Assessment of Perceptions and Barriers of Nurses in Using Electronic Handover Information System

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Abstract. Introduction: The handover process between the healthcare providers is one of the essential parts of the healthcare system as it will focus on exchanging information pertaining to patient conditions and treatment plans, furthermore, the handover process among nurses needs to be at a higher level of quality and accuracy.

Objectives: To assess the perception and barriers of the nursing staff in Sultan Bin Abdulaziz Humanitarian City (SBAHC) to the implementation of a new electronic handover information system.

Methods: This is a cross-sectional web-based survey with a series of closed-ended questions utilizing a three-section questionnaire that was developed by the study team. The study was conducted during a period from February to March 2022 including all the staff nurses working in SBAHC, full or part-time, and spending at least 50% of their time in direct patient care.

Results: The developed scale was valid and reliable, where Cronbach's alpha for the perception was 0.93 and 0.74 for the barriers. The mean age of the studied sample was 34.81 ± 6.44 years with more than 65% being females. A total of 128 (64%) had a positive perception of the electronic hand-over with the rate being higher among females, and those with work experience of fewer than 10 years. On the other hand, a total of 85.5% were having negative scores for the barrier, which was also associated with female gender and experience of fewer than 10 years.

Conclusions: The result showed that the assessment of the implementation of the electronic handover information system had more positive perceptions among nurses. Socio-demographic characteristics, such as good computer skills, were significantly associated with a positive perception.

Keywords: Electronic Shift Handover · Nurses perception · Information System · Nurses Barriers · Saudi Arabia

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1 Introduction

The handover process between the healthcare providers is one of the essential parts of the healthcare system as it mainly focuses on exchanging information pertaining to patient conditions and treatment plans, furthermore, the handover process among nurses needs to be at a higher level of quality and accuracy [1]. It should be a detailed process that is supported by evidence-based tools in order to ensure the quality, reliability, and accuracy of the information that is being exchanged between the nursing staff to maintain the continuity of care and patient safety by preventing adverse events and inappropriate procedures.

Verbal and paper-based handovers are still common practices in many institutions but the potential for clinical errors is significant [2]. On the other hand, handover communication protocols are designed to help nursing staff to structure their handover communication and present patients' information in a logical and coherent manner, with the aim of reducing the possibility of miscommunication or misunderstanding between the nursing professionals [3]. One of the best practices and recommended tools are (I-SBAR), which is an acronym of (I: Introduction, S: Situation, B: Background, A: Assessment & R: Recommendation). ISBAR is an internationally strongly recommended tool that provides a structure for teams to communicate important safety information related to patients during the hospitalization period [4]. However, despite the advantages of using a standardized communication framework, variations in the patterns of nursing handover communication and content have been observed [5].

An electronic handover information system can integrate and disseminate patient information more efficiently and accurately [6, 7]. It was associated with an increased handover completion rate, an increase in nurses' satisfaction, and a reduction in handover time [8, 9]. Not only that, but also it facilitates interdisciplinary communication, given the evidence regarding emergent communication patterns and the role of individual providers in the handover process [10]. It has been also proven to be a possible solution to avoid duplicate data entry and errors caused by information gaps as well as to maintain continuity of care [11].

Sultan bin Abdulaziz Humanitarian City (SBAHC) has recently implemented an electronic handover information system with the aim of supporting the handover process with an organized sequence of information that will help the staff, mainly nurses, to be focused, relevant, and able to communicate clearly with a timeliness patient-centered approach. However, the nursing staff could face several challenges during the handover process with the major challenges the nursing staff could face is the lengthy handover process and the huge amount of information in an unstructured way.

As per the Technology Acceptance Model (TAM*)*, the user acceptance of a new technology depends mainly on two factors, namely the *perceived usefulness and perceived* ease of use. T*hese factors* together, are thought to *determine attitudes toward the use of technology* by *affect*ing *the* behavioral *intention to use* the system [12]. Therefore, the aim of this study was to assess the perception and barriers experienced by nurses in using the electronic handover information system. Additionally, the current study aimed to assess factors associated with the perception and barriers of the nurses towards using the new system.

