"Evaluation of the Effectiveness of Electronic Patient Report (ePCR)in the Saudi Red Crescent Authority (SRCA) in the Western Region to Reduce Treatment Intervention Errors"

Presented by:

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Date: March 2024

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Research project declaration form

I, the undersigned, declare that the information provided in this Research Declaration Form for research (Evaluation of the Effectiveness of Electronic Patient Report (ePCR)in the Saudi Red Crescent Authority (SRCA) in the Western Region to Reduce Treatment Intervention Errors) is accurate and complete to the best of my knowledge.

I understand the ethical and legal responsibilities associated with conducting this research and will adhere to all relevant guidelines and regulations.

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Date: 31/03/2024

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Date: 31/03/2024

Abbreviation

DSS: Decision Support System

EMR: Electronic Medical Records

EMS: Emergency Medical Services

EMT: Emergency Medical Technician

ePCR: Electronic Patient Care Report

EPR: Electronic Patient Record

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GPS: Global Positioning System

HIS: Health Information System

HIT: Health Information Technology

IT: Information Technology

PCR: Patient Care Report

SRCA: Saudi Red Crescent Authority

AI: Artificial Intelligence

Abstract:

Medical errors have become a significant concern in healthcare systems worldwide leading to adverse patient outcomes and increased healthcare costs. The implementation of Electronic Patient Reports (ePCR) has been involved as a potential solution to mitigate medical errors and improve patient safety. This research proposal aims to investigate the effectiveness of electronic patient reports (ePCR)in the Saudi Red Crescent Authority (SRCA) in the Western region to reduce treatment intervention errors. And measuring the importance of developing electronic reports to reduce medical errors by using artificial intelligence in the process of determining proper medical intervention, as they are determined after setting basic inputs according to the SRCA medical guidelines.

Method

The study design that will be used in this research is a descriptive cross-sectional study in which a questionnaire will be used to collect data about how the electronic patient care report (ePCR) affects the prehospital setting outcomes, saves time, enhances performance, and minimizes medical treatment errors in Saudi Red Crescent Authority in the western region. The study was conducted between August 30 to 12 December, 2023, including all phases.

Results

The data indicates that the majority of study individuals were male (97%), while only a small percentage were female (3%). In terms of age distribution, the highest proportion of respondents fell within the 31-40-year age group, followed by 20% in the 41-50-year age group, and 10% below the age of 30. Respondents over the age of 50 accounted for only 4% of the sample. The distribution of work locations was evenly split, with 50% working inside Makkah and 50% working outside Makkah. In terms of professions, 72% of respondents worked as Emergency Medical Services Technicians, 22% were Emergency Medical Services Specialists, 4% were physicians, and 2% were Emergency Medical Dispatchers. Regarding years of experience, 44% of respondents had 11-20 years of experience, followed by 30% with 6-10 years of experience. Approximately 14% had more than 20 years of experience, while those with less than 5 years of experience accounted for around 13% of the sample.

The respondents expressed a neutral stance on the motivational effect of the ePCR application, with average scores indicating neutrality. They were also divided in their opinions on job satisfaction with the ePCR system, leaning towards disagreement. The respondents held neutral views on the reasons for adopting the ePCR system, with no

strong consensus on its benefits. Similarly, they disagreed on the performance quality of the ePCR system, expressing reservations about its reliability, ease of use, and integration with artificial intelligence for medical decision-making. These findings reflect the mixed opinions and concerns of the respondents regarding the ePCR system.

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Conclusion

There is a relationship between both motivational impact and job satisfaction with SRCA prehospital healthcare providers' knowledge about the reason behind adopting the ePCR system, the quality of the system's performance, and the quality of the system's information to reduce interventional medical errors.

Also, the importance of developing the current program of ePCR and adding artificial intelligence to provide appropriate diagnoses and interventions based on medical protocols.

CHAPTER ONE

INTRODUCTION

While many sectors are moving toward Information Technology (IT) as a solution to solve some problems related to performance and quality, in the healthcare field, Healthcare Information Technology (HIT) has an impact on the process including job tasks of healthcare workers and many advantages according to the entity which adopted that Health Information System (HIS) (ElSaied & Khan, 2017). Under the E-Government section, the document of Saudi Vision 2030 encourages and supports governmental entities to expand the use of the HIS application and effective data-sharing platforms, such changes inside governmental entities and healthcare organizations like any lead to change in the process. According to the World Health Organization healthcare digital services include four classifications: intervention for clients, intervention for healthcare workers, intervention for a health system or resource managers, and intervention for data services (World Health Organization, 2016). Innovative solutions have many goals such as improving processes, reducing costs, and improving quality. These innovations include Telemedicine, Electronic Health Records, Electronic Medical Records (EMR), and Electronic Patient Care Reports. So, every intervention should be evaluated and monitored carefully for the main objectives of implementation and other effects (Ricciardi et al., 2019). In general, HIS can be defined as a combination of hardware, software, and people who are using that system, and the process in which that system be used to achieve the goals of HIS implementation (Al-Gharbi et al., 2015; Smuts et al., 2017). In the field of Emergency Medical Services (EMS) as a part of health system technology development was introduced in developed countries EMS system as a recommended improvement area in the EMS industry (Schooley & Horan, 2015). Any change in healthcare organizations will be done through one of the health system building blocks, which are; health services delivery, workforce, medical productions such as drugs and technologies, financing system, governance and leadership, and finally, Health Information System (HIS), which is an important building tool to find reliable innovations and solution for health system governance, reducing cost, and ease healthcare delivery which is the main objective of using information technologies such as ePCR (Stoskopf et al., 2017). Despite these known objectives, there is no detailed information about the effects of such technologies on prehospital workers who are working in a different environment in comparison with healthcare workers who are working at hospitals. The prehospital environment has a slower technology engagement than hospitals (Saini et al., 2005).

recently increasing usage of electronic health records (EHRs) and the persistent issue of preventable diagnostic errors in healthcare. It highlights that EHRs may contribute to diagnostic errors due to poor usability and over-reliance on electronic chart-based communication. (Liebovitz, 2015)

