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## FACTORS FOR AUTOMATIC EARLY WARNING SCORING IMPLEMENTATION IN MALAYSIAN PRIVATE HOSPITALS

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### Abstract:

The paper explored factors affecting the choice of early warning score (EWS) card adoption using the case study of Malaysian hospitals. One hundred hospitals in Malaysia participated in a survey where CEO's and nursing directors filled semi-structured questionnaires. A review of current literature confirms that deteriorating health following treatment of acute health is a critical issue undermining sustainable marketing in healthcare. Lack of sufficient and efficient measures to effectively care for these patients promptly has continued to present challenges to healthcare providers. Part of the problem is that it has always been problematic to detect early warning signs and calls when vital signs appeared. While early warning signs have been adopted to respond to calls of vital signs, difficulties arise in terms of efficient documentation, recording, interpretation and implementation of EWS. Hospitals with limited financial capabilities are compelled to use manual early warning scores. EWS is relatively affordable to acquire, install and maintain. They, however, lack in efficiency, timeliness and accuracy. The present study revealed that only seven hospitals had implemented manual early warnings signs. Findings indicated that no hospitals have implemented automatic warning signs, despite respondents indicating their understanding of the benefits and complexity associated with automation of EWS. The management of these hospitals revealed the high cost of implementing and maintaining automated EWS and inability to measure outcomes as the top reasons for not having automated EWS. However, the study noted that leadership and ethics, especially the leader's attitude, employee's engagement and perceived benefits of automatic EWS have a role in determining the successful implementation of EWS. To successfully implement EWS as a powerful marketing strategy, good management for implementation should be in place.

**Keywords:**

Early Warning Score In Hospital, Factors Implementing EWS, Automated And Manual EWS

**Introduction**

Health is a priority that defines the status of the current and future generations. The health industry also creates social, political, and economic issues, and as such, it is important to foster constant evaluation of the population's health for the development of sustainable initiatives. In the 1987 UN conference definitions, sustainable developments are those that accomplish the needs of the current population without interfering with ability to fulfil the needs of the future generations. Sustainable strategies are founded on accountability and planning, and should be implemented by each stakeholder in the respective industries. With this regard, the role of the marketing function is amplified. Viable marketing strategies should be designed to offer solutions on various issues facing the healthcare industry. One main issue affecting the population is the disease management essentially in the case of advanced symptoms. Medical practitioners are tasked with the decision of determining the method to use for early score adoption to minimise cardiac arrests and other preventable symptoms. This paper tends to identify the factors that affect the choice for automated early warning score adoption while focussing on Malaysian hospitals.

**Literature Review**

Different studies have been conducted related to the safety of ill patients in wards which describes the deterioration of the patient's health due to failure for monitoring the vital signs (Spencer, Sherwood Burge & Jones, 2001, Goldhill et al. 1999). According to McQuillan (1998), 41% of these illnesses could have been mitigated using proper optimal care. This shows that early signs of health deterioration were not noted that lead to advanced care and support. Schuster et al. (1998) has defined good healthcare as the provision of healthcare services given to the patients in a competent manner with cultural diversity. On the other hand good healthcare has been defined in terms of efficiency based on clinical standards (Mosadeghrad, 2003). Some of the key defining characteristics of quality healthcare include the availability, acceptability, appropriateness, competency, timeliness, confidentiality, responsiveness, reliability and comprehensiveness of the care (Robb & Seddon, 2010). Although quality healthcare is the key to sustainable marketing in healthcare, deteriorating patients' observations have been indicated to precede treatments (Dummet et al. 2016). These physiological effects have a negative impact on acute ill patients. As a consequence, delivery of good quality healthcare becomes a challenge to the caregiver and the organisation.

