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Error and Discrepancy in Ultrasound Reporting by Sonographers: Inevitable or Negligence

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Abstract

Background: Errors and discrepancies in ultrasound reporting have significant implications for diagnostic accuracy, patient safety, and medico-legal accountability. Literature is awash with radiologists' quality audits that are aimed at alleviating these errors and discrepancies by radiologists. However, a growing body of evidence suggests increasing responsibilities by sonographers, particularly in under-resourced clinical environments yet there remains a paucity of research regarding quality audits on the conduct of sonographers. **Objective:** The objective of this study was to explore the nature, frequency, causes, and consequences of diagnostic errors by sonographers in ultrasound reporting. This was in order to determine whether these discrepancies are inevitable outcomes of perceptual limitations or avoidable instances of professional negligence. **Methods:** A qualitative systematic literature review methodology was adopted using databases including PubMed, ScienceDirect, Web of Science, MEDLINE, and Google Scholar for studies published between 2010 and 2020. Boolean operators and specific keywords such as "errors," "discrepancies," "sonographer," "malpractice," and "negligence" guided the selection process. Out of 947 initially identified articles, 38 met the inclusion criteria following a PRISMA-guided screening. Thematic synthesis and frequency statistics were employed to analyse recurrent patterns and diagnostic discrepancies. **Results:** The most prevalent error identified was under-reading or missed findings (18%), followed by lack of knowledge (11%), satisfaction-of-search bias (11%), Poor examination (11%), and satisfaction of report (11%). Systemic issues including sub-optimal workflows, poor access to clinical histories, and inadequate induction training emerged as predominant causes, accounting for 21% of reported discrepancies. Only 17% of the reviewed litera-

ture explicitly attributed errors to negligence. **Conclusion:** The findings suggest that most sonographer errors are perceptual and system-related rather than intentional acts of negligence. Policy reforms focusing on institutional support, standardised protocols, and targeted training initiatives are essential to reduce discrepancies and enhance diagnostic accuracy in ultrasound reporting.

Keywords

Ultrasound Reporting, Sonographer Errors, Diagnostic Discrepancies, Medical Negligence, Structured Reporting, System-Related Causes

1. Introduction

Context of Ultrasound in Diagnostic Imaging

Diagnostic radiology relies on ultrasound imaging for its real-time capacity, safety, cost-effectiveness, and accessibility, especially in non-tertiary therapy. In resource-limited situations, sonographers perform and record ultrasounds independently [1]. Sonographers' frontline diagnostic decision-making without radiologist monitoring raises issues regarding report dependability and accountability as ultrasonography becomes more common in obstetrics, emergency care, and oncology, interpretive accuracy and reporting uniformity are issues [2].

Rationale for Study (Error vs. Negligence)

Due to perceptual and cognitive limitations, diagnostic imaging errors are unavoidable, but the legal and ethical threshold for negligence is still contested [3]. Sonographers that violate the standard of care risk lawsuits, disciplinary action, and institutional sanction [4]. Poor processes, understaffing, and equipment make distinguishing innocent error from professional malfeasance difficult. As healthcare systems increasingly rely on sonographers to make crucial diagnoses, scholarship is needed to separate error from neglect [5].

Gap in Literature: Sonographers vs. Radiologists

Most diagnostic mistake literature confuses radiologists and sonographers, masking profession-specific issues and accountability. Without government regulation, sonographers in many jurisdictions have different expectations, reporting standards, and lawsuit outcomes than radiologists [6]. There is limited data on sonographer-specific reporting inconsistencies' occurrence, causes, and legal repercussions. This disparity hinders sonographic accuracy policies and training.

Aims and Research Questions

This study examined sonographer diagnostic errors, their origins, and effects, questioning the line between error and neglect. Main study questions: (1) What are the most prevalent ultrasound reporting sonographer errors and causes? (2) When are such errors negligent? (3) What institutional strategies can reduce discrepancies and promote patient safety?

