

# The Impact of Using Smart Infusion Pumps among Nursing Practice

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**Abstract** - The most prevalent cause of medical injuries is medication errors especially when patients take multiple medications at the same period of time with different doses. One of the technologies that have been developed to improve patient outcomes is the smart infusion pump, which has the ability to identify several programming problems when applied correctly. However, based on existing use, there are contradictory reports on smart pumps' potential to avoid patients' harm in the absence of other features, as well as deliver professional care to patients. This study aimed to understand the experience of nurses when performing smart infusion pumps in their practice, the influence of this technology on their confidence, and how much this technology is trusted to rely on to prevent medical errors. Previous studies focused entirely on longitudinal and quantitative studies, which take a long time and cost a lot. A qualitative study collected from an online survey that contained three types of questions: open-ended questions, closed-ended questions, and rating questions to evaluate participants' answers about smart infusion pumps among their practices in Saudi Arabia hospitals, a survey targeting nursing staff and we got 30 replies. The outcomes have revealed a significant impact of smart infusion pumps on nursing practice.

**Keywords** – smart infusion pumps, technology, medications error, nursing.

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## 1. Introduction

Medication errors are the most probable cause of medical injuries. It is a broad term that refers to the numerous and different ways in which IV infusions can go incorrectly at nearly every stage of the medication delivery process [1]. Medication errors can endanger patients and place a financial burden on hospitals and health care providers. Infusion pumps are available to help reduce errors and promote safety, when integrating infusion technology, it is essential to assess relations with employee satisfaction, safe and effective nursing practices, and the value of evaluations of healthcare professionals [2]. In the healthcare industry, IV infusion pumps are widely used since an approximated 90% of hospitalized patients need to have their drugs carefully administered intravenously. The administration of medication via intravenous infusion pumps is a crucial task that involves potential dangers to patient safety [1].

Computerized smart infusion pumps infusion technology with capabilities for administration error prevention and data collecting offer transformative therapeutic technologies that have the potential to significantly reduce the prevalence of IV drug mistakes in hospitals [3]. Smart pumps are dose error reduction systems that allow the delivery of intravenous fluids and drugs within the confines of predefined parameters such as drug concentration and dose [4] as shown in Figure 1.

Programmable infusion pumps with safety software were developed to mistakes by showing alarms when doses exceed hospital parameters or, in the case of one pump, when duplicate infusions are provided [5].

Despite, any inaccuracy in the smart infusion pump sittings leads to medical errors. Nurses' faith in new technology can be effortless in their daily practice. This study intends to determine whether the infusion pump can be trusted more than a basic intravenous line by nurses.

## 2. Literature Review

IV drug mistakes are prevalent, although they are more epidemiologically varied than predicted.

Rate deviation problems caused by a programming fault were less common than predicted, however mistakes linked with orders, document, labeling, and patient identification were more common. This research provides motivation for healthcare organizations and IV pump suppliers to recognize that hidden faults and conditions can have at least as large of an influence on patient damage as active failures, and to account for these sorts of errors in the design of safer systems [6].

According to this study, the soft (changeable) limitations of smart infusion pumps had little effect on preventing dose errors.

Smart pumps can reduce dosing errors and hence increase patient safety if they are programmed with hard (unchangeable) restrictions. To reduce the dangers associated with intravenous infusions, particularly secondary infusions, pump technology has to be improved further. The limitation of this study is not generalizable due to the limited sample size and simulation of a real in-patient unit, this study was not applied in Saudi Arabia [7].

The frequency and type of medication used, as well as the procedural problems related with infusion pumps. Despite this, there is little research on how workflow and process adjustments can be implemented to alleviate these issues.

There is also a scarcity of data on optimal practices in education and training [8].

The findings of function of smart infusion pumps in preventing medications administration errors indicate that utilizing any pump will provide significant safety gains when administering infusions by gravity. Therefore, using smart infusion devices can significantly increase the risk of errors. The limitation of this study is the expert panels were at an early stage of smart infusion implementation and may not have been aware of full implication that undesired of utilizing them in clinical practice and it was retrospective study [9].