One of the core activities of quality patient assessment is the documentation and analysis of symptoms of deteriorating health. However, existing literature has indicated that recording of patients is a routinely missed exercise. Hands et al. (2013) has revealed that application of an early warning score (EWS) system is to detect vital signs in hospitals is inadequate. According to McLaughlin (2015), hospital staff are hardly adhering for routine observations at night and such tasks have been perceived as low priority. These findings indicate a sharp contrast between current practice of some caregivers and fundamental parts of caring, which, according to Higgins et al (2009) has been considered to take patient observations. The failure of caregivers to frequently use the early warning score cards (ESC) has been considered for monitoring patients which has occurred due to the perceived low priority of such tasks.

Some of the vital signs, like abnormal respiratory, are early indicators of physiological deterioration. According to Wheatly (2006), the recording of respiratory rate was regularly missed by the caregivers. Additionally, Endacott Kidd, Chaboyer & Edington (2007) have studied the analysed patient's chart records that revealed the level of the patient's consciousness which was missing on any other record. In most cases, the recording of vital signs was found to be incomplete despite the use of EWS.

Some of the barriers for proper detection and management of deteriorating patients included the tie limits and heavy workloads. It was due to challenges involved in delivering quality care that the idea of early warning score was created. Early warning scores helped the nurses to recognise the deterioration among patient's health so that caregivers can provide responsive and timely care when required. The score helps in observations of vital signs like heart rate, temperature, saturation of oxygen, conscious level and blood pressure. A higher EWS score indicates abnormal signs.

### ***Automatic EWS as a Sustainable Marketing Initiative***

A study by (Bonnici, Gerry, Wong, Knight, & Watkinson, 2016) revealed that the automatic system of recording vital sign observations is more beneficial when compared with the paperbased model. The authors used a non-randomised method to compare the recorded vital signs on paper and charting on System for Notification and Documentation (SEND), which is the type of EWS. In this study, four hospitals were surveyed with the assumption that frequent visitation of acutely ill patients would lead to better recognition of patient's deterioration. Here, automatic charting proved to be faster than paper-based model as it is timely; the efficiency is when hospital staff is provided with a lower workload, hence improving the observation frequency. Further observation noted that the workers were used to the manual system that resulted in a decrease in charting rates in case the electronic systems are not adequately implemented. Similar findings given by Wiebe implicated that electronic health information provides accurate, up-to-date, and complete information about patients, while enabling quick access to information, reliable prescribing and legitimate writing (Wiebe et al., 2018).

The automated systems increased the adherence to organisational and local policies on the frequency of observation recording for the hospitalised patients. Therefore, the automatic system has been considered as a change of initiative that breeds sustainable returns for the hospital and community at large scale. The value system is considerate of the physical and emotional needs of the nurses. The automatic program thereby relieves medical personnel with the pressure of handling multiple needs at once (Bonnici et al., 2016). The result is a motivated and productive workforce. An emotionally satisfied workforce promotes positive outcomes to the benefit of the hospital and the patients.

In a related study, Downey et al. (2017) carried out a systematic review of Medline and PubMed to evaluate studies that focused on monitoring the adult human subjects. A total of 232 cases were used in this study. From the studies, the authors reported that the manual warning scores had a high prediction value that positively impacted the clinical outcomes, and could interact with other variables. The authors further noted the limitation of the scores included high sensitivity, the need for practitioner engagement, requirement for a reaction to rise, irregular nature of recording and requirement for clinical judgment. According to Downey et al. (2017), the limitations can be overcome by automation. Even though the manual scores offer the right language and environment for management of escalated cases, integration with

automated technologies can improve the outcomes. In the study, Downey et al. (2017) observed that most hospitals failed to incorporate the automated system due to the associated high costs of installation and training. Furthermore, most of the hospitals were not familiar with the automated systems provided that they still relied on the conventional operational models to conduct businesses. The authors recommended an awareness campaign that aims for promoting the use of the automated system as a standard measure of quality in hospitals.