2 Methods

2.1 Study Design

This is a cross-sectional web-based survey with a series of closed-ended questions utilizing a three-section questionnaire instrument consisting of 28 questions that were developed by the authors of the study.

2.2 Study Population and Setting

The study participants are staff nurses working in SBAHC, full or part-time, regardless of job level, and spending at least 50% of their time in direct patient care. The study excluded staff nurses with work experience of fewerthan three months in SBAHC, staff nurses in the operating room, home health care, and sultan city medical center (SCMC) as those sections were using different form of handover. In this study, the aim was to reach 90 nurses, corresponding to five times the 19 items related to perception and barriers in the handover perception scale, considering that at least five to ten participants should answer each scale item. The total number of nurses that participated in this study was 200 participants.

2.3 Data Collection Tool

a. Baseline information

The SBAHC Electronic Handover Tool was developed by researchers and consisted of three sections. The first section included data related to the sociodemographic characteristics, namely: age, gender, marital status, educational level, work experience as a staff nurse (in years), work experience as a staff nurse in SBAHC (in years), current unit, level of computer skills, and whether they have received any form of education or training.

b. The electronic handover perception and barrier scale

The second section of the questionnaire is meant to assess the perception of the nurses of the electronic handover. It consisted of ten items that cover three dimensions including easiness of use, efficacy, and reliability. The easiness of use dimension includes four statements that were as follows: The electronic handover is easy to use, the electronic handover is practical to use, the electronic handover is understandable, and the electronic handover is presented in an organized manner. The efficacy dimensions included three items that were as follows the use of the electronic handover is effective in the transfer of information between nurses, the electronic handover provides specific patient information, and the current electronic handover information system allows modification of the information delivery process among nurses. The reliability dimension included the following items: the use of electronic handover is in accordance with the hospital's legal policy, I am satisfied with the use of electronic handover, and the information presented in the electronic handover is reliable.

The Third section means is t to assess the barriers for tong the electronic handover. It consisted of ten items that cover three dimensions including technical challenges, practicality, and training and knowledge. The technical challenges dimension included the following items: I experience technical difficulties in using the electronic handover information system and technical and system downtime greatly affects the use of electronic handover. The practicality dimension included the following items: I face difficulties in navigating the electronic handover, I face difficulty in retrieving the data from the electronic handover, the electronic handover information system is not practical to use, and the different delivery method used by each staff during staff-to-staff handover affects the overall process of the electronic handover. The training and knowledge dimension included the following items: I have a challenge in understanding the language used in electronic handover, the training and education I received on the proper utilization of electronic handover is not sufficient, and I am not fully aware of new hospital policy and procedures that cover the process in regards with the electronic handover. Each of the items had response options on a five-point Likert-type scale, from "1: disagree strongly" to "5: agree strongly".

2.4 Validity and Reliability

In order to increase the face validity of the questionnaire, the relevance of the questionnaire items was discussed with a small group of study members, including clinicians. Two of the group members (nurses with previous working experience in the study ward) made the first version of the questionnaire, and two other group members (a nurse and a doctor, both with clinical and research experience) gave comments and suggestions; this process was repeated several times until the complete group was satisfied with the result and the final version of the questionnaire was approved. A pilot study with 96 participants was conducted to assess the tool's practicality and estimate the time needed to complete it. Additionally, the explanatory factor analysis (EFA) and the confirmatory factor analysis (CFA) were used to determine the tool's construct validity. Intraclass correlation coefficient (ICC) and Cronbach's alpha internal co-efficiency were used to assess reliability.

2.5 Data Collection

The questionnaire was sent to all nursing staff in the form of an e-mail link to a secure web-based form. The researchers did not have access to information regarding who had responded to the questionnaire (and who had not). The questionnaire did not contain information that could identify the respondents, and all respondents were anonymous.

2.6 Ethical Consideration

The study was approved by the institutional review board in Sultan Bin Abdulaziz Humanitarian City, IRB No#63–2022. After explaining the purpose of the study, verbal consent was obtained from the nursing staff to assuring the strict confidentiality of any obtained information.