The changing context of healthcare delivery provides financial incentives for organizations to leverage EHRs in reducing diagnostic errors. However, the lack of standard quality metrics for reporting diagnostic error rates, feedback systems for physicians and organizations, and compelling evidence for specific interventions necessitate further research in preventing diagnostic errors. practical next steps for leveraging EHR systems to assist in the diagnostic process, including patient engagement strategies, closed-loop result tracking, targeted next-step reminder systems, and expanding actionable patient states based on diagnosis triggers.(Liebovitz, 2015)

CHAPTER TWO

LITERATURE REVIEW

There is an emerging interest in studying innovation and technology applications in order to understand the effect of these technologies. Focusing on the quality of healthcare and cost is common because they are the main objectives of technology use in healthcare as the technology eases governance of healthcare services and increases access (Shahmoradi et al., 2017). Sasson et al., 2012; mentioned that Emergency Medical Services agencies are motivated to adopt ePCR, to support quality improvement efforts. This is true at the agency level, but at the individual level, new technologies may face resistance and different levels of perceived usefulness of technology which is the degree to a worker believes that the new system will improve his performance (Vitari & Ologeanu-Taddei, 2018). This will motivate the healthcare worker and increase his confidence to complete his tasks. Similar motivational factors may enhance the ability of managers to change and overcome subordinate's concerns about new organizational changes (Kellogg, 2019). For example, in our context utilization and taking advantage of the positive effects of ePCR application may help us to develop an electronic Decision Support System to help prehospital providers deal with various emergencies more efficiently (Johansson et al., 2018). Documentation is an important and critical part of patient care. Patient Care Report (ePCR) is an authentic record of all events occurring during emergency medical services (EMS) calls, including all important information about patients, persons, provided medical care, treatment intervention, and scene information. The correctly written PCR most accurately describes assessment, care provided by a prehospital healthcare provider, and the effect of provided care (Bledsoe et al., 2017). Measure goals of ePCR are to provide comprehensive information about the patient and provide care to subsequent healthcare providers, to provide billing information for reimbursement, and to provide legal records that are useful in case of a court proceeding. In addition to medical, administrative, and legal information, ePCR is a rich source of information for researchers. It could be used in determining the efficiency of a new procedure or drug and could be used in the continuous improvement process (Bledsoe et al., 2017). In the context of Saudi Arabia, according to Vision 2030 goals, many initiatives were started by all governmental organizations through the National Transformation Program 2020 (MOH, 2019). The Healthcare industry is similar to other sectors mediated by digital uprising (Sarangi & Wynn, 2016). Using HIT to improve quality, reduce costs, reduce medical errors, and increase access to healthcare services are the main goals of HIT applications. This is true at the agency level, but at the individual level, new technologies may face resistance and different levels of perceived usefulness of technology which is the degree to which a worker believes that the new system will improve his performance and quality level of services he provides (Vitari & Ologeanu-Taddei, 2018). in our context utilization and taking advantage of the positive effects of ePCR application may help us to develop an electronic Decision Support System (DSS) to help prehospital providers deal with various emergencies with more efficiency, which improves the quality of care and reduce medical errors (Johansson et al., 2018). Artificial intelligence (AI) can be used to reduce medical errors in several ways. One application is the development of medical chatbots that can diagnose diseases and provide basic information to users before consulting a doctor (S., A. 2022). AI algorithms can also assist medical providers in diagnosing conditions or predicting them, improving the efficiency of medical care and reducing costs and medical errors, (Liang. 2023). Additionally, AI integrated with smart medical sensors can monitor patient health conditions, helping to prevent errors in treatment and medication adherence (F, Alp., Betül, Akalın. 2022) In the field of oncology, AI methods have been used to provide more effective service to patients, minimize costs, and reduce errors in decision-making (2022. Healthcare.). Furthermore, AI can help medical providers prevent medical errors by automating tasks such as medical billing and reducing paperwork, allowing them to spend more time with patients (Daniel, Salamone. 2023). Artificial intelligence is widely used in healthcare, and there is a growing interest in implementing machine learning models in medical practice High-quality datasets are crucial for training artificial intelligence models, and the transition from a model-centric approach to a data-centric approach is occurring in the field. The collection of statistically reliable medical datasets poses challenges, and the article explores an innovative solution: synthetic datasets. Synthetic datasets can address issues related to dataset quality in artificial intelligence training, and they have the potential to reduce development time, balance data, and improve the quality of artificial intelligence products in the medical field. (Daniel, Salamone. 2023).

The implementation of an electronic medical record (EMR) is being encouraged by the government to reduce medical and medication errors and improve healthcare efficiency and safety. Implementing an EMR has significant health and safety benefits, with potential annual savings of $81 billion if organizations implement and networked EMR. EMR enables the prevention and management of chronic diseases, contributing to improved healthcare outcomes. (Karena, Russell. 2011).

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Clinicians are generally satisfied with the electronic system as it reduces or eliminates paperwork. This satisfaction level increases progressively with time as they practice the system, get proper technical support and training to get the maximum benefits of that system (Chisolm et al., 2010). At the same time, dissatisfaction may come from problems in the operation of the new system which may delay workflow or come with some complications, in the addition to changes in daily routine (Khajouei et al. 2011).

In a study Job satisfaction of healthcare workers linked to the adoption of E- Health system which is broader than ePCR or EMR systems (Atinga et al., 2020).

CHAPTER THREE

OBJECTIVES

Research Aims

Objectives of the Study

- Aim of the Study:

To evaluate the effectiveness of electronic patient report (ePCR)in the Saudi Red Crescent Authority (SRCA) in the Western region to reduce medical intervention errors.

- Specific Objectives:

1- To collect data about medical intervention errors.

2- To collect data about performance.

3-To collect the data about Accuracy of data filling in (ePCR) and percentage of errors.

4- To know whether applications of information technology, especially Electronic Patient Care Report ePCR motivate SRCA prehospital healthcare workers.

5- Understand how the application of HIT in prehospital settings affects ambulance service workers.

- Secondary Objectives:

1- To develop the (ePCR) and linking to artificial intelligence in the process of determining medical interventions in order to reduce medical errors and save time.

CHAPTER FOUR

RESEARCH METHODOLOGY

Methodology and Procedures
Preamble:
This chapter tackles detailed analysis, shows the results throughout the statistical management that has been performed on the sample of the study, analyzing and discussing the results.