After integrating smart pump interoperability or auto programming, our study found that numerous drug mistakes associated with IV infusion pump programming were reduced. Total mistakes as well as errors related to high-risk drugs were decreased substantially [10].



Figure 1. Smart infusion pump [11].

### 3. Methodology

In this study the data is qualitative and collected through an online survey by snowball technique. We created our own questions translated into Arabic language by an online survey by Google form to investigate and evaluate nurses' experiences with smart infusion pumps in hospitals and how much of it is reliable enough to depend on. We asked three types of questions: closed-ended questions, open questions, and rating questions.

### 4. Results

As part of the data collection period, the questionnaire targeted nursing staff and included nine mixed-type questions, including closed-ended and open-ended questions regarding the nurses' experience with and faith in the smart infusion pump, as well as three demographic questions. We received 30 responses from different hospitals in Saudi Arabia: King Fahad hospital, King Abdulaziz Medical City, The University Medical Center in University of Jeddah, King Abdullah Hospital, King Abdulaziz University Hospital, Mouwasat Hospital, Specialized Clinics Comprehensive National Guard and Public Medical Center in Almuzaylif. Participants' average age ranged between 31 and 32, depending on the method used to calculate the mean value for grouped data.

The questionnaire was designed to determine whether it was sufficient to rely on practice and whether nurses could be trusted with smart infusion pumps. Figure 2 displays participants years of work.

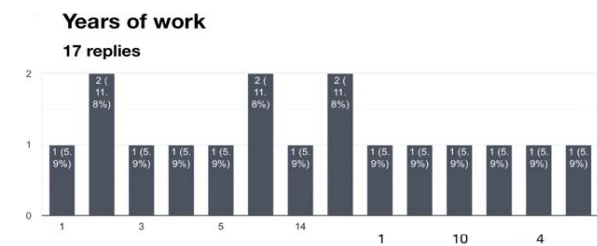


Figure 2. Years of work

Have you ever used a smart infusion pump to administer medication to a patient ?

30 replies

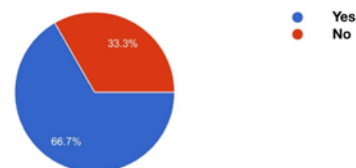


Figure 3. Availability of smart pumps in hospitals

Have you ever used a smart infusion pump to administer medication to a patient ?

30 replies

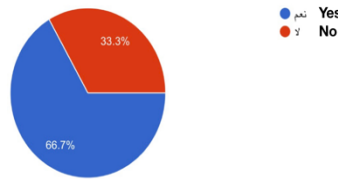


Figure 4. Participants use of smart infusion pumps

Using smart infusion pump will reduce medical errors

30 replies

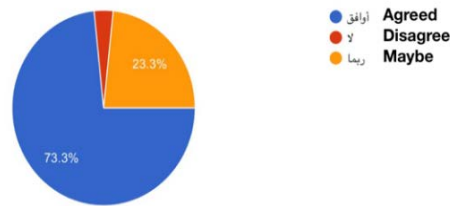


Figure 8. Reducing medical errors and smart pumps

I'm concerned that's smart infusion pump will be inaccurate and causing medical errors

30 replies

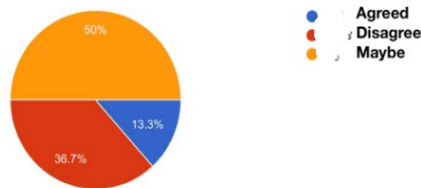


Figure 5. Medical errors and smart pumps

Based on your experience is it safe to give patient a dose of medication via smart infusion pump ?