2. Methodology

2.1. Research Design

Initial browse

Figure 1 shows the process and protocols used to establish the results are presented in a flow chart. It was conducted on Google and discover University of Botswana search engine using "errors", "discrepancies", "ultrasound reports", "sonographer", "malpractice", "inevitable" "negligence", and "radiology" as keywords. Initially, grey literature and journals that were obtained were vital in providing a general overview of the topic and potential literature search keywords that were later used in the systematic literature search.

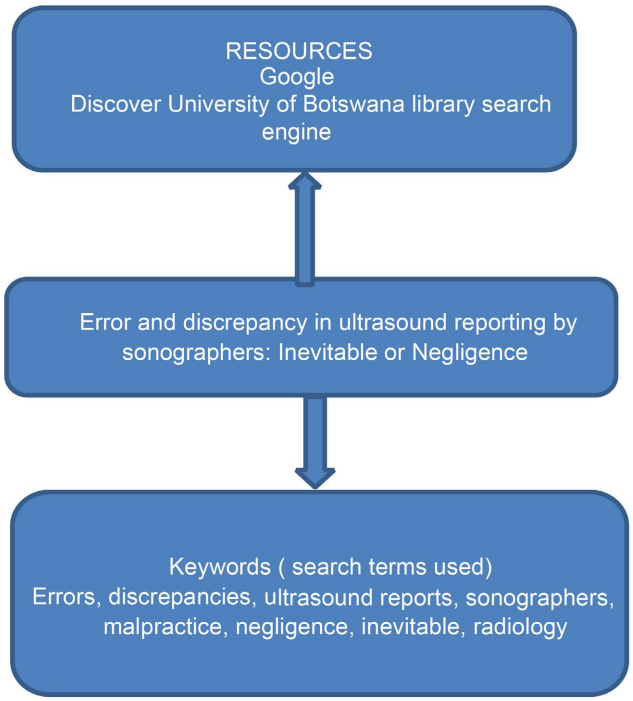

Figure 1. Initial search mind map.

2.2. Literature Search Strategy

A systematic review of studies published between 2010 and 2020 accessed on Science Direct, Web of Science, Medical Literature Analysis and Retrieval System Online (MEDLINE), PubMed and Google Scholar was conducted. The study retrospectively looked into previous studies and data was collected through in-depth thematic analysis of literature. The use of various databases and relevant academic databases was done in order to ensure that the results obtained are valid and reliable. The literature search keywords were linked accordingly with Boolean operators and they were "errors", "discrepancies", "sonographer", "malpractice", "inevitable" "radiology" and "negligence".

To ensure that articles retrieved were robust and up to date only peer reviewed articles published within the last two decades but because of untenable number

these were further filtered to those for the decade qualified for inclusion. These articles were then appraised using the checklist which shows the Critical appraisal tool program that were informed by literature [7]. This was a mechanism to ensure that they are unbiased with good external validity such that the conclusion drawn herein is reliable and applicable in practice the following table depicts the literature search strategy (**Table 1**).

Table 1. Literature search strategy.

Literature search keywords	•	Errors
	•	Discrepancies
	•	Sonographer
	•	Malpractice
	•	Inevitable
	•	Negligence
	•	Radiology keywords were interlinked with boolean operator "AND"
Search engines/Databases used	•	Google Scholar
	•	Web of Science
	•	Science Direct
	•	Med line
	•	PUBMED
Parts of journals searched	•	Titles
	•	Abstracts
Years searched	•	2010-2020
Language(s)	•	English
Types of studies to be included	•	Prospective cohort studies
	•	Retrospective cohort studies
Inclusion criteria	•	Articles published in the last two decades
	•	Peer reviewed articles
	•	Written in English
Exclusion criteria	•	Grey literature
	•	Articles published before 2000

The literature search retrieved 947 articles in total. Abstracts of retrieved articles were assessed to exclude articles with topics that do not address the aim of this review. Then duplicate copies across the databases were removed. Only 56 and 47 articles were left for further inclusion consideration after the first and second screening steps, respectively. The 47 remaining articles were screened for relevance in addressing the research questions by evaluation of their full text, and 9

articles were removed for the reason as stated in the Prisma flow diagram (Figure 2).