Methodology of Study and Tool:
The researcher has utilized the descriptive methodology that considers the best-utilized methodology on researchers and it considers available to this study. This methodology describes all matters, interprets and defines the circumstances which exist on the fact, points out the common or prevailing practices or any methodology that relates to the definite phenomenon in order to describe and interpret. The tool of study has been described to find the descriptive statistics for all questions. a

questionnaire will be used to collect data about how the electronic patient care report (ePCR)does affect the prehospital setting outcomes, saves time, enhance performance, and minimizes medical treatment errors in Saudi Red Crescent Authority in western region.

the questionnaire is provided in two languages English and Arabic, to help participants at all professional levels to understand questions before responding. The questionnaire has sixteen questions including Socio-Demographic information. All of the questions in section two to section Five were designed to be answered on the Likert Scale with Five possible responses ranging from (1 Strongly disagree) to (5 Strongly agree); other responses were (2 disagree), (3 neutral), and (4 agree).

The questionnaire was developed in Five sections: Socio-Demographics characteristics with five questions about gender, age group, working location, years of experience, and profession. Section two is about the motivational effect of the ePCR application with Two questions. Section Three is about Job satisfaction with the ePCR. Section four has three questions about workers' perceptions of the cause behind the ePCR adoption. Section Five is about the ePCR System performance quality with Four questions. All questions were used in previous studies. (Alharthi et al., 2014; Atinga et al., 2020; Yoo et al., 2020). And were modified to fit in our context because most previous studies on HIT systems were done in the hospital setting previous studies on HIT systems were done in the hospital setting while we are trying to explore another environment which is the HIT system in the prehospital setting. All questions are positively worded to ensure questionnaire consistency.

Population and Sampling

The population under consideration for this research are EMS workers in western region (Makkah, Jeddah and Al Taif) in Saudi Arabia. the sampling method to be used is simple random, where the sample of the study (360) EMS workers.

Study Setting:

The study includes EMS workers who have been working in the Saudi Red Crescent Authority in the Western region. The data were collected from SRCA Emergency Medical Services (EMS) stations in Makkah city by using an electronic questionnaire. Data will be analyzed using Statistics Package for Social Sciences Software (SPSS).

• **Study subject:**

▪ **The inclusion criteria**

Dispatch center, Quality employees, EMTs, Physicians, Paramedics, and Nurses who have been working in the Saudi Red Crescent Authority (SRCA).

▪ The exclusion criteria (if any)

Drivers, Logistic employees, and Administrations who have been working in Saudi Red Crescent Authority (SRCA)

Sampling:

The study will be conducted among EMS workers in the western region(Makkah, Jeddah, and Al Taif) in Saudi Arabia. The equation of simple random sampling which depends on population proportion will be used in determining the sample size, the equation takes the form:

$$n = \frac{z^2 P(1-P)}{d^2} \text{ Where:}$$

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n: sample size.

z: The standard variable of the normal distribution.

corresponding to 95% confidence level.

P: Anticipated population proportion.

d: the absolute statistical precision on either side of the anticipated population proportion.

Using 95% confidence, d = 10% and P = 50%

The estimated initial sample size is 360 cases.

Characteristics of study sample individuals

In the light of questions and targets of study, the study has been reached at the followings:
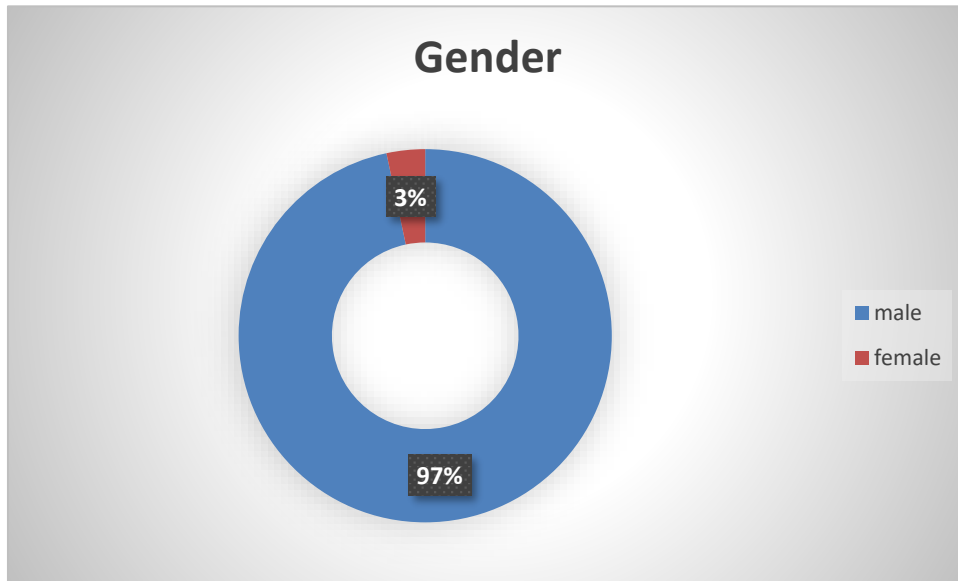
firstly: Demographic information: The followings show the general information of the study sample about the demographic data of sample individuals (360) on answering the first part from the questionnaire and the individuals have been classified into the following case:

Gender:

Table (1) Shows the distribution of study individuals according to their gender

Gender	Frequency	Ratio
male	348	97%
female	12	3%
Total	360	100%

Source: Preparation by Researcher by SPSS V.26 2026

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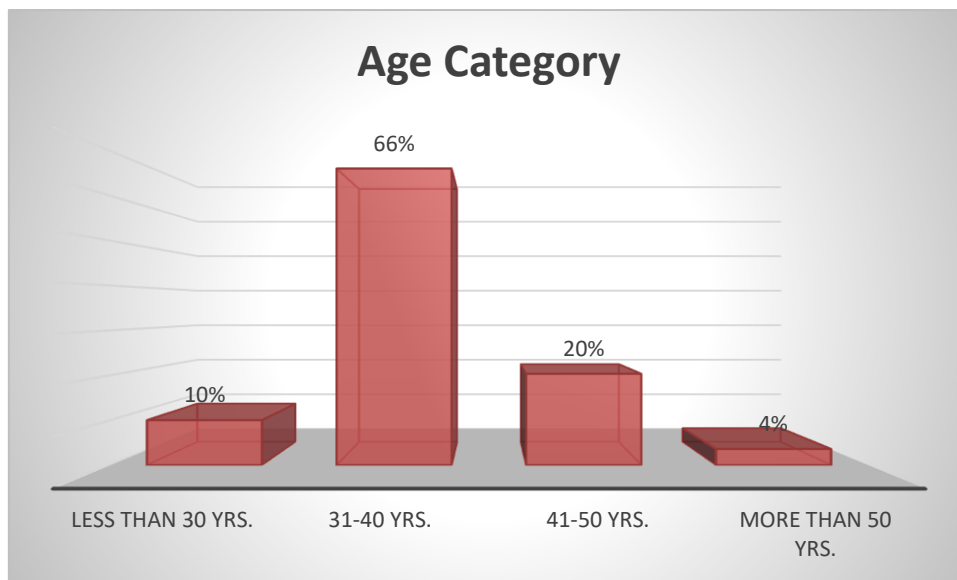
The aforementioned table & figure show that (97%) of study individuals were males, while only (3%) of the study individuals were female.