2.7 Statistical Analysis

Data were collected anonymously. The data were analysed using IBM SPSS statistical software, version 21. Data were analysed descriptively, where the t-test was used for continuous variables and the chi-square test was used for categorical variables. Cronbach's alpha was used to test internal consistency, while the time invariance of the instrument was tested through the test-retest approach. Construct validity was assessed using exploratory factor analysis and confirmatory factor analysis. A significance level of $P < .05$ was considered. The overall cut-off for the instrument was obtained by multiplying the correction factor with the 25^{th} percentile of each item and finally adding them up together. The correction factor was obtained from the ratio of the total weightage score and the total raw score. The weighted score for each value was obtained by calculating the observed item score and multiplying it by the product of the discrimination index and Cronbach's alpha.

3 Results

The instrument showed acceptable evidence of internal consistency, where Cronbach's alpha for the perception was 0.93 and 0.74 for the barriers. In the test-retest assessment of 15 nurses that was performed two weeks after the initial participation, there was no significant difference between the measurement from the overall scale, with a strong positive correlation between the scores of the two measurements performed with a four-week interval ($r = 0.986$, $p = 0.74$). EFA was conducted for the 18 items and indicated that the samples met the criteria for factor analysis, where Kaiser-Meyer-Olkin (KMO) measure was 0.931 and Bartlett's sphericity was statistically significant ($\chi 2 = 951.226$, $df = 45$, $p < .0001$). As per the CFA, the fit indices were as follows: the Chi-square goodness of fit ($\chi 2$) = 91.181, df = 32, $\chi 2/df = 2.8$, RMSEA = 0.09, CFI = 0.95, GFI = 0.91 AGFI = 0.85, and IFI = 0.95 which indicated that the scale is at a sufficient level of fit.

3.1 Sociodemographic Characteristics

The mean age of the studied sample was 34.81 ± 6.44 years with more than 65% being females. The mean duration for work experience was 10.07 ± 4.89 years. The vast majority had a bachelor's degree (92%) and had good computer skills (74.5%). Almost 50% of the nurses were working in the inpatient adult department as shown in Table 1.

3.2 Nurses' Perception Scores

The overall perception of study participants on feasibility and barriers to electronic handover was computed, and the score was calculated. The responses ranged from 1 = strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, and 5 = strongly agree. The response "agrees" or "strongly agree" on each item was considered a positive response. Perceptions of the feasibility of the electronic handover had ten items, the minimum score was 10, and the maximum score was 50. Thus, the score of 35/50 (70%) was taken as the

Table 1. Baseline characteristics of the study participants

Variable	Total (200)
Mean age, years (±SD)	34.81 ± 6.44
Mean Work experience, years (±SD)	10.07 ± 4.89
Received any form of training on the electronic handover N(%)	167(83.5)
Gender N (%)	
Males	65 (32.5)
Females	135 (67.5)
Marital status N (%)	
Single	80 (40)
Married	112 (56)
Widowed	7 (3.5)
Divorced	1 (0.5)
Educational status N (%)	
Bachelor's degree in nursing	184 (92)
Diploma in Nursing	15 (7.5)
Master's degree	1 (0.5)
Working Unit N (%)	
Ambulatory care clinics	12 (6)
Inpatient adult units	98 (49)
Emergency Room	11 (5.5)
Inpatient pediatric unit	68 (34)
ICU	11 (5.5)
Level of computer skills in relation to the use of electronic handover information system N (%)	
Good	149 (74.5)
Poor	51 (25.5)

ICU: intensive care unit.

cut-off point. Any score equal to or above 35 was categorized as a positive perception, while a score lower than 40 was categorized as a negative perception. The computed results indicated that most of the participants 128 (64%) had a positive perception of the electronic handover. There were 9 items for the barriers to electronic handover with a minimum score of 9 and the maximum score of 45. Thus, the score of 32/45 (70%) was taken as the cut-off point and was categorized as a positive perception while a score lower than 32 was categorized as a negative perception.

3.3 Nurses' Perception of Using the Electronic Handover

As shown in Table 2, the 5-point Likert scale was used to collect participants' perceptions on ten items related to the handover process. A total of 66.5% agreed that the handover is easy, practical (62%), understandable (67.5), effective in information transfer (60%), presented in an organized manner (60%), and in accordance with hospital policy (73%), provide specific information about the patient (70%), allow information modification (69.5%), reliable (65%), and 57% were satisfied with the electronic handover. The rate of participants who had a neutral perception of electronic handover ranged from 24% to 32.5%.