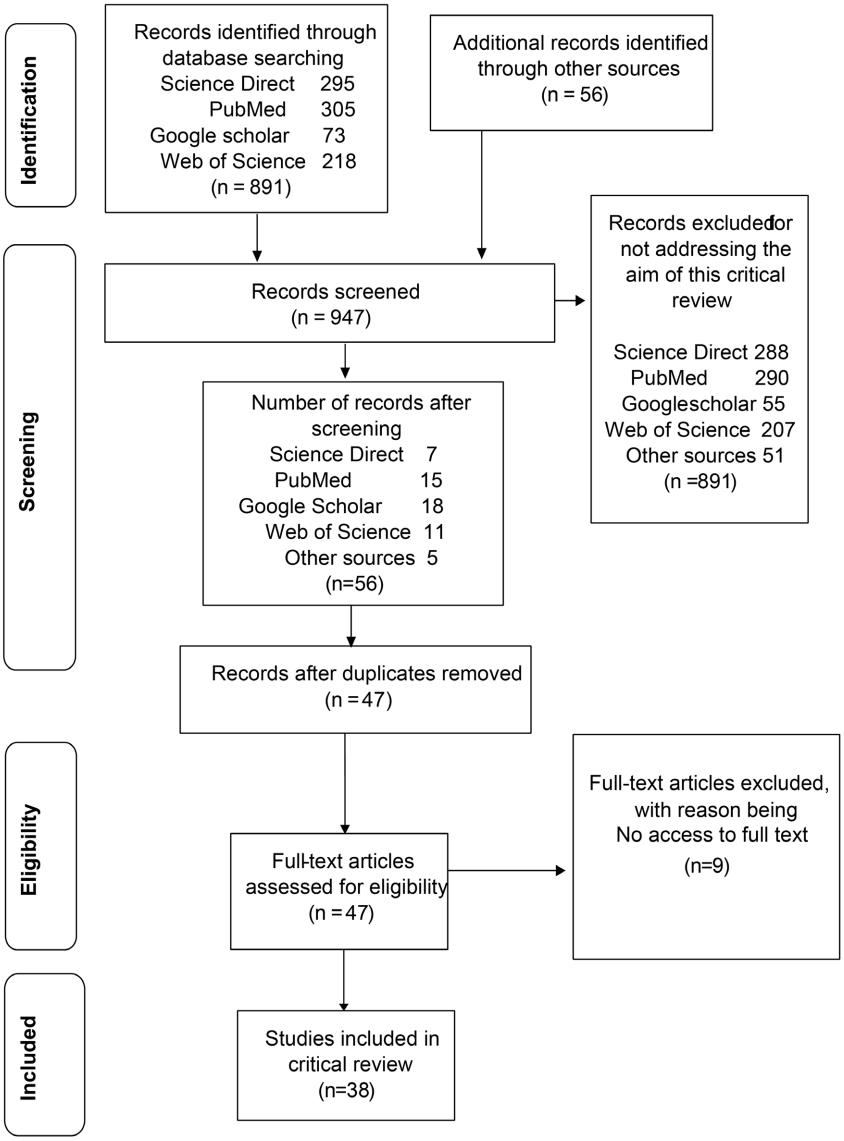

Figure 2. Prisma flow diagram.

The final 38 studies were used to tabulate a literature review table (Table 2).

Table 2. Summary of inclusion and exclusion criteria.

Item	Description
Population	Total records identified through (N = 947)
Sampling method	Purposive sampling method was used to include only the most recent and relevant studies. This eliminated 891 records for not meeting the aims of this critical review and a further 9 records for having limited access to full text. A final sample size of 38 records was finally incorporated for the study.