29 replies

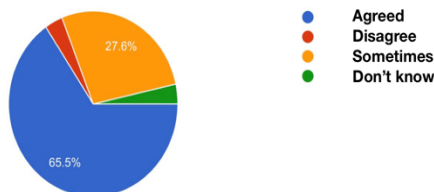


Figure 6. Safety of smart infusion pumps

I'm certain that the use of smart infusion pump will reduce my pressure at work

30 replies

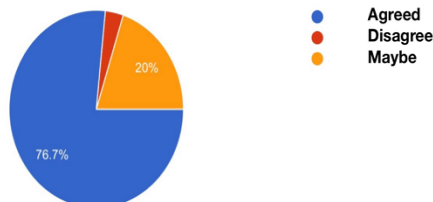


Figure 7. Work pressure and smart pumps

In an open-ended question, participants answered based on their experience. The fourth answer explained that a smart infusion pump has a significant difference from a traditional one, but without further explanation. Another nine-point answer was given: the smart infusion pump.

The use of smart infusion pump will increase my confidence about my nursing care

30 replies

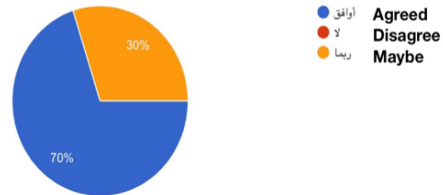


Figure 9. Participants trust on smart pumps.

It is impossible for a traditional infusion pump to perform these tasks in real time. On the other hand, one answer suggested that the traditional method is better. One answer explains that there is no difference. One of the participants did not have experience with a smart infusion pump. One participant answered, "sort of, without further explanation.

In close-ended questions section infusion pump availability in hospital's response as shown below in Figure (3) was 73% Agreed, 10% Disagree and 10% Maybe. Participants who are using smart infusion pump when administering medications to their patients gave the following answers as shown below in Figure 4: Yes 66.7% and 33.3% No. Inaccuracy of smart infusion and the causing of medication errors as shown in Figure (5) was 13.3 Agreed, 36.7% disagree and Maybe 50%. Safety of smart infusion pump as shown below in Figure (6) was Agreed 65.5% and sometimes 27.6%. Ability of smart infusion pump to reduce pressure at work as shown below in Figure (7) was Agreed 76.7% and Maybe 20%. Participants trust on smart infusion pump as shown below in Figure (8) was Agreed 70% and Maybe 30%. Smart infusion pump reduces medication errors as shown in Figure (9) was Agreed 73.3% and Maybe 23.3%.

The rating section was from 1 to 10 scores the majority of the rates was between 8 (30%) and 10 (26.7%). Figure 10 displays ratings of smart infusion pumps.

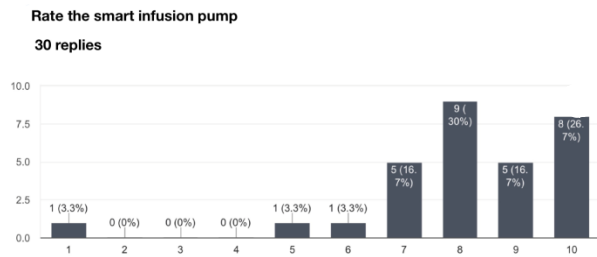


Figure 10. Rating results of smart infusion pump

## 5. Discussion

There has not been enough study on standard practices for avoiding mistakes, enhancing infusion pump utilization, and the extent to which nurses can rely on smart infusion pumps. There are several factors which could reduce medication errors as previous studies confirmed such as adjusting the smart infusion pump by soft limiting and hard limiting and by gravity. Errors caused by software irregularities were less noticeable than expected, but errors caused by records, doctor orders, and patient identification were more common. However, our study findings indicate that a smart infusion pump can be highly dependent upon the nurses' experience, showing positive influence on reducing their work pressure and helps them providing the best care to patients by administration medications safely.

## 6. Conclusion

Finding of this research answered the question, which is: If the infusion pump is flawless enough to nurses trusted more than the basic intravenous line. The plurality of nurses agreed the infusion pump has decreased medications errors, lowering pressure work, high level of confidence, as well as surely helped in their crucial daily tasks. Technology has been improving over years to serve health care providers in delivery professional care to patients, additional enhancements in the smart pump's capabilities to minimize medication errors will increase nurses' trust in this technology in the future.

The study's limitation is that the online survey was not distributed to a larger sample, and the number of replies was not enough to get a much more reliable result of our research..

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