The results indicated that most of the participants 128 (64%) had a positive perception of the electronic handover system. This finding was consistent across age, gender, experience, and different departments, with significant differences between the positive and negative perception rates. However, the positive and negative perceptions of participants from two departments (ICU and inpatient adult) were not significantly different as shown in Table 3.

3.4 Nurses' Perception of Barriers Using the Electronic Handover

The most perceived barriers were technical downtime at 62.5%, different delivery methods, and technical difficulties in the electronic handover information system (32.5%). Almost 50% of participants were in disagreement in regards to different barriers to the electronic handover such as challenging understanding of the language used in electronic handover (55.5%), difficulties navigating the electronic handover (52%), difficulty retrieving the data from the electronic handover (47%), insufficient training (40.5%), handover information system is not practical (49%), lack of awareness about the new hospital policy about handover (49.5%). On the other hand, one-third of the participants had neutral perceptions concerning the barriers to electronic handover.

The computed results indicated that most of the participants 171(85.5%) had a negative perception of barriers to the electronic handover, which means that they believe that they did not perceive the questioned barriers as barriers to the electronic handover process, see Table 4. Regardless of the age group, both age groups had a significantly higher rate of participants who had negative perceptions of barriers to the electronic handover. Both genders have shown almost the same rates of participants with a negative perception of barriers that were significantly higher than the positive perception of barriers group. Additionally, years of experience did not show in difference in terms of the rate of participants with negative perceptions of barriers, which was significantly higher than those with positive perceptions of barriers. The rate of nurses with negative perceptions of barriers was significantly higher among those who were working in the ambulatory unit, emergency, and pediatric inpatients. Nurses' with good computer skills had lower rates than those who have a positive perception of barriers.

Table 2. Perception of barriers to using electronic handover

Variable	Strongly agree n(%)	Agree n(%)	Neutral n(%)	Disagree n(%)	Strongly disagree n(%)
Experience technical difficulties in using electronic handover information system	15 (7.5)	50 (25)	65 (32.5)	60 (30)	10 (5)
The challenge in understanding the language used in electronic handover	3 (1.5)	23 (11.5)	62 (31)	96 (48)	15 (7.5)
Difficulties in navigating the electronic handover	2 (1)	36 (18)	58 (29)	91 (45.5)	13 (6.5)
Difficulty in retrieving the data from the electronic handover.	4 (2)	35 (17.5)	66 (33)	88 (44)	6 (3)
The training received on the proper utilization of electronic handover is not sufficient	2 (1)	46 (23)	71 (35.5)	73 (36.5)	8 (4)
Technical downtime greatly affects the use of electronic handover.	35 (17.5)	90 (45)	44 (22)	23 (11.5)	8 (4)
An electronic handover information system is not practical to use.	4 (2)	31 (15.5)	79 (39.5)	74 (37)	12 (6)
Awareness about the new hospital policy and procedures related to electronic handover.	10 (5)	18 (9)	73 (36.5)	85 (42.5)	14 (7)
The different delivery method affects the overall process of the electronic handover.	11 (5.5)	76 (38)	71 (35.5)	37 (18.5)	5 (2.5)

Table 3. Nurses' perception of the electronic handover according to their gender, age, experience, unit, and computer skills.

Variable	Total		P-value
	positive perception score (n = 128, 64%)	Negative perception score (n = 72,36%)	
Age			
≤30 years (43)	29 (67.44)	14 (32.56)	**0.0013**
>30 years (157)	99 (63.05)	58 (36.94)	**< 0.0001**
Gender			
Male (65)	39 (60.0)	26 (40.0)	**0.0231**
Female (135)	89 (65.93)	46 (34.07)	**< 0.0001**
Experience			
≤ 10 years (118)	78 (66.10)	40 (33.89)	**< 0.0001**
> 10 years (82)	50 (60.97)	32 (39.02)	**0.0051**
Unit			
Ambulatory (12)	9 (75.0)	3 (25.0)	**0.0165**
Inpatient Adult (98)	54 (55.10)	44 (44.90)	0.1245
Emergency (11)	8 (72.72)	3 (27.27)	**0.0373**
Inpatient pediatric (68)	51 (75.0)	17 (25.0)	**< 0.0001**
ICU (11)	6 (54.54)	5 (45.46)	0.6773
Computer Skills			
Good (149)	104 (69.79)	45 (30.20)	**< 0.0001**
Poor (51)	24 (47.05)	27 (52.94)	0.5539