Age Category:

Table (2) Shows the distribution of the study sample according to their Age

Age	Frequency	Ratio
less than 30 yrs.	36	10%
31-40 yrs.	237	66%
41-50 yrs.	73	20%
more than 50 yrs.	13	4%
Total	360	100%

Source: Preparation by Researcher by SPSS V.26 2026

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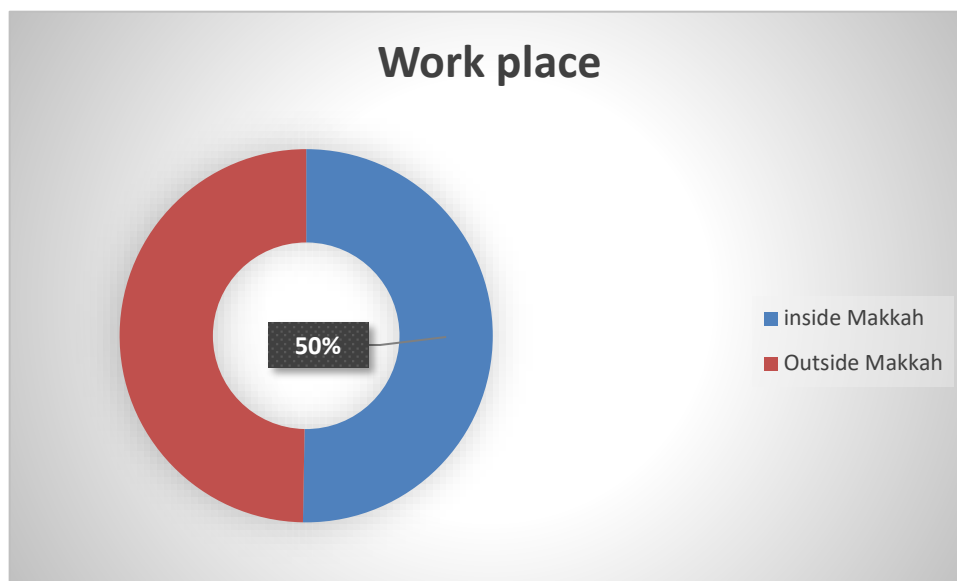
Age Category

The aforementioned figure & table shows that the majority of respondents were (31-40 yrs.) followed by 20% whose (41-50 yrs.) and 10% less than 30 yrs. While just 4% of the study individuals over 50 years old.

Work place:

Table (3) shows the distribution of the study sample according to their Work place

Work place	Frequency	Ratio
Inside Makkah	181	50.3%
Outside Makkah	179	49.7%
Total	**360**	**100%**

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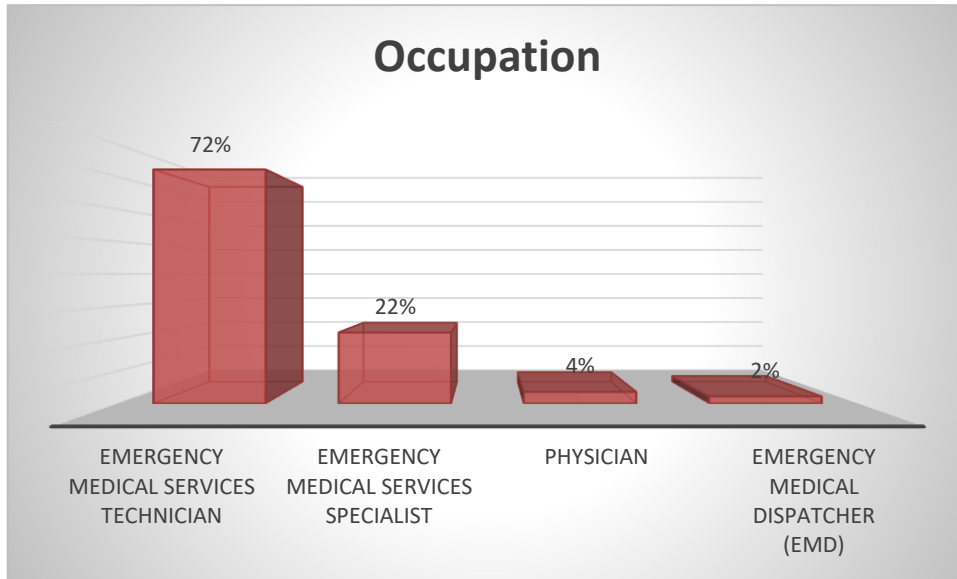
The aforementioned figure & table show that the distribution of study individuals according to their work place are equal 50% for both inside & outside Makkah

Occupation

Table (4) shows the distribution of the study sample according to their occupation

Occupation	Frequency	Ratio
Emergency Medical Services Technician	260	72%
Emergency Medical Services Specialist	79	22%
Physician	7	4%
Emergency Medical Dispatcher (EMD)	5	2%
Total	360	100%

