Intelligence; Nurse Management Strengthening; Business Intelligence Implementation

**BACKGROUND**

Nurse managers are responsible for the nursing service delivery within their unit, division, or directorate. This includes managing elements of high-quality consumer-centred care, service operational flow, financial issues, and the team's performance, development, and well-being.<sup>1-4</sup> As nursing managers hold such broad accountability in the functioning of the health system, it is critical to always look for opportunities to facilitate them with data-driven decision-making and support nursing management practices.

Globally and in Australia, aligned with strategies at the state and national levels of health systems, the premise is that strengthening nursing management practices should involve access to digital health technologies and data-informed innovative responses.<sup>5-8,9-10</sup> Data-informed approaches will facilitate nursing care to support the delivery of connected and quality care.<sup>9-10</sup> Current nursing care issues, including management of patient risks and safety, information across the patient journey, and staffing and nursing workload distribution, elevate the need for relevant, timely and accurate digitised information.<sup>14,11-13</sup> Digitised health information now needs to be easily accessible, coherently presented, and interactive, to facilitate information literacy and evidence-based decision making in nursing management.<sup>14-15</sup>

Business intelligence (BI), a digital health solution, uses integrated technologies to apply technological processes to capture, manage, and analyse data from multiple data sources into meaningful insights for business strategies and operations, primarily through interactive dashboards and reports.<sup>11-12,19</sup> Within healthcare systems, BI has become an

increasingly important capability to support data-driven decision making, performance monitoring, and workforce management amid growing service demand, workforce pressures, and expectations for quality and safety.<sup>11-12,16-18</sup>

BI in nursing, delivered through nursing dashboards, enables managers to monitor performance, identify trends, and drive quality and safety improvements in patient care.<sup>11-12,15,20-21</sup> Nursing dashboards visually consolidate key clinical and operational data such as safety indicators, patient acuity, and workload, providing nurse managers with timely insights to support informed decision-making and quality improvement.<sup>11-12,20-21</sup> Nursing dashboards have improved patient outcomes by consolidating performance trends about patient care and usage of resources in a visually meaningful way.<sup>11-12,20-21</sup> Dashboards have enabled nurses to track evidence of the impact of their work and areas of improvement in safety and quality.<sup>3,11-12,20-21</sup> Additionally, a dashboard can be an avenue for nurses to move away from less efficient disparate reporting systems and extraneous hard copy reports.<sup>3,20-21</sup>

However, the use of dashboards is still facing challenges in areas of end-user satisfaction, development of design and content of dashboards, and dashboard integration with other legacy systems in health organisations.<sup>15,22</sup> These challenges have complex components and cannot be resolved with standardised solutions, as dashboards are developed to address context-specific needs of management of care.<sup>15</sup> A key issue here is understanding the end-user experiences of what works and does not work with dashboards in various contexts.<sup>15,23</sup>

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Currently, within Australia and internationally, the application of BI in nursing, including the use of nursing dashboards, is typically centred on safety, quality, and operational metrics rather than providing a truly holistic view of nurse management practice.<sup>1,4,11-13,24</sup> BI often does not cover broader nursing management responsibilities, especially a combination of people and culture, finance, and operational management with patient flow. Whereas these areas fall within the accountability of nurses for consumer-centred care, financial viability of the service unit and the nursing team's wellbeing and development.<sup>1,3-4</sup> Moreover, nurses relying on dashboards for management of quality improvement initiatives could miss the required holistic perspective if people, finance, and patient flow information are not covered.<sup>15,25</sup> Hence, there is a limited understanding of BI's potential to be responsive to support nurses with broader nursing management practices.<sup>6,14,26</sup>