* Positive perception with a score ≥ 35; Neg: Negative perception with a score < 35 (The cut-off is 70% of the total score (35 out of 50)

3.5 Association of Nurses' Perception of the Electronic Handover with Demographic Factors, Personal and Work-Related Factors

Age, long work experience, and good computer skills were determinants of nurses' perceptions. However, only good computer skills were associated with a positive perception of the electronic handover, see Table 5.

3.6 Association of Nurses' Perception of the Barriers to the Electronic Handover with Demographic Factors, Personal and Work-Related Factors

The female gender was associated with a significantly increased risk of having a positive perception of barriers to the electronic handover, which means that they mostly assume that there are barriers. Such kind of association was also observed for experience years ≤ 10 years and working in the non-critical department, however, it was not significant.

Table 4. Nurses' barriers to electronic handover according to their gender, age, material status, experience, unit, and computer skills

Variable	Total		P-value
	Negative perception of barriers (n = 171, 85.5%)	Positive perception of barriers (n = 29, 14,5%)	
Age			
≤ 30 years (43)	40 (93.02)	3 (6.98)	**< 0.0001**
> 30 years (157)	131 (83.43)	26 (16.57)	**< 0.0001**
Gender			
Male (65)	51 (78.46)	14 (21.54)	**< 0.0001**
Female (135)	120 (88.88)	15 (11.12)	**< 0.0001**
Experience			
≤ 10 years (118)	100 (84.74)	18 (15.26)	**< 0.0001**
> 10 years (82)	71 (86.58)	11 (13.42)	**< 0.0001**
Unit			
Ambulatory (12)	10 (83.33)	2 (16.64)	0.0014
Inpatient Adult (98)	76 (77.55)	22 (22.45)	**< 0.0001**
Emergency (11)	11 (100)	-	-
Inpatient pediatric (68)	67 (98.52)	1 (1.48)	**< 0.0001**
ICU (11)	7 (63.63)	4 (36.37)	0.2116
Computer Skills			
Good (149)	134 (89.93)	15 (10.07)	**< 0.0001**
Poor (51)	37 (72.54)	14 (27.46)	**< 0.0001**

Positive perception of barriers is for patients with a score ≥ 32, and negative perception of barriers is for patients with a score < 32. (The cut-off is 70% of the total score (32 out of 45). ICU: intensive case unit.

Table 5. Factors associated with a positive perception of electronic handover.

Variables	OR	(95% CI)	P-value
Age ≤ 30 years	1.21	0.59 – 2.48	0.59
Female Gender	0.57	0.30 –1.09	0.08
≤ 10 years of experience	1.2	0.69 – 2.24	0.458
Non-critical care departments	0.98	0.39 – 2.46	0.84
Good computer skills	2.6	1.35 – 4.98	**0.003**

OR: odds ratio, CI: confidence interval

Table 6. Factors associated with a positive perception of barriers to electronic handover.

Variables	OR	95% CI	P-value
Age ≤ 30 years	0.377	0.10 – 1.31	0.11
Female Gender	2.19	0.98 – 4.88	**0.049**
≤ 10 years of experience	1.14	0.50 –2.57	0.74
Non-critical care departments	1.36	0.42 – 4.35	0.74
Good computer skills	0.29	0.13 – 0.66	**0.0023**

OR: odds ratio, CI: confidence interval

On the other hand, having good computer skills was significantly associated with a decreased risk of the positive perception of barriers, which means that this skill reduces the perception of the existence of the barriers or their effect. The age ≤ 30 was also associated with a decreased risk of the positive perception of barriers; however, this association was not significant, See Table 6.

