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## Factors Influencing User Satisfaction While Using Health Dashboard in Asia: A Rapid Review of the Evidence

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### ABSTRACT

Despite having many dashboards to display large-scale real-time data in this big data era, there is a shortage of user-friendly dashboards in Asian countries, indicating the importance of examining the factors that make a dashboard effective. This literature gap in dashboard usage has created the ground for this rapid review. This study followed a Google Scholar and PubMed search for a rapid review of 8 health-related dashboard articles taken from 33 articles following the step-by-step screening process, where some critical exclusion and inclusion criteria were maintained. The first finding of this study is that there are a few relevant articles available in Asian countries that match the inclusion criteria of the study focusing on usability and user satisfaction while using health-related dashboards. The second finding is that user satisfaction is one of the essential components for any effective health-related dashboard. The third finding considers easy-to-use, relevant, and accurate content, the right object to display data, an interactive dashboard, increased work efficiency, simplicity, patient care, and data quality as the factors of a user-friendly health-related dashboard. Finally, this study revealed that the dashboard on the web and different access levels have better usability.

### INTRODUCTION

A dashboard is an effective tool for displaying large volumes of data through graphical presentations (Janes *et al.*, 2013). From an organizational perspective, a dashboard applies organized systems to display multiple indicators of data sources effectively required for decision-making purposes (Few, 2006).

A comprehensive and useful dashboard focuses on two aspects - selecting the right data and choosing the right technique for display (Janes *et al.*, 2013). Though there are many dashboards to display large-scale real-time data in this big data era, there is a shortage of user-friendly dashboards. Some dashboards do not satisfy consumers effectively, which is critical. Because, there is a significant correlation between users' satisfaction and dashboard design (Alhabib *et al.*, 2020). Thus, finding out the factors that make a dashboard effective is pertinent. Nowadays, the health system mostly depends on live data for prompt decisions, especially in critical situations. Thus, many health dashboards have already been developed to support such situations. The use of these dashboards was mostly seen during the COVID-19 pandemic. Policymakers and program managers of healthcare services use these dashboards to make quick decisions. Unfortunately, they did not get the expected results as those dashboards were not user-friendly. From this perspective, a dashboard evaluation is important to ensure further development of a user-friendly and effective dashboard for health services, especially in Asian countries. Till now this region has a few health dashboard evaluations compared to the other world. Thus, this study has been designed to examine the factors that affect user satisfaction of dashboard users in

the health sector in the Asia region which will ultimately ensure the effectiveness of the dashboard.

### LITERATURE REVIEW

A dashboard is an outstanding platform for data display accumulated from multiple sources (Concannon *et al.*, 2019). According to Few (2006), a dashboard is a consolidated visual display of relevant information to monitor and understand at a glance for further decisions (Wexler *et al.*, 2017). Dashboards naturally encompass different visual methods accumulating data from multiple sources (Sarikaya *et al.*, 2019). Carroll's (2014) review stated dashboards as the richness of the information displayed through effective communication and interpretation of the dataset. Dashboards are used to monitor and share performance measures for decision-making (Jeffs *et al.*, 2014) for the improved performance of different healthcare services (Field *et al.*, 2018; Pemberton *et al.*, 2017).

According to La Valle (Lavallo *et al.*, 2011), visualization of data is one of the most useful tools for gaining insight into a large dashboard. The lack of vital information in dashboards presents significant challenges for users as evidence-based decision-making processes in health interventions are required (Ye *et al.*, 2012). Thus, preparing a large and complex dataset poses many challenges to user end while making decisions (Caban *et al.*, 2015).

A diverse group of users, like community members, nurses, and scientific and operational staff in healthcare centres use health-related dashboards. Studies show high usability for the dashboard across these groups among the health services providers, as they feel that

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the dashboards provide a clear understanding of the datasets (Concannon *et al.*, 2019). However, the usability differences among the user groups demonstrate the need for the user-led design of dashboards, which is very important for its utility (Concannon *et al.*, 2019).

From the user's perspective, the framework of any dashboard is important. A framework of a good dashboard includes elements of data, user interaction, and dashboard design (Concannon *et al.*, 2019). However, the outline of any dashboard framework includes core 5 components: the context of the framework, purpose-target user group, user interaction and flow, and framework architecture (Concannon *et al.*, 2019). The web-based interactive dashboards worked better during the COVID-19 invasion (C). These dashboards reported the cases more efficiently at the province level in China, the USA, Australia, and Canada (C. Concannon *et al.*, 2019). Data for these dashboards were processed manually, and updated typically twice daily - morning and night (Concannon *et al.*, 2019).