Addressing the above issues, this research has investigated how the implementation of BI influenced work practices and experience of nurse leaders and managers, in the context of a Nursing Dashboard rolled out in April 2022 at an NSW Health Local Health District (LHD). The LHD developed the dashboard internally as a quality improvement project, aiming to facilitate nursing management through relevant, accessible, and understandable metrics into a consolidated platform. Nurse management initially identified the need for a centrally accessible dashboard that could deliver timely nursing management information through an efficient and streamlined process. This qualitative study focuses on the use of dashboard metrics in operational, financial, and workforce areas, rather than the well-researched area of safety and quality.<sup>11</sup>

## METHOD

A qualitative phenomenological approach has been applied to conduct this research.<sup>27</sup>

## SETTING

The research setting is a single NSW Health Local Health District, confined to the surgery and medicine division wards/units at two hospitals. As medical and surgical nurses have significant accountabilities towards patient flow, particularly through their role in facilitating timely and safe discharges, the selection of the chosen wards is rational. Out of the two selected hospitals, one was a major metropolitan hospital and the other a principal tertiary referral hospital. At the time of the study, the dashboard had been available for six months, and the principal tertiary referral hospital recorded 50% fewer dashboard user sessions at the chosen wards. Inclusion of two different types of hospitals allowed the study to understand the use of dashboard across different facility-level cultures and priorities that influence nursing practices in association with BI.<sup>28-30</sup>

## BI DASHBOARD & METRICS

This study focuses on nurse managers' use of a locally designed nursing dashboard that integrates operational, financial, and workforce metrics. The aim of the dashboard is to better support and facilitate nursing management decision-making through the provision of relevant, accessible, and accurate information. The dashboard, developed in QlikView's 2022 platform, an analytics solution offered by Qlik, consolidated multiple disparate reporting systems into a single access point. In this dashboard, reporting of the data comes from source systems following appropriate extraction processes to ensure accuracy of the data. Due to the extraction process check built into the system, the dashboard faces a slight delay in reporting the metrics from the source. Finance and operations metrics are updated daily, and workforce metrics are updated fortnightly as per the payroll cycle.

The metrics to be reported in the dashboard were identified through consultations with nurse management, operations, finance, and workforce departments. The operational metrics included 'Discharge before noon' or 'Discharge via Transit Lounge' and 'Emergency Treatment Performance' data, promoting patient flow. Financial metrics covered data about budgets, actuals and variances, private elections, and excess leave. Finally, the workforce metrics included leave utilisation, performance development review rates, and health training courses needing completion data.

## PARTICIPANTS

The study participants are nurse unit managers (NUMs) and nurse leaders (NL). NUMs report to the NL, a senior nursing manager with higher classifications and responsibilities. Both NUMs and NLs are the primary end-users of the Nursing Dashboard at hospitals, needing to access nursing management information according to their roles and accountabilities.<sup>1,20</sup>

Participants were purposely recruited, following the inclusion criteria of nurses who were in the NUM or NL role, with a minimum of 4-5 months' experience with the BI at the study organisation. All prospective participants were contacted by email by the first author, a male health professional who was also an officer in the BI project at the study organisation. The participant information sheet clearly stated that this research was conducted with the second author, who is an expert health management researcher and academic at a university in Australia. All contacted participants participated in the study and did not report any bias. The number of participants was guided by voluntary responses from invited nurses according to the consent process in the approved study protocol by the LHD Human Research Ethics Committee (Approval "2022/ETH00987" with site approvals "2022/STEO1738" and "2022/STEO1739"). Therefore, the participant recruitment process

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was not influenced by the objective of data saturation, that is, recruiting interviews till no new data are generated.<sup>31</sup> As Table 1 shows, the cohort of participants came from the selected two hospitals of the study organisation, reflecting varying nursing management positions and years of work experience.

