Assessment Of Awareness Of Health Care Providers On Swiss-Cheese Medical Error Model In Tertiary Health Facilities In Sokoto, Northwest Nigeria.

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Abstract
Background:
Iatrogenic diseases are the 5th leading causes of death globally and in many parts of the world, adverse drugs reactions constitute a major cause of fatality and poses one of the major public health challenges. This may arise from any of health services provision spectrum of physicians, medical laboratory scientists, pharmacists, nursing personnel and medical records. Swiss cheese medical error model is an important tool in identifying and correcting anomalies within the healthcare system. The study aimed at assessing the awareness of healthcare professionals on the Swiss cheese medical error model in the study area
Methods:
This cross sectional descriptive study was carried out in Sokoto metropolis which houses 2 tertiary, 4 secondary tier hospitals and host of primary healthcare facilities. Respondents enrolled included physicians, nurses, pharmacists, medical laboratory scientists by convenient sampling technique. Swiss-cheese medical error questionnaire was adapted with slight modification by adding demographics of participants to suit our purpose. The data generated was analyzed using Software Package for Social Sciences (SPSS) for proportion, standard error of mean, odds and 95% confidence interval. Sixty-one questionnaires were administered and retrieved with a response rate of about 81.9%.
Results:
The mean age of participants was 36.4±0.8 years and that of working experience 12.6±0.6 years. Majority of study subjects were males 35(70%).Participant demonstrated adequate awareness of the Swiss cheese medical error model
Conclusion:
Majority of the participants have adequate awareness on Swiss \Cheese Medical error model though because of non-random sampling technique used findings may not generalizable
Keywords: *Swiss-Cheese model, Health professionals, Sokoto, Awareness*

I. Introduction

Iatrogenesis refers to risks and side effects that arise from errors in diagnosis, therapy or prophylactic procedures performed on patients (Peer, 2018). Iatrogenic diseases are the 5th leading causes of death globally. In many parts of the world, adverse drugs reactions constitute a major cause of fatality and poses one of the major public health challenges faced not only by developing but also by developed economies (Shamna et al, 2014; Angamo, 2016).

This event may arise from any of health services provision spectrum of physicians, medical laboratory scientists, pharmacists, nursing personnel and medical records. The prevalence of adverse drug events varies from 4.2-30% in USA and Canada to 6-9% in Australia with significant direct medically related economic burden (Sendekie, 2023, Howard, 2007). Despite enhanced patients' safety due to improved healthcare delivery system globally there is much to be done and remains a worldwide challenge (Shashi, 2018).

One of the foremost operational bottlenecks for health care system is inadequate number and skills distribution of qualified health professionals and incomplete knowledge about practices (Aluko, 2019). This is more pronounced in developing and transition climes where the highly skilled personnel migrate to more developed countries for greener pasture. Dearth of skilled manpower coupled with administrative flaws synergistically contribute immensely to high prevalence of iatrogenic diseases.

Swiss cheese medical error model is an important tool in identifying and correcting anomalies within the spectrum of healthcare provision. This model, is an integral component of the Swiss cheese model designed by

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James Reed to avert occurrence of catastrophe in complex systems (Reason, 2000). In a healthcare settings hazards occurs only when all the holes in the cheese which opens randomly align. Hence at any point when any of hole is close or do not bring into line health hazard is averted. Communication gap within the health care provision band has been recognized to be an important factor that promotes errors among healthcare professionals (Tiwary, 2019).

Awareness of the healthcare providers on this important model can go a long way in stemming the tides of this ugly situation and assist hospital administrators institute targeted intervention towards addressing the missing links.

This is more so considering the paradigm shift from the 'one size fits all 'approach to the precision or personalized medicine, tailored to individual patient's needs based on genetic, and environmental considerations thereby maximizing risks benefit ratio in favour of therapeutic good outcome (Ashey, 2015)

II.   Materials And Methods

Settings, study population, and design

The study was carried out in Sokoto metropolis which houses 2 tertiary which provide referral services from neighboring Zamfara, Kebbi, Katsina and Niger states, 4 secondary tier hospitals and host of primary healthcare facilities. Sokoto is located in northwest geopolitical zone and is the seat of the famous Sokoto Caliphate. The respondents enrolled into the study included physicians, nurses, pharmacists, medical laboratory scientists. They were drawn from the Usmanu Danfodiyo University Teaching Hospital, Specialists Hospital, Noma Hospital, Maryam Abacha Women and Children Hospital all within Sokoto metropolis by convenient sampling technique.

The study was cross sectional descriptive in design aimed at determining the level of awareness of the healthcare professionals on Swiss- cheese medical error model within the study area.

Eligibility criteria, sampling and consent

Only healthcare professional working in the public health facilities were recruited for the study and convenient sampling technique was employed. Expressed consents of participants were sought before delivering instruments of data collection. Participation in the survey was entirely voluntary.

Instrument and methods of data collection

Swiss-cheese medical error model was adapted to generate data from the respondents with slight modification by adding demographics of participants to suit our purpose. A pilot study was carried out for test retest reliability, construct and content validity before on-set of the full scale study. The questionnaire essentially comprised two sections A and B. Section A is about demographic characteristics of the participants while section B contains five stem questions with 5 possible answers followed by Yes or No option making a total of 25 responses all bordered on the Swiss cheese model knowledge. This section consists of 25 questions with yes or No responses. The questionnaires were delivered at the point of duty of respondents for on spot filling and collection. Two research assistants trained in all aspects of the study were recruited for questionnaire delivery and retrieving.