Bonnici et al. (2016) and Downey et al. (2017) indicated that automatic early warning scores provide an opportunity for sustainable marketing. While manual early warning scores have been in the industry for years, the studies stipulate that implementation of the automated systems is still in the early stages, providing the fact that not all hospital leaders are aware of the implications of the system relative to the manual programs. Installation of the system is a change initiative that requires a lot of monitoring and collaboration among the stakeholders for successful outcomes. Given that the benefits outweigh the limitations, the decision to use the system should be universal among the stakeholders.

### ***Factors Influencing EWS Implementation EWS***

The type of early warning score, whether manual or automatic is an important factor for successful implementation of EWS. Automatic warning scores reduce the distraction experienced by nurses due to workflow and helps in avoiding the risks associated with anxiety. Additionally, automatic warning scores mitigate the risks of error associated with self-censorship when making decisions to activate the response team. Automation is particularly important if early warning scores are designed for different client's types and different settings of the healthcare institution.

Efficient utilisation of hospital resources is an associated benefit for implementing early warning scorers. The utilisation of hospital resources will likely reduce when early warning signs scores cards are implemented. The benefit associated with EWS not only extends to sustainable and pre-emptive healthcare, but also improves the internal efficiency when resources that may be used otherwise for Intensive care units (ICU) admissions, length stays and readmissions. The study found that there is a reduction of relative risk of 80 percent for days spent at ICU following a cardiac arrest and another 88 percent reduction total for the bed days. Additionally, implementation of EWS shows a positive outcome for escalations that are not anticipated to ICU. For instance, hospitals in which early warning detection technology were implemented showed significantly lower chance of patient readmission in patients of post-critical care.

Successful implementation of early warning scores requires employee dedication and high levels of engagement. Responding to code in a timely manner requires considerable utilisation of the hospital resources. While it is an important part of quality care delivery, nursing may be anxious when placing an emergency call due to the concern of blame in case the alarm is not based on a real emergency. Additionally, hospitals have different attitudes towards unjustified alerts that lead to a high level of self-censorship. Unlike automatic EWS, manual systems require a lot of human effort and proper interpretation of scores. According to a study by Petersen, Rasmussen, & Rydahl-Hansen (2017), staff were reluctant to activate the systems due to fear of making a false alarm, despite meeting the conditions for emergency intervention. This leads to an organisation culture where employees place sensitivity in place of sacrifice.

According to Bonnici et al. (2016), the effects of intervention dependent on early warning scores may not provide the desired results due to lack of familiarity with automatic early warning scores. However, it has been considered that the intervention will increase as the staff become more familiar with the system. In some cases, nurses have limited time to monitor the executions of early warning signs. Also, the calculation of aggregate scores on electronic systems represents new work flows that may require additional human resources. Most of these challenges are however related to the manual early warning scores. Therefore, automation is desirable in the calculation process as well as recording along with transcription of important signs and in the notification of the reaction team.

### **Research Methodology**

The aim of the present study is to explore the factors involved in determining the choices of automated early warning scoring adoption in hospitals and its relation with sustainability. Accordingly, the current section has described the procedures and methods involved in pursuing the objective of the study.

### **Research Design**

An exploratory research design has been implemented that highlights the issue such as it is suited for studies where a problem has not been explicitly defined like the one in this study, whereby the intent is to gauge various factors associated with automatic early warning scores adaption.

### **Instruments and Data Collection**

A quality research without flaws requires effective data collection. This research used surveys and questionnaires to extract the most appropriate data for achieving the major objectives of the study. In a survey, a group of people representing the population are studied for data collection and analysis. The essence of a survey is to question people on the given topic and then describing their answers. Due to the large number of respondents, and the need to allow each person to provide feedback, this study applied semi-structured questionnaires with closed and open-ended questions.

### **Sampling Technique**

A stratified sampling technique was applied in the selection of participants for the study. This technique ensures fair representation of the population. Stratification was based on the type of hospitals such as private hospitals, acute care and bed capacity of more than 150 beds. The sample population consisted of 100 hospitals in Malaysia. Respondents were hospital CEO, Nursing Directors or Medical Director. Each hospital had one respondent and a total of 100 respondents.