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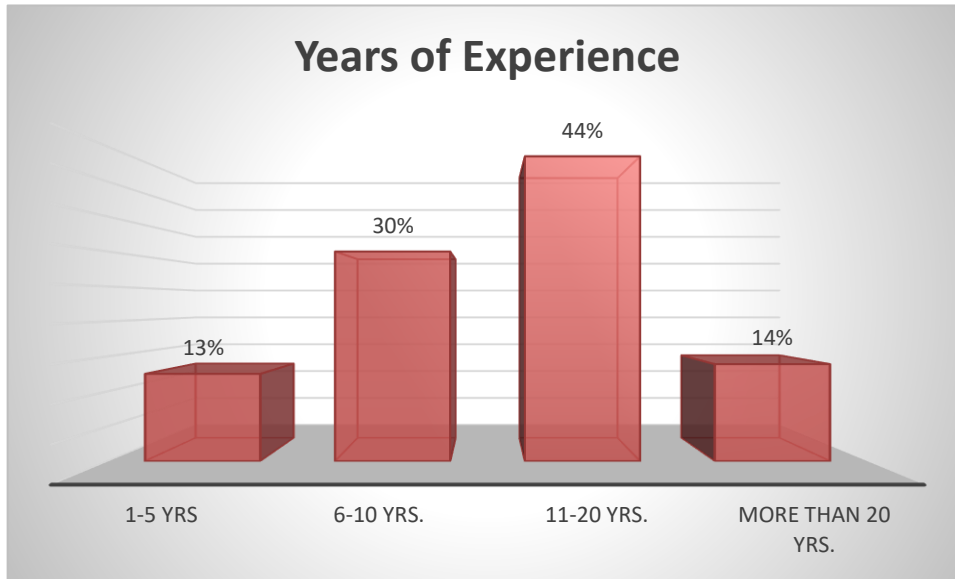
Occupation

The aforementioned figure& table shows that 72% of respondents works as "Emergency Medical Services Technician", and about 22% are "Emergency Medical Services Specialist", while Physician are 4% and 2% are EMD.

Years of Experience:

Table (5) Shows the distribution of study individuals according to their Years of Experience

Years of Experience	Frequency	Ratio
1-5 yrs	45	13%
6-10 yrs.	108	30%
11-20 yrs.	157	44%
More than 20 yrs.	50	14%
Total	360	100%

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Years of Experience

Concerning the number of years of experience, we notice that 44% have experience of about 11–20 years, followed by 30% for those who have experience of 6–10 years. Also, about 14% have experience more than 20 years. While those who have less than 5 years of experience are estimated at about 13%.

Tool of study

The study depends on a questionnaire which is considered the appropriate tool to collect data and the questionnaire is consisting of two parts:

First part includes the personal information of study individuals.

Second part includes the axes of the questionnaire and it shall be formulated according to targets and study questionnaires on the following matter:

The Health Lifestyle and Personal Control Questionnaire

• **First axis:** The motivational effect of the (ePCR)application

• **Second axis:** Job satisfaction with the (ePCR)

• **Third axis:** Worker's perceptions about the cause behind the (ePCR) adoption

• **Fourth Axis:** ePCR System performance quality

Validity of tool:

It will implement to make sure of the validity of the study tool with the following methods: -

• **internal consistency validity**: many methods shall be used to reach this type of validity such as calculating the degree of relationship between the items with the total degree, the degree of relations will be an indicator in order to judge the extent of each item validity on measuring the characteristics that total degree shall seek to measure it.

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For more assurance about the of the study tool and its structure validity, the researcher has calculated the coefficient of correlation of axis items with the total degree for all items of this axis, the calculation has been implemented on all axes as described on hereunder table:

Table (6) Pearson's test Correlations

Item	Variables	Correlation
1.	**The motivational effect of the (ePCR)application**	0.944**
2.		0.930**
3.	**Job satisfaction with the (ePCR)**	0.937**
4.		0.933**
5.	**Worker's perceptions about the cause behind the (ePCR) adoption**	0.829**
6.		0.904**
7.		0.872**
8.	**ePCR System performance quality**	0.790**
9.		0.873**
10.		0.853**
11.		0.796**

**Correlation is significant at the 0.01 level (2-tailed).

The table shows the correlation between various variables related to the adoption and impact of the ePCR (electronic Patient Care Report) application. Which represents statistical significance at the level of significance (0.01), which indicates to the structural validity of tools and then assurance to results.

Reliability of tool:

to assess the extent of the study tool (questionnaire), the researcher has utilized Cronbach' Alpha to make sure of the validity of the study tool and the researcher has implemented the equation to assess the structural validity and the table (7) shows the study reliability coefficient

Table (7) Cronbach' Alpha to assess the tool of study

Items Of Questionnaire	No. of questions	Reliability of question
The motivational effect of the (ePCR)application	2	0.859
Job satisfaction with the (ePCR)	2	0.856
Worker's perceptions about the cause behind the (ePCR) adoption	3	0.837
ePCR System performance quality	4	0.842
Total	11	0.935

The aforementioned table shows that that the coefficient of reliability of study questions is at high level, whereas reaching between (0.837 – 0.859) and that indicates to the items of the questionnaire are advantaged with a good degree of reliability and it can be depended on the operational implementation of the study where the general reliability for all axes are (0.935)

Used Statistical methods on analyzing data: -

For the questionnaire's axes, to achieve the targets of study and analyzing data, many appropriate statistical methods have been used by statistical package for social sciences and its abbreviation is (SPSS). After entering data to and to define the length of Pentagon standard (upper and lower limitations) that used on study items, the extent has been calculated (5-1=4), then dividing into many cells of the questionnaire to get the correct length of the cells for the first axe which is followed

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Likert's triple scale, that meaning (4/5=0.8), after that this value has been added to the least value on standard (or the beginning of standard is one) to define the upper limits of this cell.

Category	Means Range	DEFINITION
First	1 – 1.80	**STRONGLY DISAGREE**
Second	1.81 – 2.60	**DISAGREE**
Third	2.61 – 3.40	**NEUTRAL**
Fourth	3.41 – 4.20	**AGREE**
Fifth	4.20 – 5.00	**STRONGLY AGREE**

The frequencies and percentages have been calculated in order to know the personal and professional characteristics of the items of the study's sample and define the responses of its items towards the basic items that including to the tool of study, after that the following statistical standards have been calculated:

- **Average:** in order to know the extent of increasing or decreasing of responses of study individuals about the questions of study (average of phase's average). Noting that it is helpful for arranging the items of study according to the higher weighted mean.

- **Standard deviation** has been utilized in order to know the extent of deviation or dispersion of study individuals` responses for each item of study variables, for basic axis and mean. It has been noted that the Standard deviation shows the dispersion of responses of study sample individuals for each item of study variables to the side of basic axes, when its value is near zero, the responses will be centralized and decreased the dispersion between standards.