During COVID-19, the World Health Organization (WHO) directly connected its members and fought against this infection through its online web-based dashboard, which globally covered COVID-19 cases and the number of casualties (Dong *et al.*, 2020). This dashboard was very detailed and provided other information related to COVID-19, which benefited people to a great extent (Dong *et al.*, 2020). However, the WHO dashboard had some interesting and unique differences from the Johns Hopkins University dashboard (Dong *et al.*, 2020). The Johns Hopkins University dashboard provided cases diagnosed with symptoms of COVID-19, whereas the WHO dashboard provided other disease information (Dong *et al.*, 2020).

The first dashboard published on 22 January 2020 by the Johan Hopkins University in response to COVID-19 was the first online web dashboard (B. Dong *et al.*, 2020), that indicated the importance of a health-related dashboard from the user end (Concannon *et al.*, 2019).

Considering the importance of health-related dashboards during COVID-19 in India, the Ministry of Health of India launched the first COVID-19 dashboard at the end of January 2020, which displayed the information on its website (Concannon *et al.*, 2019). Similarly, Newslab Malaysia represented the growth of COVID-19 in terms of daily infection cases, patient treatment and death tools in Malaysia (Concannon *et al.*, 2019). On the other hand, the CAN dashboard of Singapore connects the Ministry of Health of Singapore to the rest of the world (Concannon *et al.*, 2019).

The above discussion on health-related dashboards depicts that all types of dashboards do not have user satisfaction; users' satisfaction is the main criterion for any good dashboard, thus this has to be checked more specifically in the context of dashboards of the Asian region. This essence of dashboard usage has created the ground for this rapid review.

## MATERIALS AND METHOD

A rapid review of relevant available dashboard articles has been considered for this study (what and why). 8 health-related dashboard articles have been considered to examine the actors contributing to user satisfaction while using the health dashboards. Initially, 33 articles were considered and after discarding duplicated abstracts, 28 articles were screened out. Later, following the inclusion and exclusion criteria 15 articles were

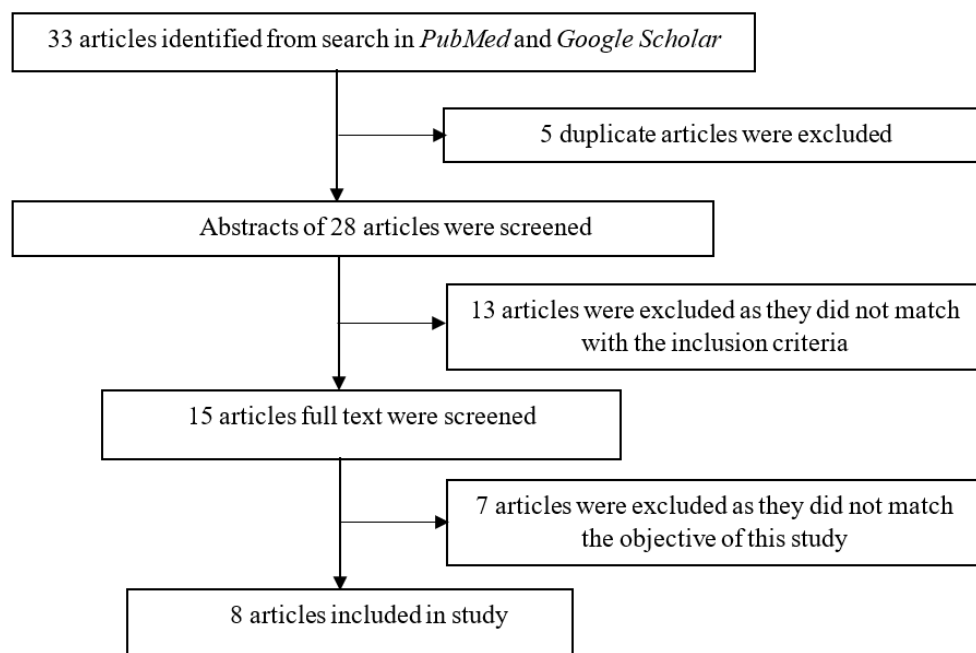


Figure 1: Screening process of review articles.

selected for full review. In the next step, 8 articles were selected for full review as these articles matched the objective of the study. The search for the article was conducted in Google Scholar and PubMed. Figure 1 shows the screening process of articles for rapid review.