TABLE 1. COHORT OF PARTICIPANTS

Identifier	Hospital Type	Position	Nursing Management Experience (Years)
NUM1	Tertiary – Referral	NUM	12
NUM2	Tertiary – Referral	NUM	2
NL1	Tertiary – Referral	NL	15
NUM3	Metropolitan	NUM	18
NUM4	Metropolitan	NUM	8
NL2	Metropolitan	NL	14

## METHODOLOGY &amp; ANALYSIS

In August 2022, six one-hour one-on-one semi-structured interviews were conducted, with the interviewee at locations without privacy concerns, through either Microsoft Teams videoconferencing platform or face-to-face, based on participants' preferences. The overarching interview question was "how nurse managers perceive the utilisation of BI had influenced their practice". The interviewees were interviewed only once in a semi-structured format, following an interview guide that allowed inclusion of refined probing questions based on participants' responses.<sup>26,32–33</sup>

As per the approved protocol, the interviews were audio-recorded and transcribed. The authors had confirmed the transcribed content against the audio recording. Moreover, transcripts were emailed back to the respondents for review and feedback, but no amendments to the transcripts were suggested or made. The transcribed data were then subjected to thematic analysis, following an inductive approach, where themes were identified from the data. The first author had manually conducted the theme development, while the second author reviewed and validated the process. This was a non-linear process, with the first author identifying, analysing, and organising codes through quotations in the transcripts and finally, drawing the preliminary themes from the codes.<sup>25,33</sup> The second author then independently reviewed the work of the first author and validated the preliminary themes against the transcript data. For example, the second author suggested merging multiple codes to support a more stable theme about BI's contribution to nursing management processes. Decisions on such suggestions were resolved in agreement between the two authors. Hence, the independent and then collective data analyses of the two authors, where the first author is an insider researcher, ensured a credible and non-biased theme development from the research data.<sup>34</sup>

The Consolidated Criteria for Reporting Qualitative Research (COREQ) checklist was used to ensure a thorough report of the findings.<sup>35</sup>

## FINDINGS

Two overarching themes were identified following thematic analysis: 1) 'BI contributing to enabling of nursing management' and 2) 'BI implementation requiring improvement'. Table 2 shows how these themes were supported by certain sub-themes.

TABLE 2. OVERVIEW OF THE THEMES AND ASSOCIATED SUB-THEMES

Themes	Sub-themes
BI contributing to enabling of nursing management	<ul style="list-style-type: none"> <li>• Efficiency in accessing information</li> <li>• Value from the use of dashboard data</li> </ul>
BI implementation requiring improvement	<ul style="list-style-type: none"> <li>• Specific BI elements needing improvement</li> <li>• Collaboration in BI implementation</li> </ul>

## BI CONTRIBUTING TO ENABLING OF NURSING MANAGEMENT

The nurse manager cohort, in comparison to the nurse leaders, were more frequent users of the dashboard. However, all the interviewees, across the two hospitals and different levels of professional roles, expressed a general sense of positive experience with access to information from the introduction of the dashboard at work.

## Efficiency in accessing information

Half of the participants described the Nursing Dashboard as a "one-stop shop" due to its consolidation and provision of operational, finance and workforce metrics. Participants recognised significant time savings as the Nursing Dashboard presented all information from different systems in one place. It enhanced the provision of information previously not accessed due to systematic or time related constrains. The following statements are reflective of their experience of how BI improved efficiency in accessing information.

"Improved my time management as a manager ... I don't like using other databases, I like just using the one" (NUM1)

"Definitely made our reviewing of operational data, staff management type data and financial data much more efficient" (NUM4)

"I wouldn't look for that information, but now it's presented here to me ... I can use that information in terms of my staffing and my rostering" (NUM2)

"I could be a more effective manager when that information is consolidated there for me so I can get things done quicker and more efficiently" (NUM2)

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Furthermore, participants recognised that the Nursing Dashboard presented relevant information in a visually meaningful manner. They stated the dashboard:

- “presented (information) in a way you know is very logical for me as a NUM” (NUM4)
- “makes it quicker to find that information and it’s much more visual” (NL1)
- “is very nursing specific” (NL1)