Continued

Study setting	The study covers all the previous studies done on the study subject since between the period 2010 and 2020.
Research philosophy	The study focused on humans as social factors hence a qualitative interpretivist philosophy was adopted.
Research design	The study was conducted purely based on desk research (literature) hence a qualitative approach was adopted. The population of 947 records included all the previous studies on the subject matter but only a manageable sample size of 38 records was purposively selected after a careful consideration of the records' relevance, accessibility of information, and time.
Justification of study period	The study period of year 2010 to 2020 was justified due to its relevance and currency to technological and technical developments in the radiology profession in trying to address the research questions. A decade-long window gave the researcher adequate and manageable literature (articles) to peruse while remaining focused.

2.3. Critical Appraisal Skills Program (CASP) Appraisal Results

The CASP results are attached to the document.

2.4. Data Analysis

This study employed topic synthesis and fundamental frequency statistics to extract qualitative and quantitative trends from the literature. First, a detailed full-text analysis was performed on the 38 papers selected after screening to detect recurring themes, expressions, and interpretations connected to sonographic errors, their classifications, contributory variables, and legal implications. Secondly, the data gathered was thematically synthesised by assigning a correct theme to the data as well as grouping the supporting data under the most relevant theme as possible. This method allowed the data to provide interpretive insights into the institutional, perceptual, and procedural causes of reporting disparities beyond content aggregation [8]. Meanwhile, Microsoft Excel was utilised to calculate frequency statistics that quantified the prevalence of the discovered mistake types and causes according to the literature. Each theme was matched to numerical counts to enable statistical tabulation of patterns such scholars discovering system-related causes or under-reading errors [9].

Finally, to simplify reading and cross-referencing, percentages were displayed in tables. This comprehensive analytical technique supported evidence-based conclusions about sonographer responsibility and training limitations while thoroughly investigating qualitative insights and stressing diagnostic mistake frequencies and patterns.

2.5. Ethical Considerations

To assure academic integrity, data accuracy, and indirect participant dignity in

the evaluated literature, this study followed strict ethical standards. The research used secondary data review, however ethical clearance was obtained to conform with university and international human participant data research requirements. The University of Botswana ethical review committee approved the research under its non-human subject review protocol. Analysing published study data without interacting with participants preserved privacy and confidentiality. None of the data sources contained patient information, and informed permission methods necessitate anonymisation and de-identification [10]. Due diligence was done to verify no articles breached copyright or used modified datasets. Use of PubMed, MEDLINE, and ScienceDirect reduced bias and fraudulent studies [11]. The analysis followed jurisdictional guidelines for litigation records and practitioner conduct from tribunal websites and regulatory authorities [12].

2.6. Bias Elimination Measures

Study bias was reduced using multiple ways. A transparent and repeatable Boolean operator literature search protocol across five major academic databases, including PubMed and Web of Science, minimised selection bias [8]. The search was limited to peer-reviewed papers published between 2010 and 2020 to balance recency, depth, and methodological consistency [13]. The review chose literature on error origins and sonographer neglect with conflicting findings to prevent confirmation bias [3]. After independent data extraction and thematic coding, two researchers conducted a consensus review to increase inter-rater reliability. To ensure quality, only peer-reviewed studies were included for final synthesis after grey literature was explored to identify themes and gaps [14]. These methods made the study legitimate and assured that its findings reflected ultrasonography inaccuracy and professional accountability scholarship.

3. Results

3.1. What Are the Common Types of Errors Encountered by Sonographers?

The results shown in **Table 3** above were gathered from 38 publications and the results were translated to smoothed percentages. The results on the common types of errors revealed that; 2 out of the 38 articles (5%) advocated for complacency error; 13% for faulty reasoning error; 11% for lack of knowledge error; 18% for under-reading (missed finding) error; 5% for poor communication error; 8% for technique error; 11% for poor examination error; 8% for history error; 11% for location error; 11% for satisfaction of search error; 5% for complication error; and 11% for satisfaction of report error. In this regard the modal result was under-reading or missed finding error with the highest frequency of 7 out of 38 articles while the median result was lack of knowledge error, technique error, and satisfaction of report error as vouched by 4 out of 38 articles reviewed hence the central tendency was that sonographers tend to make under-reading or missed finding errors in line with the modal result. Notably, in these results the total percent ex-

ceed 100% because some articles vouched for more than one type of error. There was some modification to the common types of errors by some scholars like [15] classifying the errors into two broad categories as perceptual errors (missed abnormality) and cognitive errors (wrong interpretation of abnormality).