**Inclusion and exclusion criteria for screening articles**

Some inclusion and exclusion criteria were followed while screening the articles. Articles published between 2010 and 2023 in peer-reviewed journals about health service-related dashboards of the Asia region were considered for this study. Whereas, book chapters, short reports, editorials, conference papers, and dashboards not related to health sectors nor satisfying customer requirements were excluded from this study.

**Search words**

The search words of this study include health, dashboard, evaluation, satisfaction, usefulness, and specific country

names. To capture different ways of the interested term the query of (“health” OR “public health”) AND (“visualization” OR “dashboard” OR “design”) AND (“evaluation” OR “satisfaction” OR “effectiveness”) AND (“Country Name”) was applied for searching the required articles.

**Data Analysis**

A content analysis approach was applied for data analysis and synthesis. An Excel format was developed and used to extract the details of the articles. This format mainly captured the study objective, respondents, methods, data collection and analysis procedure, and findings for further analysis. The results of this analysis were turned into categories and subcategories based on similarities in patterns or opinions. Articles were reviewed and re-reviewed to reveal their similarities and dissimilarities. Table 1 shows the description of the reviewed articles.

**Table 1:** Details description of articles

Reference	Country	Study Design	Dashboard	Participants	Evaluation Method
Ming Tan <i>et al.</i> (2013)	Singapore	Mixed method	An interactive clinical dashboard of a hospital in Singapore	122 Nurses in the hospital	Data was collected through a survey. A 5-point Likert Scale was used to measure the satisfaction level
Alhabib <i>et al.</i> (2020)	Saudi Arabia	Quantitative cross-sectional study	An electronic dashboard in the emergency room at Royal Commission Hospital in Jubail	51 end users of the dashboard including doctors, nurses, and receptionists	Data was collected through a survey. A five-point Likert Scale was used to measure the satisfaction level
Shravsantina <i>et al.</i> (2019)	Indonesia	Mixed method	Health program dashboard in DHIS2 Platform	80 dashboard data evaluated by researchers themselves	Few criteria were used to evaluate the dashboard and both qualitative and quantitative analysis was done to analyze data extracted from the dashboard
Jinpon <i>et al.</i> (2017)	Thailand	Quantitative cross-sectional study	A web-based dashboard for the visualization of comprehensive data on health care	22 Executives and Health Officers of the Community Health and Learning Center (CHLC), Staff from Laem Chabang Hospital, and Teachers and Nursing Students of Burapha University	Data were collected through a survey. A five-point Likert Scale was used to measure the satisfaction level
Talagala <i>et al.</i> (2022)	Sri Lanka	Comparative study	15 COVID-19 dashboards	2 Researchers examined 15 different dashboards to see how various visualization techniques were used to design an effective dashboard	Descriptive analysis

Ismail <i>et al.</i> (2022)	Malaysia	Case study	3 COVID-19 dashboards in Malaysia	4 Researchers from Computer and Mathematical Sciences faculty of the University of Malaysia conducted this study	A descriptive analysis was done using 5 V's -of big data, which are volume, velocity, variety, veracity, and value
Fazaeli <i>et al.</i> (2021)	Iran	Descriptive developmental applied study	A COVID-19 management dashboard in a third-level hospital in Mashhad, Iran	10 potential users including infectious disease specialists and heads of COVID-19 committees emergency medicine specialists)	Focus group discussion and A five-point Likert Scale was used to measure the satisfaction level
Kharazmi <i>et al.</i> (2023)	Iran	Evaluation of a hospitale cono- mic monitoring dashboard	A Hospital Economic Monitoring Dashboard in Iran	3 Experts and 20 End users	Data was collected through a questionnaire. A seven-point Likert Scale was used to measure the satisfaction level.

**RESULTS AND DISCUSSION:**

**Results**

After conducting a rigorous search, it assumed that very few relevant articles were available in Asian countries that matched the inclusion criteria of searching for articles. This number for reviewing articles turned into 8 only. These articles were considered for full review because they focused on usability and user satisfaction while using health-related dashboards. These articles mainly evaluated and discussed health dashboards from 2013 to 2013 focusing on diverse health-related topics. Specifically, 3 out of 8 articles focused on usability and user satisfaction, whereas 5 focused on only user satisfaction, which has been depicted in the following subsections.