### **Result**

None of the 100 hospitals surveyed implemented automatic EWS for detection of vital signs. Only seven (7%) had implemented manual early warning signs. Most of the hospital CEO's and Nursing Directors surveyed (70%) indicated they were familiar with the concept of EWS and showed appreciation of implementing the system to achieve objectives of sustainable marketing through timely delivery of quality healthcare. However, based on the study's findings, the failure of these leaders to actually implement automatic EWS indicated that there is a tendency of healthcare management to underestimate the complexity and benefits derived

from automatic EWS. The survey also indicated that most of these hospitals (80%) fail to properly grasp the engagement required to completely and successfully implement EWS.

All the seven hospitals that had implemented manual early warning scores reported improved results for deteriorating patient's health. It was noted that EWS implementation was not a trivial matter for six of the hospitals, but one that calls for commitment and patience. The respondents from the seven hospitals agreed to the fact that EWS is challenging to implement, and successful results like early responding to deterioration and prevention of complication come with time. Although yet to experience the outcome of automatic EWS, the seven hospitals that implemented manual EWS provided several insights for successful EWS implementation. There was consensus that managerial leadership is critical when considering sustainable marketing through innovative technology. The management team must be ready for the concept of EWS and possess an early-adopter quality, while ensuring proper communication. The organisation should be able to perceive the need for the system so as to prepare all members for organisation changes related to workflow. For the nurses who see EWS as extra work, the management should engage them in order to make them realise that EWS is a way of validating their nursing procedures. Additionally, there is a need to establish pre-implementation and post-implementation metric systems to determine the efficiency of the system and monitor patient improvements.

The reluctance of healthcare providers to integrate automatic EWS can be attributed to several factors. The adoption of either manual or automatic early warning scores depends on the ability of leaders to adapt to technological changes. Innovative leaders with an early-adopter quality will find the need to implement new changes and will easily adjust to automated EWS instead of manual systems. This can help explain why the survey found no implementation of automatic early warning scores in the 100 hospitals surveyed. It takes months and efforts of creativity to reap benefits of novel technology such as automatic EWS. The roll out of automatic EWS may be slow and will mostly begin on a small scale. Without the right leadership mind-set, sustainable marketing through automatic EWS may not be realised. Respondents who had not yet implemented automatic EWS showed no signs of appreciating the complexity of the EWS in sustainable marketing, and the challenges involved in implementing EWS.

Results from the survey indicated that hospital care assistants (HCAs) did not possess sufficient IT skills and training to completely respond to blue codes and monitor vital signs (75%). Successful implementation of EWS depends on the training and skills of the nurses' involved with monitoring vital signs. The role of HCA is critical in the detection of acute ill patients as they are responsible for examining, responding and recording caring for the acute ill patients. To improve quality of care as a sustainable marketing effort, HCA should be well trained and highly motivated in the workplace to discharge their duties effectively. Training programs on the use of EWS should be designed to impact skills to the staff in caring for the patients.

## Discussion

### *Economic Theory and EWS Adoption*

Classical economists defined the process of producing goods and services as one involving labour, capital, and land natural resources using a specific type of technology. The total factor of production is the efficiency with which a given country produced goods and services using

the available capital and labour. Since total factors of production can be used to describe the relationship between income, technological progress, capital availability and welfare, the factor of production is dependent on the available technology. According to Foster and Rosenzweig (2010), the inclusion of healthcare expenditure of technology is influenced by the level of complement between the new and the old technology, the agents whose function is to maximise profit, efficiency of the new technology, and the type of healthcare systems in place in terms of regulation and financing. One of the major tenets of economic theories is that the economic situation of a country can help predict the level of technology adoption.