Table 3. Common types of errors by sonographers (N = 38).

Category	Type of error	Description	Number	Percent
1	Complacency	A finding is appreciated but attributed to a wrong cause (false-positive finding)	2	5%
2	Faulty reasoning	A finding is appreciated and interpreted as abnormal but attributed to the wrong cause (misclassified true-positive finding)	5	13%
3	Lack of knowledge	A finding is seen but attributed to wrong cause due to lack of knowledge of interpreter	4	11%
4	Under-reading (missed finding)	A finding is present on the image but is missed	7	18%
5	Poor communication	An abnormality is identified and interpreted correctly but the message does not reach the clinicians	2	5%
6	Technique	A finding is missed because of the limitations of the examination or technique	3	8%
7	Poor examination	A finding is missed because of failure to consult prior radiologic studies or reports	4	11%
8	History	A finding is missed because of inaccurate/incomplete clinical history	3	8%
9	Location	A finding is missed because of the location of the lesion outside the area of interest on the image	4	11%
10	Satisfaction of search	A finding is missed because of failure to continue to search for additional abnormalities after the first abnormality was found	4	11%
11	Complication	A complication from a procedure	2	5%
12	Satisfaction of report	A finding was missed because of overreliance on the radiology report from a previous examination	4	11%

3.2. What Are the Causes and Consequences of Such Errors by Sonographers?

The findings on the various causes of errors by Sonographers showed that the scholars had almost similar views although there were some modifications in cat-

egorising some of the causes of errors. The causes of errors by sonographers were organised into themes as shown in Table 3.

3.2. Below and the Relevant Support from the Scholars Reviewed

Table 4 shows results obtained from 38 articles reviewed on the various causes of errors. The errors were attributed to various causes or a combination of causes as follows: 8% (3 out of 38) to inadequacy of clinical information; 5% to poor imaging technique; 11% to excessive workload; 8% to observation or interpretive errors; 5% to ambiguity of reports; 3% to medication management; 8% to poor communication; 8% to lack of resources; 3% to culture of the institution; 5% to technology; 11% to sonographer bias; 11% to poor working conditions; 5% to inexperienced staff; and 21% to the system. Inadequate clinical information included lack of patient history and absence patient's previous report to compare with the current. An outline in the reviewed scholarly reports showed that a relevant clinical history of a patient increases accuracy of various interpretations by sonographers (8%). It was also noted that sonographers may choose a wrong imaging technique (5%), poorly set equipment (5%) and/or make wrong diagnosis such as under-readings and false positives (5%). Suggestions that modern ultrasound machines are preloaded with pre-set parameters for different body organs depending on the clinical presentation or the disease under study were recommended (8%).

Table 4. Causes of errors by sonographers (N = 38).

Cause of error	Number	Percent
Inadequate or incorrect clinical information	3	8%
Poor technique	2	5%
Excessive workload	4	11%
Observation or interpretation errors	3	8%
Ambiguity wording of reports	2	5%
Medication management	1	3%
Poor communication	3	8%
Lack of resources	3	8%
Culture of the institution	1	3%
Technology	2	5%
Sonographer bias	4	11%
Poor working conditions	4	11%
Inexperienced staff	2	5%
System	8	21%