### Value from the use of dashboard data

The value of the dashboard to the participants depended on the content, that is, the different types of data metrics covered in the dashboard. All participants identified the workforce metrics, for example, the leave utilisation and performance development reviews, as most beneficial and relevant for staff management and development. A few NUMs also found operational metrics valuable for a better understanding of the patient flow. They reflected on such experiences of the dashboard, stating:

- “I just find it very easy to use. I like that it’s all in the one spot and you get a very quick overview of who is overdue for their PDR’s [Performance Development Reviews]” (NUM4)
- “if I got issues with patient flow, it provides me the evidence” (NUM1)

Another interesting insight from participants was that dashboard data created opportunities for proactive work conversations between nurse leaders and staff. Efficiencies gained by the dashboards’ timely and easy access to information facilitated nurses to engage in proactive work conversations. As a nurse leader stated:

- “When you’re trying to run these reports, you can’t as you’re constantly interrupted ... but if you got the dashboard, you can just open up now and look ... you can have those conversations with staff earlier” (NL2)

Nurses had also shared their experience of how the dashboard facilitated data-informed higher-level decision-making across various areas, for example, budgeting, staffing, and patient flow management. The following statements from the participants can elaborate this point:

- “to make sure that they’ve been costed properly” and “if you’re over ... how are you going to pull it back then the following month to try and keep your budget on track” (NUM4)
- “trying to work out what we could do with revenue ... and then also around being able to explain the variance” (NL2)
- “help you look retrospectively at ... what’s been happening over the last couple of weeks and ... is there anything that we could be doing to try and improve, you know, getting patients up from the emergency department or ... getting people out quicker” (NUM4)

## BI IMPLEMENTATION REQUIRING IMPROVEMENT

### Specific BI elements needing improvement

Nurses also explained how certain business intelligence (BI) elements needed improvement to ensure a better experience with the dashboard. A few nurses indicated that they faced difficulties using the dashboard data, most prominently, the financial metrics. They explained that further fine-tuning of the dashboard data content was necessary to make it understandable and suitable for the end-users’ scope of work. For instance, they stated:

- “I think a lot of the NUMs are scared of financial stuff. We’re nurses at the end of the day” (NUM1)
- “I don’t exactly know what to do with it and I don’t exactly know what it all means” (NUM2)
- “some aspects of it are outside of our control and some aspects are within our control” (NUM4)
- “I don’t look at the finance dashboard very often ... financial responsibility for me is looking at my premium Labour as well as looking at overtime” (NUM1)

Additionally, it was evident that an element of “education for end users” needed to be part of BI implementation. As the statements below indicate, such education could be about how to interpret certain dashboard data and realising the value addition of the dashboard.

- “if someone sort of sat me down and went through everything and I had a better understanding of it, then maybe I could use that information better” (NUM2)
- “I just don’t know a lot of nurse managers are aware. Probably aware of the dashboard, but don’t know the benefits ... if it’s a new NUM, it might be a bit daunting ... understanding how that is going to benefit” (NUM1)

### Collaboration in BI implementation

Both the cohort of nurse managers and nurse leaders conveyed that the dashboard design and implementation needed strong collaboration with end-users. This is to ensure regular rapport with end-users, so that information and design of BI is relevant and understandable to the nursing management. In the words of a nurse leader, this means the dashboard development team will “just need to keep collaborating with them” (NL1). In the above quotation, the words “keep collaborating” are important, as it reflected the notion of continuous collaboration between the strategic and operational views of BI throughout the BI project.

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### DISCUSSION

This research presents nurse managers' and leaders' perceptions of how a recently implemented nursing dashboard, focusing on operational, financial, and workforce areas, influenced their work in a hospital setting. Based on nurses' perception, who are the end-users of the dashboard, this study found that a nursing dashboard reporting metrics beyond the usual safety and quality areas can support nursing management practices and decision making to enhance management effectiveness. This finding expands the current literature, which has predominantly focused on reporting the usage of safety and quality dashboards in nursing.