User satisfaction is one of the essential components for the successful use of a dashboard. The objective of a health dashboard is to provide all the necessary information precisely so that users can make the necessary decisions to solve the problem immediately. Therefore, the dashboard should meet the requirements of the users, and thus the dashboard makers need to keep in mind the user satisfaction factors while designing it. As per the findings of this study, the parameters of user satisfaction are described in the following sub-subsections.

**Easy to use**

From the review, it was identified that a user-friendly dashboard is one of the vital factors for user satisfaction. In most of the cases, this factor works as a key factor in explaining end-user satisfaction (Alhabib *et al.*, 2020). It was noted that user-friendly dashboards are also considered a source of learning (Kharazmi *et al.*, 2023). Only one study showed that end users scored the second highest points 3.89 out of 5 to the “easy to use” indicator (Tan *et al.*, 2013). In another study, 57% of participants agreed that the dashboard is easy to use while evaluating their satisfaction with using a dashboard (Alhabib *et al.*, 2020). A study in Thailand identified learnability and memorability as the evaluation of users’ satisfaction

(Kharazmi *et al.*, 2023). On the other hand, a strong positive correlation was reported between the easiness of use and overall satisfaction of the users, indicating that user-friendly dashboards affect users’ acceptance and satisfaction (Alhabib *et al.*, 2020). Supporting this relationship, another article suggested fitting in a single screen so that a dashboard user can see the whole dashboard without any adjustment of grid overlaying (Alhabib *et al.*, 2020).

**Relevancy and Accuracy of Content**

One of the main purposes of a dashboard is to provide a large-scale of information precisely helping to make quick decisions. This review revealed that maximum health dashboards provide relevant, accurate, and up-to-date information, as necessary for user satisfaction (Fazaeli *et al.*, 2021). A study in Singapore showed that a respondent group of nurses provided high scores in two aspects – relevancy (Mean score = 3.93); and accuracy (Mean score = 3.81) out of 5 (Tan *et al.*, 2013). Another study showed that 53% of the respondents considered relevant and accurate information as important factors for user satisfaction (Alhabib *et al.*, 2020). Other studies in Indonesia (Chrysantina & Saebo, 2019) also supported the above findings, stating the importance of the real-time update of data or updates within a specific time interval of the dashboard so that instant decisions can be made based on such dashboards (Talagala & Shashikala, 2022).

**Right object for visualizing data**

Choosing the right and appropriate object for displaying large-scale data is always challenging, especially in the case of maintaining satisfaction. This study on a rapid review revealed three components explaining the right object of a dashboard.

**Font**

Using the right font in a dashboard matters to its acceptability to the users (Fazaeli *et al.*, 2021). Dark-

colored fonts draw more user's attention of the users, as such colors highlight information with a combination of pale backgrounds and provide a more soothing and less starkly contrasting surface while plotting the data (Fazaeli *et al.*, 2021).

### Colour

Some articles reported that color plays an important role in user comfortability and satisfaction (Ismail *et al.*, 2022). A study in Sri Lanka stated the background color and unique color code for different data types in the dashboard are required (Talagala & Shashikala, 2022). Similar findings were reported in a study conducted in Thailand (Fazaeli *et al.*, 2021). Actually, the objective of using color is to raise the purpose clearly, but not to distract the users anyhow from the use dashboard anyhow. Thus, while designing a dashboard, the selection of colors should be purpose-oriented; it must focus on information regarding the changes in indicators over time (Ismail *et al.*, 2022).

### Graph and map

Researchers claimed that visualization tools like graphs, and maps should be relevant and understandable to users. (Talagala & Shashikala, 2022) A study in Indonesia found that too many visuals and unnecessary gaps in one dashboard create dashboard layout problems (Chrysantina, 2019), whereas a study in Thailand stated that simple line graphs are the most useful way to present reports (Talagala & Shashikala, 2022).

### Interactive dashboard

#### Fast

Some articles revealed that the efficiency and flexibility of users' satisfaction with a dashboard depend on the speed of such a dashboard (Alhabib *et al.*, 2020). Around 41% of the respondents in a study reported that their satisfaction relies on how fast the dashboard was visualized (Alhabib *et al.* 2020).