Developed countries tend to have sophisticated technology while developing nations are characterised by inferior technologies. Economic theories imply that capabilities to implement new technologies are insufficient in the developing economies. According to neo-classical economic theories, the adoption of new technology is related to other factors of production that determine the GDP of a country. The failure of most of the hospitals in Malaysia to implement automatic EWS can therefore be explained from an economic perspective. Malaysia is considered a developing nation with GDP of 0.78 (Department of Statistics Malaysia, 2020). The country experiences challenges of implementing new technology that are characteristic of developing nations. These countries, compared to the developed economies, have low human labour, poor infrastructure and low income per household to support development of new technology. Implementing automatic EWS in Malaysia that will require trained personnel and intensive capital that may not be easily available.

Due to limited resources and lack of sufficient human labour, healthcare organisations in developing nations may rely on old technology for keeping the operations running. Although effective implementation of EWS is key to sustainable marketing, automatic EWS increases the frequency of emergency calls. The impact associated with increased calls may motivate hospitals to be reluctant in implementing EWS so as to ensure efficiency of operations using the available limited resources. When the number of calls goes high, the workflow increases, which constraints productivity. If the hospital has no means to provide extra resources for deteriorating patients, then calls will then go unanswered which may taint the corporate image. In case, before implementation of automatic EWS the calls for emergency response were fewer, the response team was more likely to provide fewer interventions with higher efficiency. With fewer calls, the team is available to respond to vital signs and provide timely response to the satisfaction of the deteriorating patient.

### ***Effects of Leadership and Ethics on Factors of EWS Implementation***

Leadership plays an important role in determining the implementation of early warning scores for monitoring vital signs. The kind of management system put in place is an important factor for sustainable healthcare practices through early warning scores. Adoption of EWS requires a change in the process of management. EWS can greatly increase demand for information communication technology and push the demand for employee training and to suit the needs of the system. To monitor the equipment, leaders may find the need to implement novel practices related to IT. Without careful assessment of the management planning and process, these factors can contribute to bottlenecks and poor implementation of sustainable EWS.

### ***Cost of Equipment***

Most hospitals, particularly public institutions, are underfinanced. The facilities are mainly sponsored by the government and as such, they have a limited budget. The financial resources

are redistributed among various departmental units. The choice for the early warning score adoption is therefore mainly influenced by capital availability. The technologically-based system is however costly to acquire, install and maintain. Financial constrictions force hospitals to rely on the manual system. The cost of equipment can help explain why Malaysia has only implemented manual EWS. The survey conducted in this study explained cost as the barrier in implementing automatic EWS in Malaysia.

### ***Reduction of Labour Cost***

Henry et. al. (2015) observed that the manual system is labour intensive given that it requires a physical presence of the medical team to monitor patient progress often. Hospitals are therefore pressured to hire more nurses to cater for the varying needs of the patients and ensure that emergency cases are observed on time for redress. Apart from breeding an unhealthy culture for the medics, in the form of emotional deprivation, the hospitals spend more on labour thereby disadvantaging other units in need of financial support.

### ***Rate of Code Blues***

The decision to adopt a specific EWS is also impacted by the rate of code blues. Henry et. al. (2015) defined code blue is a condition in which a patient undergoes a cardiopulmonary arrest that requires a medical team to attend to. The occurrence of code blues influence the adoption of EWS. If the prevalence rate is high, the hospital management is supposed to integrate a program that alerts the medical team of the situation to reduce mortality rate. The manual system offers unsustainable solutions in such situations.

### ***Length of Stay and Mortality Rates***

Research by Edwards et. al. (2015) showed that early detection of vital sign changes is critical in the reduction of mortality rate. When the deteriorating signs are noted immediately, the medics are positioned to handle the issue on time for positive outcomes. In the case of a manual system, the scores have to be calculated several times a day and the medics may not be available when a patient records a vital sign thereby increasing mortality rate.

### ***Effects of Leadership and Ethics on choice of EWS***

#### ***Automatic vs. Manual EWS***

Hospitals using manual warning scores contrast with those using automatic early warning scores and those yet to implement EWS. Part of the explanation is that early warning scores not only help sustain quality delivery of healthcare services to the population, but also plays an important role in internal management of the organisation. EWS, when implemented successfully, has the potential to change various aspects of nursing care management such as workflow for nursing, expenditure, number of employees and response teams.