- **Person Correlation** has been utilized to know the degree of relationship between each question of the study.

- **Cronbach's Alpha:** to test the extent of reliability of the study tool.

CHAPTER FIVE

Analyzing and discussing the question

The RESULTS

Analyzing and discussing the question of the study:

This section tackles the results and discusses of operational study throughout shows the responses of study individuals on questionnaire items and answering the following questions .and we used the averages, standard deviations for responses of study individuals on questionnaire questions have been frequented and the results shall be on hereunder tables.

1. The motivational effect of the (ePCR)application

2. Job satisfaction with the (ePCR)

3. Worker's perceptions about the cause behind the (ePCR) adoption

4. ePCR System performance quality

The motivational effect of the (ePCR)application

To identify the factors for the axe's statements, the calculation averages, the standard deviations, and the levels of the responses of the study individuals were calculated on the factors regarding the Dietary Healthy Choices

Table (9) responses of the study individuals on the motivational effect of the (ePCR)application study axes

#	Axis phrases	Avg.	S. D	%	Rank
1.	The Electronic Patient Care Report (ePCR) make recording data easier at my workplace.	3.03	1.49	61%	1
2.	With the Electronic Patient Care Report (ePCR) system, I am motivated to improve the patient experience	2.86	1.34	57%	2
	Average of Axis= 2.95				
	Stander deviation of Axis=1.41				

Table (9) table shows that all of the items of the axis are dissimilar refer to (Neutral), these averages are located on the extent (2.86-3.03), from the Five-point Likert scale frequencies gradual categories, along with the degree of approval by the study individuals about on the motivational effect of the (ePCR)application, indicated general average of (2.95) this result explains the "Neutral" consent of the respondents. Moreover, the results showed that the respondent provide neutral response regarding that the (ePCR) make recording data easier at their workplace with 61%, also with ePCR system 57% are motivated to improve the patient experience

Job satisfaction with the (ePCR)

In order to identify the factors for the axe statements, the calculation averages, the standard deviations, and the levels of the responses of the study individuals were calculated on the ePCR job Satisfaction.

Table (10) responses of the study individuals on the study axes

#	Axis phrases	Avg.	S. D	%	Rank
	Generally, I am satisfied with the current Electronic Patient Care Report (ePCR) system	2.29	1.33	46%	2
2	With the Electronic Patient Care Report (ePCR) system, my performance at work is satisfactory	2.33	1.29	47%	1
	Average of Axis= 2.31				
	Stander deviation of Axis=1.31				

Table (10) table shows that all of the items of the axis are similar refer to (Disagree), from the Five-point Likert scale frequencies gradual categories, along with the degree of approval by the study individuals about on Job satisfaction with the (ePCR), indicated general average of (2.31) this result explains the "Disagree" consent of the respondents. Moreover, the results showed that the respondents are disagree that (ePCR) system, made their performance at work is satisfactory 47%, also they are not satisfying in general with the current ePCR system 46%

Worker's perceptions about the cause behind the (ePCR) adoption

In order to identify the factors for the axe statements, the calculation averages, the standard deviations, and the levels of the responses of the study individuals were calculated on the perceptions about the cause behind the (ePCR) adoption.

Table (11) responses of the study individuals on the study axes

#	Axis phrases	Avg.	S. D	%	Rank
1.	Emergency Medical Services Universal best practices require us to use Electronic Patient Care Report System (ePCR).	3.13	1.35	63%	1

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.2	My organization uses Electronic Patient Care Report (ePCR) to improve the efficiency of the decision process.	2.73	1.37	55%	3
.3	My organization uses Electronic Patient Care Report (ePCR) to reduce medical intervention errors.	2.78	1.39	59%	2
	Average of Axis= 2.88				
	Stander deviation of Axis=1.37				

Table 11 presents the findings regarding the respondents' perceptions about the cause behind the adoption of the Electronic Patient Care Report (ePCR) system. The table indicates that all items in this axis received similar responses, falling under the "Neutral" category on the Five-point Likert scale. The average score of 2.88 further confirms the respondents' neutral stance. Additionally, the results reveal that the respondents neither agree nor disagree on certain aspects. Specifically, 63% neither agree nor disagree that Emergency Medical Services Universal best practices require the use of the ePCR system. Similarly, 59% neither agree nor disagree that their organization uses ePCR to reduce medical intervention errors, and 55% neither agree nor disagree that ePCR improves the efficiency of the decision-making process. These findings suggest a lack of strong opinions or consensus among the respondents regarding the perceived benefits and necessity of the ePCR system.

In order to identify the factors for the axe statements, the calculation averages, the standard deviations, and the levels of the responses of the study individuals were calculated on the ePCR System performance quality.

Table (12) responses of the study individuals on the study axes

#	Axis phrases	Avg.	S. D	%	Rank
1.	Electronic Patient Care Report (ePCR) is Easy to use	2.49	1.43	50%	2
2.	Electronic Patient Care Report (ePCR) is Linked with artificial intelligence to provide medical diagnoses	2.38	1.25	48%	4
3.	Electronic Patient Care Report (ePCR) Linked with artificial intelligence to determine medical interventions according to medical protocol.	2.42	1.27	49%	3
4.	Electronic Patient Care Report (ePCR) has reliable performance.	2.77	1.29	49%	1
	Average of Axis= 2.52				
	Stander deviation of Axis=1.31				

Table 12 presents the results of the respondents' perceptions regarding the performance quality of the ePCR system. The table shows that all items in this axis received similar responses, indicating disagreement among the respondents. The average score of 2.52 further confirms their disagreement. Specifically, the respondents neither agree nor disagree (49%) that the ePCR system has reliable performance. Additionally, 50% disagree that the ePCR system is easy to use. Moreover, the respondents disagree that the ePCR system is linked with artificial intelligence to determine medical interventions according to medical protocol. Lastly, 48% disagree that the ePCR system is linked with artificial intelligence to provide medical diagnoses. These findings suggest that the respondents have reservations and concerns about the performance quality of the ePCR system, including its ease of use and integration with artificial intelligence for medical decision-making.