It was reported that excess workload and long working hours resulted in fatigue (mental and visual) and failure to concentrate hence wrong judgments (11%). Furthermore, ambiguity/complex reporting system resulted in omissions such as

inadequately labeled images (5%). Medication management as a contributor to errors resulting from poor communication between referring physicians and clinicians on medications offered to the patient as well as wrong dose of IV fluids by sonographers (3%). It was also noted that, poor communication during handovers between shifts also contributed to diagnostic errors (8%). Similarly, poor handover of patients from clinicians and physicians hence the sonographer lacked adequate information about the patient leading to wrong procedure, wrong patients, wrong side, and wrong site (8%). In addition to that, evidence showed that lack of resources was also a major cause of errors (8%); including understaffing of sonographers (use of inexperienced sonographers and low incomers) (5%), inadequate equipment and other supplies (5%). It was also noted that a culture of blame has induced fear on sonographers hence many errors not recorded and corrected (3%). Furthermore, 5% of the scholars attributed the cause of errors to technology but some of these scholars argued that most of the technological errors are due to lack of technical knowledge and training on operating the equipment. About 11% of the articles reviewed showed that sonographer bias was also a significant cause of diagnostic errors including cognitive bias, anchoring bias, outcome bias, zebra treat bias, premature closure bias, and confirmation bias.

About 4 out of 38 (11%) scholars reviewed also vouched that, diagnostic errors are due to poor working conditions including poor lighting, long working shifts, busy working environment, all these affected sonographers' concentration, observations, and final judgment. Moreover, 5% of the scholars reviewed revealed that there was widespread use of inexperienced sonographers due to staff shortages since sonographers are a scarce skill in many countries. A large proportion of the articles (21%) attributed most of the errors by sonographers to the system of the institution including its poor policies and procedures, poor communication and reporting system, poor and ageing equipment, poor working conditions, and poor recruiting system. However, the results revealed that some previous studies have identified two broad categories of the causes of diagnostic errors as the human factors and system factors. It was also further revealed that errors of perception are a result of physiological processes and not necessarily by negligence or biasness of Sonographers in what some scholars referred to as unavoidable hazard of "human condition" [16]. The study also revealed that the errors made by sonographers might lead to death of patients. At times sonographers face litigation for their actions from the patients or their families; malpractice lawsuits were on the rise with the majority of the suits being on missed diagnosis by Radiologists including Sonographers; the first ultrasound suit was in 1982 for, for CT was in 1982 and for MRI was in 1987 [16].

3.3. Litigation Associated to Negligence

[17] states that "The legal basis for negligence involves a breach of the standard of care, which is usually defined as being the use of the same degree of knowledge, skill and ability as an ordinary careful physician would exercise under similar cir-

cumstances". It is evident that many legal judgments exonerated physicians including sonographers by stating that "physicians including Doctors and Sonographers cannot be required to be perfect and cannot be expected to guarantee a good result to patients" [17]. [18] further elaborates that "Negligence occurs not when there is merely an error, but when the degree of error exceeds an acceptable standard". However, in contrast to negligence, perfection is defined by The Devil's Dictionary as "An imaginary state or quality distinguished from the actual by an element known as excellence, an attribute of the critic" [19]. The scholars reviewed only showed few cases of negligence that is only 17% of the articles, however it takes effort for sonographers to avoid errors as much as they can to avoid been sued.

3.4. What Strategies Can Be Used to Reduce or Eliminate Errors by Sonographers?

The findings for this section were put into the following themes: well-structured reporting system; induction on all new equipment; policies and procedures; clear communication procedures/structure; medication management knowledge; collaborative team approach; culture of quality and safety; sophisticated IT equipment; and adequate resources for sonographers. These were derived from 16 scholars reviewed. All the scholars reviewed vouched that a well-structured reporting system such as use of incidents reports to allow reporting of all the errors including near misses by both Sonographers and patients or their families. About 30% of the scholars including [16] agreed that patients or their families must report perceived errors and unsafe practices by Sonographers. It was also revealed (85% of the scholars) that, Sonographers must be given adequate training and induction on operating and interpreting results on all new equipment to reduce errors relating to equipment setting and misinterpreting results in addition to undergoing continuous professional development. Various scholars (20%) and other medical institutions supported the use of Failure Modes and Effects Analysis (FMEA) protocol before introducing new procedures or equipment in order to reduce errors. A considerable portion of scholars (25%) showed that clear policies and procedures for Sonographers and the department at large helps in reducing errors including reporting, accessing patient clinical information policies and procedures such as handover between shifts such as Situation-Background-Assessment-Recommendations (SBAR), communication, medication administration, standard procedures for the various tasks such as checklists, and giving Sonographers access to clinical data and portals for referring physicians. Furthermore, 30% of scholars studied showed that clear communication is key in reducing errors by sonographers, communication about patient history, patient medications, key diagnosis, and clearly labelled images. Other scholars (15%) argued that sonographers must have medication management knowledge to avoid overdosing and other medication related errors; this includes understanding the five "rights" of medication administration; right medication; right patient; right dose; right time; and right route of