This research explained how dashboards at the research site facilitated processes such as proactive data analysis and data-informed work conversations with staff for better decision-making in various areas, for example, staff performance management, budget variance assessment, and patient flow optimisation from the emergency department. The dashboard at the research site provided timely and relevant data, with features such as efficient access to accurate information, consolidation of data from various databases, and meaningful visual presentation of nursing-specific data as reported in the literature.<sup>12,15</sup> These findings endorse the effectiveness of dashboards for informed decision-making, enhanced data sharing, performance tracking, and communication with stakeholders.<sup>15,22</sup>

Another finding is how nursing dashboard implementation can be compromised due to inadequate focus on education of and collaboration with end-users. It was identified that a few nurses faced limited capability in utilising the recently implemented nursing dashboard. Some nurses, including new nurse managers, may not have known how to interpret the data or felt that the dashboard covered a scope beyond their work area. It is possible that nurses needed guidance to understand how different metrics were linked and interdependent within their scope of work. This resonates with the insight that dashboard implementation should be supported with continuous education and capability development initiatives for end-users in nursing management.<sup>26,36</sup> In line with previous literature, the study also highlighted that regular collaboration with end-users would be necessary to fine-tune the portfolio of metrics in a dashboard.<sup>26,37</sup>

A limitation of the research was the situational healthcare environment at the time of the research. Situational factors, including the presence of COVID-19 and the subsequent actions, for example, fluctuating number of COVID-19 cases, stoppage of elective surgery, varying patient complexity, and limited staffing levels, may have influenced the usage of the nursing dashboard. Furthermore, the availability of participants for interviews was affected by the COVID-19 environment. Despite such limitations, this study has

covered the perception of all relevant levels of end users of BI, nurse managers and leaders, as required by the aim of this study.

### IMPLICATIONS AND RECOMMENDATIONS

An implication of this study is that nursing dashboards should be implemented with metrics of broader nursing management practices in alignment with the strategic direction of the relevant health system and nursing service. Given the current advancement of digital technology and relevant national and state-level policy guidance, it should be possible to present nurses with a dashboard that hosts the required breadth and depth of data for timely and holistic management decision making and support delivery of connected and quality care.<sup>9-10,15,22,26</sup> A key recommendation would be to strategically plan the implementation of the nursing dashboard, in joint commissioning between national governing bodies and state health organisations, ensuring relevant BI projects are funded, resourced and evaluated with the core purpose of supporting decision making of relevant stakeholders. This approach should serve as a long-term strategy to enable nurses to make data-driven decisions and achieve organisational success.<sup>25</sup>

This study also implies that nursing dashboard implementation should be more end-user oriented. Accordingly, another key recommendation is to focus on education of and collaboration with end-users by BI developers throughout, from idea generation to business-as-usual stages of the nursing dashboard project, to ensure relevancy and value of BI.<sup>37-38</sup> The national nursing governing bodies are also recommended to make such education, training and collaboration at local health organisations a condition for the possible funding support for nursing dashboard projects. Moreover, educating end-users about the benefits of a nursing dashboard and their required capabilities should be prioritised and approached collaboratively.<sup>37-38</sup> This process should involve co-designing, where the authority implementing the dashboard and nurses collaborate for design, selection of measures, capability development training, feedback on continuous improvement of the dashboard, and evaluation.<sup>37-38</sup>

### CONCLUSION

The study has made a case for the utilisation of BI in work areas beyond safety and quality, in an Australian public healthcare context. This indicates opportunities to plan BI implementation with metrics that represent the broad range of nursing management responsibilities in alignment with local and national strategic direction of the health system. Furthermore, the study has demonstrated the importance of implementing BIs with continuous improvement processes and greater focus on end-users.

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Future studies investigating BI experience in the long-term and how to co-design BIs in this era of artificial intelligence, with an appropriate portfolio of metrics for optimum value to nursing management, would be beneficial. With unprecedented momentum for data-driven decision making in health, it is critical to implement BI approaches to offer the most benefit to nursing management.

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