Hypothesis test:

The main research Hypothesis is:

Effectiveness of (ePCR) vs. Demographic aspects

The problem:

To investigate if the Demographic aspects have an impact on ePCR

H0: Demographic aspects have no impact on Effectiveness of (ePCR)

H1: Demographic aspects have an impact on Effectiveness of (ePCR)

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ANOVA

	Sum of Squares	Df	Mean Square	F	Sig.
Sex	.330	17	.019	1.162	0.294
Age	7.210	17	.424	1.005	0.452
Work Place	4.172	17	.245	.978	0.483
Profession	3.801	17	.224	.663	0.839
No. Experience	11.066	17	.651	0.849	0.636

Note: *$p<0.05$, Demographic aspect; HLPCQ

The hypothesis test if demographic aspects carry out a significant impact/ relationship on Evaluation Effectiveness of (ePCR). From the analysis of variance (ANOVA) table, we realize that all demographic aspects significance are greater than 0.05 (> 0.05) which indicate that EMS workers demographic aspects has no impact on the evaluation of effectiveness of ePCR in SRCA.
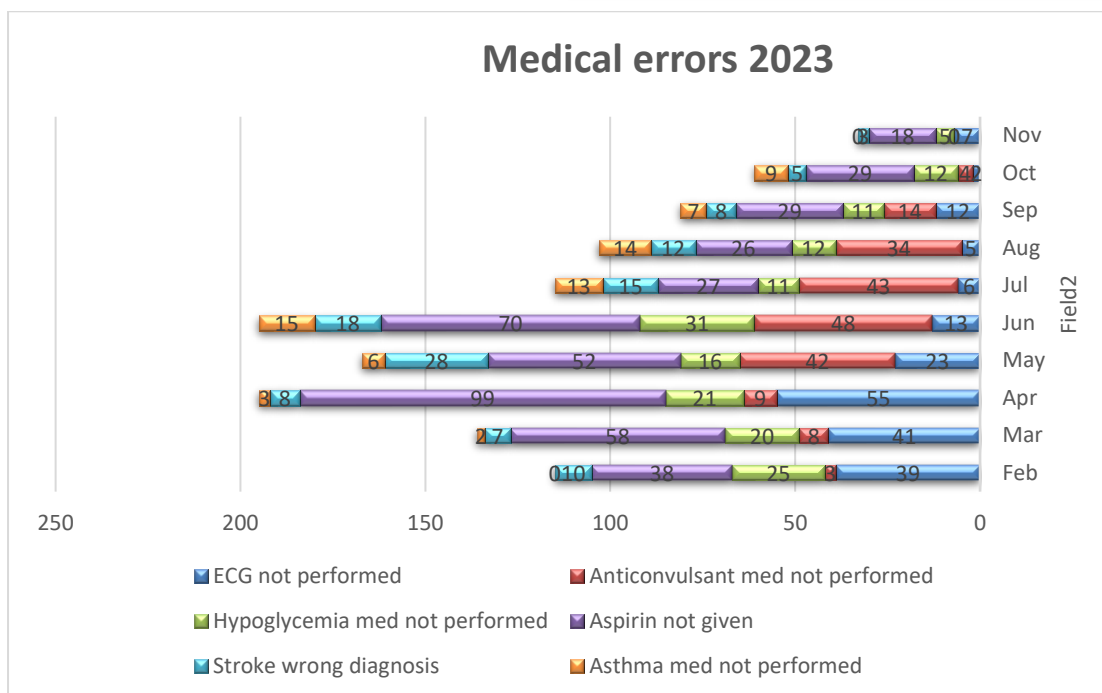
Medical errors observed in the Western Region of the Saudi Red Crescent Authority for the year 2023:

Based on the data obtained from the medical affairs of the Saudi Red Crescent Authority regarding the medical errors that were monitored after studying the electronic reports(ePCR), major errors were extracted and linked to periodic indicators, which are the ECG work index for cardiac cases and the use of epilepsy medications as well as the treatment of hypoglycemia and the administration of aspirin. In cases of chest pain, the use of asthma medications, the administration of analgesic medication, and the correct evaluation of cases of stroke.

Data from February 2023 to November 2023 showed that there were 1,509 medical errors monitored from electronic reports(ePCR), from a total of 21,000 emergency reports, divided as follows:

There were 203 cases of cardiac conditions for which an ECG was not performed, 205 cases of epilepsy and persistent convulsions for which treatment was not used, 164 cases of low blood sugar(hypoglycemia) that were not treated with the appropriate medication, 446 cases of chest pain that were not given aspirin, 114 cases of stroke cases were misdiagnosed, 69 cases of asthma were not given treatment, and 308 cases of pain rate more than 7 were not given painkillers.

Total per KPI	Total repots per month										KPI (not performed, not documented procedure)
	Nov	Oct	Sep	Aug	Jul	Jun	May	Apr	Mar	Feb	
203	7	2	12	5	6	13	23	55	41	39	ECG not performed
205	0	4	14	34	43	48	42	9	8	3	Anticonvulsant med not performed
164	5	12	11	12	11	31	16	21	20	25	Hypoglycemia med not performed
446	18	29	29	26	27	70	52	99	58	38	Aspirin not given
114	3	5	8	12	15	18	28	8	7	10	Strock wrong diagnosis
69	0	9	7	14	13	15	6	3	2	0	Asthma med not performed
308	9	30	33	33	30	48	41	31	28	25	Analgesic med not given
	Total per month										
1509	42	91	114	136	145	243	208	226	164	140	

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Medical errors 2023

CHAPTER SIX

DISCUSSION

The data indicates that the majority of study individuals were male (97%), while only a small percentage were female (3%). In terms of age distribution, the highest proportion of respondents fell within the 31-40-year age group, followed by 20% in the 41-50-year age group, and 10% below the age of 30. Respondents over the age of 50 accounted for only 4% of the sample. The distribution of work locations was evenly split, with 50% working inside Makkah and 50% working outside Makkah. In terms of professions, 72% of respondents worked as Emergency Medical Services Technicians, 22% were Emergency Medical Services Specialists, 4% were physicians, and 2% were Emergency Medical Dispatchers. Regarding years of experience, 44% of respondents had 11-20 years of experience, followed by 30% with 6-10 years of experience. Approximately 14% had more than 20 years of experience, while those with less than 5 years of experience accounted for around 13% of the sample.