Scoring and grading of responses

Scoring was by award of one mark for each correct response and zero mark for each wrong response. Score of <50% was graded inadequate awareness while ≥50% adequate awareness.

Statistical Analysis

The data generated was analyzed using Software Package for Social Sciences (SPSS), version 28.0, Armonk, NY,

IBM Corp. for proportion, standard error of mean, odds and 95% confidence interval.

III.   Results

Sixty-one questionnaires were administered and retrieved and after data mining and cleaning only 50 were correctly filled and analyzed representing a response rate of about 81.9%. The mean age of participants was 36.4±0.8 years and that of working experience 12.6±0.6 years. And majority of study subjects were males 35(70%). The overall awareness of participants on Swiss Cheese Medical Error Model is adequate

Table 1: Result of Respondents Responses on Swiss-cheese Medical Error Model

Questions	Correction options N (%)	odds	95%CI
1. **What a slice of cheese represent**:			

a. Healthcare professional	35(70)	2.33	1.29-4.23
b. Barrier to harm	33(66)	1.92	1.09-3.46
c. Root cause of error	26(52)	1.08	0.63-1.87
d. Alleviation of error	41(82)	4.56	2.25-9.24
e. Defense to error	28(56)	1.27	1.27-1.28

2. What does hole represents:

a. A latent error	27(54)	1.17	0.68-2.03
b. Loss due to error	20(40)	0.67	038-1.17
c. An opportunity for error	29(58)	1.38	0.79-2.04
d. Weakness in defenses	34(68)	2.13	1.18-3.82
e. An unsafe act	31(62)	1.63	0.93-2.87

3. What does the arrow represent:

a. Patient trajectory through health system	20(40)	0.67	0.66-0.67
b. Transfer of energy that injure patients	29(58)	1.38	1.38-1.39
c. Transformation of latent error to active one	25(50)	1.00	0.99-1.00
d. Series of events leading to medical error	24(48)	0.92	0.53-1.59
e. The path from hazard to patient harm	33(66)	1.94	1.93-1.95

4. How and where is an active error represented on the figure:

a. At the base (origin)of the arrow	30(60)	1.50	1.49-1.51
b. At the tip of the arrow	28(56)	1.27	1.27-1.28
c. As one of the holes	26(52)	1.08	1.08-1.09
d. As the arrow itself	27(54)	1.17	1.17-1.18
e. As the alignment of holes	21(42)	0.72	0.72-0.73

5. How to make healthcare system safer using Swiss-cheese:

a. By adding a slice of cheese	34(68)	2.13	2.12-2.13
b. By removing a slice of cheese	37(74)	2.85	2.84-2.86
c. By plugging a hole	32(64)	1.78	1.77-1.78
d. By adding a hole	17(34)	0.52	0.51-0.52
e. By making all slices thinner	29(58)	1.38	1.38-1.39

CI= confidence interval

Table 2: Distribution of Respondents by Profession

SN	Profession		Correct response N (%)
1	Medical Doctors		14(28)
2	Pharmacists	6(12)	
3.	Medical Lab. Scientists	9(18)	
4.	Nurses	21(42)	
Total		50(100)	

IV. Discussion

The high response rate observed in this study may be due to on-spot delivery, filling and retrieving of the questionnaire at the respondents' various places of practice. Preponderance of male gender among the respondents was not surprising considering the fact that the site of the survey is mainly male dominated where male gender were more favoured to study for higher formal education and take up appointment with public service than their female counter-part. This sharply contrasted the 60% dominance of females documented in earlier survey (Eisehrawy (2021).

The findings of this study on the questions on ''barrier that protects patients from harm'', ''weakness in defense against error'', and ''transformation of latent to active error'' were all higher than 66, 63.5 and 28.2% reported respectively by a previous study (Permeeger, 2005). This might be due to the fact that the respondents

in this study were more highly skilled healthcare professionals by virtue of years of experience in healthcare provision service.

Years of experience in service can positively influence the quality of healthcare delivery by healthcare professionals.

The observation of this study on awareness of nurses on Swiss cheese medical error model is in agreement to what was previously documented (Wiegmann, 2005). A critical yet possibly discounted area that can contribute immensely in preventing errors is apparently, awareness of healthcare professionals operating within the system.

This can only be achieved through rigorous continue medical education on regular basis to keep abreast of the ever growing body of knowledge in the medical field . Awareness is paramount in identifying likely areas of medical errors and addressing them appropriately.

Swiss cheese model is widely recognized as the conceptual framework for identifying medical errors in healthcare system (Shashi,, 2018). It was initially designed for aviation and industrial hazards managements. This however may tend to limit the errors to system ignoring individual stakeholders role in error making (van Benzekom, 2010).

Previous studies have documented ranking of educations as low value in terms of intervention in promoting patient safety due advent of artificial intelligence and automated prescription (Sooky,2019). Although artificial intelligence, plays pivotal role in day to day activities in all aspect of life, it cannot be said to be self-sufficient especially in managing complex and sensitive system as healthcare. Despite it is shortcoming, Swiss cheese medical error remains one of the best identified theory in use for error causation in healthcare and probing medication errors specifically (Bannan, 2019). This observation may not reflect true picture in view of the convenient sampling technique used as well as the sample size.

V. Conclusion:

This survey has demonstrated adequate awareness of Swiss-Cheese medical error model of participants in the study area. However, in view of the non-randomization in sampling and the sample size findings may not generalizable.

Acknowledgment:

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