The impact of automatic EWS on the organisation culture is a factor to consider before implementing the system. Leaders implementing EWS must be ready to support a changing organisation culture. An organisation culture is an important aspect that has a direct impact on performance and attainment of the organization's goals. It may take a long time to change an established culture and ensure new standards of practices that are embraced. The intended outcomes of an automatic EWS may take years to achieve. Furthermore, nurses will be slow to utilise EWS system when they lack a clear reason for adopting the system. With manual systems, good timing to code blue plays a critical role. The response team may fail to initiate

emergency intervention while waiting for one of the vital signs to reach the appropriate critical level. In the process, timely intervention will be lost and the benefits of EWS will be wasted. Thus, one of the factors for successful implementation of automated early warning score is reconciliation of an objective parameter to support the emergency call. The culture of the organisation should be properly adjusted in order to motivate nurses and patients to effectively respond to emergency needs without fearing the consequences of making a false alarm.

EWS increases workload and contributes towards the changes in the organisation management and practices. One of the key defining advantages of automatic early warning signs over manual signs is that it provides functionality for automatic digital documentation of events. This greatly reduces the burden associated with manual documentation that are experienced by the nurses. The system is capable of data interfacing as well as providing timely identification of deteriorating patient health as compared to manual systems. Automated early warning scores can automatically identify the truthfulness of information using reassurance measures. It provides timely alerts and information to clinicians when early signs of deterioration appear through mobile phone notifications. However, automated EWS are associated with higher costs and maintenance compared to manual systems.

Ethical considerations are very important when developing new products and services. Kaplan (2004) argues that new technology should have ethical neutrality. However, it is possible for technology during its initial stages for adaptation to be used for other non-ethical ways. The values upheld by the healthcare institution and individuals determine the direction in which new products are perceived as practised. This in turn has a direct impact on both internal and external outcomes of the organisation. New technology that is upheld by social-ethical values like dignity and safety have positive impacts on the organisation's image. Automatic EWS are meant to provide timely response to deteriorating patients. EWS can be said to contribute positively towards pro-social and ethical values of the organisation and the society since it strengthens values of timelines and through continuous efforts to take care of patients' needs after treatment. A major issue of concern involving ethics and healthcare technology is privacy. Privacy is a human right that must be respected by the healthcare providers. Both local and international jurisdictions provide right laws for the protection of privacy. As automatic EWS are projected to become more common in healthcare settings, more ethical issues related to healthcare will become more manifest.

## Conclusion

Provision of responsive and timely healthcare is a prerequisite for sustainable healthcare marketing. The role of marketing functions is streamlined when the target market is able to access quality care in a timely manner. It is paramount that healthcare marketing focuses on delivering strategic solutions to issues facing the industry. Currently, a wide body of literature indicates that patients of acute illness are likely to experience deteriorating health after receiving treatment. It has also been revealed that few hospitals have implemented efficient measures to combat the problem of deteriorating health among the patients. The explanation for this problem is that detection and monitoring of vital signs has always been problematic to healthcare providers. In a bid to take care of patients deteriorating health, healthcare providers integrated early warning scores to provide vital signs for patients of acute illness. The initial EWS were manual and presented numerous problems for recording and interpreting results. While automation of EWS was meant to help monitor patients' health without problems associated with manual systems, a survey conducted in 100 hospitals in Malaysia indicated

that the system is yet to be embraced. Only seven hospitals used manual EWS to detect vital signs, and none had implemented automatic systems. The outcome for the study was attributed to several factors related to adoption of new technology, organisation culture and cost of implementing EWS. Successful implementation of automatic EWS requires efficient leadership and management to help nurses adjust to a new culture of extensive patient care as well as proper training on the part of nurses involved with detection and monitoring of vital signs.

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