#### Using different devices:

The analysis of this study revealed that an interactive dashboard is important for data presentation to the users (Ismail *et al.*, 2022). It allows them to understand that some data are not in ways to present in the static graphs. Interactive dashboards represent complicated, complex, and multidimensional data requiring filtering, zooming, and panning in interactive visualizations (Ismail *et al.*, 2022). According to this study, the designed dashboard should be accessed by the users through common browsers on electronic devices, such as PCs, laptops, tablets, etc. without any installation on a specific operating system (Ismail *et al.*, 2022).

### Increase Work Efficiency

Few articles emphasized the effectiveness of the dashboard in increasing the productivity of people (Alhabib *et al.*, 2020). Some respondents who attended the

survey of those articles claimed that using a dashboard increases work efficiency as it helps reduce the time for decision-making and communicating with patients (Tan *et al.*, 2013). A study in Saudi Arabia found that 52% of respondents agreed with the benefits of a dashboard for accomplishing their tasks more quickly (52%) (Alhabib *et al.*, 2020).

### Simplicity

2 articles out of 8 stated simplicities as one of the key factors for user satisfaction (Fazaeli *et al.*, 2021). They explained simplicity as the extent to which the information and operational needs of dashboard users meet their expectations, for example, the number of panels, indicators, and graphs representing the data (Tan *et al.*, 2013).

### Patient care

Another 2 articles out of 8 stated showed a strong correlation between the perception of using dashboards to improve patient safety and overall satisfaction. Respondents to these articles showed more concern about the impact of dashboards on patient care (Alhabib *et al.*, 2020). 21% of respondents in a study in Singapore answered about patient care (Tan *et al.*, 2013), whereas 55% of the respondents in another study agreed that the electronic dashboard displays data for better caring of patients (Alhabib *et al.*, 2020).

### Data Quality

According to one article, the data quality of a dashboard is a significant parameter for user satisfaction. 33.7% of respondents in a study held in Indonesia stated that data quality is one of the prerequisites for a good dashboard related to health services (Chrysantina, 2019). On the other hand, a dashboard with incomplete and inconsistent data may hamper the ultimate goal of any dashboard presentation (Chrysantina, 2019).

### Discussion

Nowadays dashboards are widely used to display complex data, especially in the health sector, which is a very positive step in this big-data age. Especially, during the COVID-19 era, many dashboards were introduced in the health sector. This rapid review focused on customer satisfaction while using health-related dashboards in the Asia region. It mainly revealed that there are not sufficient studies on dashboard designing toward customer satisfaction in this region.

This study revealed that the dashboards without having customer satisfaction are almost useless. It revealed some common factors affecting customer satisfaction in the health sector. From a data synthesis perspective, the most influential factor for users' satisfaction with the dashboard is its usability. Maximum reviewed articles highlighted this characteristic of dashboards, thus ensuring customer satisfaction of a dashboard is now a critical point for consideration. Secondly, the relevancy and accuracy of

data in a dashboard were other vital factors promoting the users' satisfaction.

Thirdly, the right choice of objects for data display in the dashboard like font size, color combination, and graphical presentation is an essential factor in the flexible use of the dashboard. These are the eye-catching issues of a dashboard that draw users' attention. Fourthly, the interactive characteristic of a dashboard is another factor ensuring users' satisfaction to some extent. Fifthly, the simplicity of a dashboard and data quality also worked as influential factors for users' satisfaction. Finally, the most important finding of this review is that the effectiveness of a dashboard is positively correlated to increased work efficiency and patient care. Thus, the sum of the discussion over the issues, is that the factors affecting user satisfaction are critical but manageable in the health sector in the Asian region.

## CONCLUSION

This rapid review identified eight factors of a dashboard influential to the users' satisfaction while using the health dashboard. These were easy to use, relevant and accurate content, the right object to display data, an interactive dashboard, increased work efficiency, simplicity, patient care, and data quality. The dashboard on the web and different access levels were distinct for users according to their roles, which provides the ability to integrate information at the national level for decision-makers. From the users' viewpoint, this type of dashboard has the best usability. Furthermore, this study revealed that aesthetic aspects and simple design and clarity of system status (0%), privacy (1.49%), "visibility and clarity of the system" and "adaptation between the system and the real world" (2.98%), have the fewest design errors. With 14 problems (20.89%), "recognition rather than remembering" and "compliance with uniformity and standards" have the highest frequency of problems. Finally, it could be concluded that a health dashboard is required to address health information effectively in Asian countries. On the contrary, an unpleasant dashboard disrupts users' attention and thus is avoided.

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