administration.

4. Discussion

Sonographers made 18% of diagnostic errors by underreading or missing results. At least 11% of the literature had incorrect logic, lack of understanding, satisfaction of report and search satisfaction. These perceptual and cognitive errors confirm Berlin's 2013 "inevitable human limitation" in diagnostic imaging, but our study linked them to institutional factors that enable or worsen them [5]. Poor communication and clinical context induced interpretation errors and clinical misjudgements [20]. [21] found that structural difficulties produce more errors than professional incompetence. 21% of scholars attributed most errors to systemic and institutional issues like obsolete equipment, heavy workload, and unclear processes. Systemic factors such staff overwork and sonographer decision fatigue affected diagnosis quality [3]. Normalising diagnostic discrepancies raises the question of whether errors are careless or unavoidable [22]. HCPTS tribunal data showed that most sonographer disciplinary cases involved context-based errors rather than flagrant misbehaviour, supporting the concept that systematic constraints generate diagnostic errors [12]. Although AHPRA closely assesses technical competence, systemic risk factors affect practitioner outcomes (Australian Health Practitioner Regulation Agency, 2024).

The legal effects of sonographic errors were investigated and studies revealed that only 17% of diagnostic errors were caused by negligence. Unless they violate a standard of care, errors are not malpractice [4]. Multiple tribunal judgements stated that sonographers cannot be expected to be faultless, especially in high-pressure environments without clinical experience or enough staff [23]. Patient knowledge and regulatory transparency may induce defensive practise, putting sonographers at legal danger [12]. Based on several studies, defensive medicine may reduce diagnostic effectiveness by prioritising legal protection over patient results [24].

5. Conclusions

This study showed the complexity of sonographer ultrasonography reporting errors and discrepancies. Most errors involve underreading, erroneous reasoning, and lack of understanding, indicating perceptual and cognitive deficits rather than neglect. Systemic issues such high workload, insufficient clinical history, poor interprofessional communication, and limited equipment introduction led diagnostic failures [22]. These patterns suggest that human perception, institutional constraints, and imaging technology make many sonographer errors inevitable [3]. Thus, sonographic error is a clinical and operational issue that requires institutional accountability and policy response [5] [21].

Most people consider sonographer errors are negligence, but law and discipline say otherwise.

Few diagnostic errors constitute negligence, which requires deviation from a

norm of care in comparable circumstances, according to health tribunal verdicts [4]. Most tribunals acknowledged that real-world interpretation is impossible, supporting the concept that many unpleasant errors are contextually inevitable [12]. However, institutions are accountable. It stresses systematic interventions such equipment induction, consistent reporting frameworks, and professional development [2]. Institutions must promote safety and non-punitive error disclosure to prevent recurring care errors [3].

6. Key Results

Sonographers made 18% of diagnostic errors due to under-reading, 11% due to lack of knowledge, and another 11% due to satisfaction-of-search bias. A larger portion of the errors made are system related including; poor workflow design, limited clinical histories, and inadequate induction training contributing to 21% of the errors. Structured reporting protocols, teamwork, and professional development improved ultrasonic imaging diagnostic accuracy.

7. Summary Statement

Institutional improvements, organised reporting, and ongoing education are needed to improve diagnostic safety and accountability because sonographer ultrasound reporting errors are mostly perceptual and system-induced.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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