The adaptation to innovation applications, including applications of IT in the healthcare setting, has unpredictable effects on many dimensions, and uncertainty is usual (Braithwaite et al., 2018). On the other hand, the data also reveals significant correlations between various variables related to the adoption and impact of the ePCR (electronic Patient Care Report) application, indicating the structural validity of the tools used. The reliability coefficient of the study questions was high, indicating good reliability for the questionnaire items.

Because of many different factors affecting healthcare workers, there are inconsistent results regarding the application of new IT. This inconsistency may be referred to as the kind of IT and different professional groups. Therefore, more studies are needed to investigate the application of new HIT (Vitari & Ologeanu-Taddei, 2018). The respondents expressed a neutral stance on the motivational effect of the ePCR application, with average scores indicating neutrality. They were also divided in their opinions on job satisfaction with the ePCR system, leaning towards disagreement. The respondents held neutral views on the reasons for adopting the ePCR system, with no strong consensus on its benefits. Similarly, they disagreed on the performance quality of the ePCR system, expressing reservations about its reliability, ease of use, and integration with artificial intelligence for medical decision-making. These findings reflect the mixed opinions and concerns of the respondents regarding the ePCR system.

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Another study surveyed the stress and burnout resulting from a poorly designed Electronic Health Record (EHR) system, the relationship between clinician's stress and burnout as an outcome of EHR design and use. Also' there are other facto rs that lead to the same outcomes and difficulty to be isolated such as workplace atmosphere and workload as the tasks of data entry increase with EHR application (Kroth et al., 2019)

System factors, including local workplace policies and procedures, societal and governmental requirements, and technological advancements, can contribute to medical errors . Poorly designed systems can make it more difficult for healthcare teams to operate effectively and for individual healthcare providers to avoid mistakes, In high-reliability organizations (HROs), medical errors rarely have a single cause, and system factors play a significant role in creating an environment where errors can occur. These factors can create barriers to effective communication, coordination, and information sharing among healthcare providers, leading to errors in diagnosis, treatment, and patient safety. (Malin, Alenius., Peter, Graf. 2016)

The main research hypothesis aims to determine if demographic aspects have an impact on the effectiveness of the electronic Patient Care Report (ePCR). The null hypothesis (H0) states that demographic aspects have no impact, while the alternative hypothesis (H1) suggests that demographic aspects do have an impact. An analysis of variance (ANOVA) was conducted, and the results show that the significance values for all demographic aspects are greater than 0.05, indicating that there is no significant impact of EMS workers' demographic aspects on the evaluation of ePCR effectiveness in SRCA.

CHAPTER SEVEN

CONCLUSION AND RECOMMENDATIONS

Conclusion

There is an emerging interest in studying innovation and technology applications in order to understand the effect of these technologies. Focusing on the quality of healthcare and cost is common because they are the main objectives of technology use in healthcare as the technology eases the governance of healthcare services and increases access (Shahmoradi et al., 2017). Emergency Medical Services agencies are motivated to adopt ePCR, to support quality improvement efforts (Sasson et al., 2012). The adaptation to innovation applications, including applications of IT in the healthcare setting, has unpredictable effects on many dimensions, and uncertainty is usual (Braithwaite et al., 2018).

In addition to controversial opinions among healthcare workers as some studies found a relationship between the adoption of new HIS and work stress and burnout according to the design of the adopted system (Kroth et al., 2019), and another study address that some healthcare workers concerned with changing the normal workflow when a new HIS applied to their workplace (Ramaiah et al., 2012). Whereas, in this study, we found that SRCA prehospital healthcare workers in Makkah accept the HIS change as a motivational effect. This is supported by the results of a country-wide study on the knowledge and preferences of healthcare workers in Saudi Arabia about the EMR system and the vast majority of the sample prefer the use of electronic records over paper-based records (Hasanain et al., 2015). Also, there is a relationship between both motivational effect and job satisfaction with knowledge of SRCA prehospital healthcare providers about the reason behind ePCR system adoption, system performance ePCR application with good satisfaction and mance quality, and information quality of the system.

Implementing electronic health records (EHRs) can help reduce medical intervention errors. EHR-based interventions can optimize antimicrobial stewardship by guiding the appropriate selection of therapy, reducing unnecessary prolonged therapy, and improving communication between providers. (Simon, Parzen-Johnson et.al .2021)

Electronic medication administration records can decrease the risk of medication errors and improve overall daily stress levels, Overall, utilizing EHRs can enhance patient safety and improve the quality of healthcare delivery by reducing medical intervention errors. (Malin, Alenius., Peter, Graf. 2016).

Recommendations

1. Take advantage of any positive effects of any change to achieve organizational objectives and improve organizational culture to align workers to the organization's strategy.
2. The results are encouraging to upgrade the ePCR system as needed e.g., through the addition of DDS, AI and connecting the ePCR device to the monitor on the patient and the receiving hospital.
3. involvement of prehospital healthcare providers in the decision-making process and making them understand the reason behind the adoption of changes motivates them and increases their job satisfaction.
4. Because of the relatively small geographical area and sample size of this study further studies involving many different areas or nationwide studies are recommended.
5. Further qualitative studies are recommended to the in-depth exploring effect of HIS adoption on healthcare workers.

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"تقييم فعالية تقرير المريض الإلكتروني (ePCR) في هيئة الهلال الأحمر السعودي (SRCA) في المنطقة الغربية لتقليل أخطاء تدخلات العلاج"

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الملخص:

أصبحت الأخطاء الطبية مصدر قلق كبير في أنظمة الرعاية الصحية حول العالم، مما يؤدي إلى نتائج سلبية للمرضى وزيادة في تكاليف الرعاية الصحية. تم اعتبار تنفيذ تقارير المرضى الإلكترونية (ePCR) كحل محتمل للتخفيف من الأخطاء الطبية وتحسين سلامة المرضى. يهدف هذا الاقتراح البحثي إلى دراسة فعالية تقارير المرضى الإلكترونية (ePCR) في هيئة الهلال الأحمر السعودي (SRCA) في المنطقة الغربية لتقليل أخطاء التدخل العلاجي. كما يهدف إلى قياس أهمية تطوير التقارير الإلكترونية لتقليل الأخطاء الطبية من خلال استخدام الذكاء الاصطناعي في عملية تحديد التدخل الطبي المناسب، حيث يتم تحديدها بعد وضع المدخلات الأساسية وفقًا لإرشادات الهيئة الطبية.

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