4 Discussion

The main aim of the current study was to assess the perception and barriers of the nurses for the electronic handover system using a newly developed and validated tool. The main finding in this study was divided into two parts, the first part was related to the staff nurses' perceptions towards using electronic handover, in this part, the nursing staff was satisfied with the reliability of the information provided by the electronic handover, the layout of the form as well as the practicability of the handover system, moreover, they responded positively to the feasibility and easiness of use of the system in terms of allowing them modified patient information in addition to the easiness of navigating the patient information as needed during the handover process between nurses. Using the electronic handover information system is considered reliable information for the nursing staff during the handover process with a comprehensive structure for information exchange and provides a standardized layout that contributes to a shared understanding among nurses [4]. The other finding of the study was related to the barriers to using electronic handover, the findings related to this section reflect that there are some fears within the nursing staff towards the electronic handover system due to technical downtime factors, which could negatively affect the smoothness of handover process, however, the nursing staff supported the process of retrieving the data in case of system downtime [13].

Table 4 supports the satisfaction level of the staff to use the electronic handover, as they express that the sequence of information is presented in an organized way which will save their time as well as provide an efficient handover process. Proper staff training, as well as staff awareness in using the system, were highlighted by staff response that the need for training is important and plays a vital role as a barrier to using the system, furthermore, half of the participants were in disagreement in regard to different barriers for the electronic handover such as challenging in the understanding language used

in electronic handover and difficulties in navigating the electronic handover [14]. The statistical analysis of the study demonstrated several factors associated with a positive perception of the new handover system, one of those factors was good computer skills with a significant P Value of (0.003), although nurses do not need a high degree of computer expertise, their performance will be much more efficient if they have good computer skills. In other words, good computer skills are supporting nurses to operate computers proficiently and then quickly access healthcare-related information [17] while using the electronic handover. Moreover, the statistical analysis of barriers under Table 6 reflects the importance of having good computer skills in reducing the risk of positive perceptions of barriers with a P. value of 0.002 [15].

This study's findings provide a good reference for better understanding nurses' perceptions during their transition to using a new HIS. The results reveal important aspects of challenges, barriers, and benefits of using the HIS and suggestions for the successful implementation of a new HIS. From the literature review, easy-to-use and integration with existing systems were the most critical requests to achieve user adherence there have been many studies carried out related to performing an electronic handover one of these studies showed that an integrated system of handover has positive outcomes of improved nurse satisfaction, nurses being informed about it [13, 16].

5 Limitations

Data were self-reported by participants. Some participants may have subconsciously responded in a manner that does not reflect the truth to answer the scale correctly rather than giving their own personal answers.

6 Conclusion

The result showed that the assessment of the implementation of the electronic handover information system had more positive perceptions among nurses. Socio-demographic characteristics, such as good computer skills, were significantly associated with a positive perception, however, the importance of training and enhancing the nursing staff awareness has been considered an asset to the electronic handover process and could increase the positive perception of barriers. This paper reflects the applicability of the electronic handover system in improving the continuity of care among the nursing staff through the accurate and reliable exchange of information as well as the accessibility of clinical information during the process itself which could positively impact the treatment plan by preventing adverse events, inappropriate procedure, and delays in treatment during the hospitalization period. The study showed that the implementation of electronic handover technology is valuable, attainable, and feasible to ease the exchange of information among healthcare providers. Even though this study contributes to an increased understanding of the perception and barriers to electronic handover among nurses in clinical practice, further studies should be considered to address the implications of the electronic handover for other aspects such as the impact on, patients' satisfaction and quality of care.

7 Disclosures Human Subjects

Verbal consent was obtained or waived by all participants in this study. Sultan Bin Abdulaziz Humanitarian City Institutional Review Board issued approval 63–2022-IRB. The study used anonymous data for analysis. The study was performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

8 Animal Subjects

All authors have confirmed that this study did not involve animal subjects or tissue.

9 Conflicts of Interest

In compliance with the ICMJE uniform disclosure form, all authors declare the following: Payment/services info: All authors have declared that no financial support was received from any organization for the submitted work.

10 Financial Relationships

All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. Other relationships: All authors have declared that there are no.

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