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Integrated Review: Anxiety Screening Tools for Diagnostic Magnetic Resonance Imaging

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Abstract

Nearly ten percent of Magnetic Resonance Imaging (MRI) scans are aborted or incomplete due to symptoms of anxiety or claustrophobia. Pharmacological and nonpharmacological treatment options, such as sedation, anesthesia, or coaching from staff, are available at most institutions for patients if anxiety or claustrophobia is "flagged" prior to the exam. In 2015, the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) released diagnostic imaging requirements that included management and tracking of patient incidents, such as aborted or incomplete exams. Pre-screening for medical conditions, including anxiety, and preparing for appropriate intervention prior to exam start may help reduce aborted or incomplete exams. Supporting evidence exists for anxiety screening tools and anxiety in the MRI setting, but evidence linking both is limited. The purpose of this scholarly inquiry paper was to assess anxiety screening tools with the intent to provide a recommendation for use in the diagnostic MRI setting. The research question used to guide the purpose was, "In patients undergoing diagnostic radiology studies, specifically MRI, is there a pre-screening anxiety tool that could be used to better prepare for successful exam completion?" A literature search was completed following the framework outlined in the first three phases of The Stetler Model of Research Utilization in evidence-based practice. Eight anxiety screening tools were identified. Three tools were further reviewed as they yielded the best evidence to support their use in the clinical setting, the 10-item Kessler Psychological Distress Scale (K10), 7-item Generalized Anxiety Disorder Scale (GAD-7), and the 2-item Generalized Anxiety Disorder Scale GAD-2. The literature suggests that the use of these tools in the clinical setting, not specifically diagnostic radiology (MRI) setting, may improve patient outcomes related to anxiety. The outcome of this integrative literature review is to recommend evaluation of the tools in the diagnostic MRI setting, specifically the GAD-7 and/or the GAD-2. Further testing of these tools could identify whether symptoms of anxiety and/or claustrophobia are successfully captured prior to the exam allowing staff to prepare for interventions that would improve patient outcomes. Tool testing measures could include: user feedback (patients), staff feedback, and successful exam completion rates yielding adequate images for diagnostic purposes. Anxiety screening tools can enhance efficiency in the department and identify whether interventions, based on screening tool calculations, would improve patient outcomes and experiences.

Keywords: Magnetic resonance imaging; Diagnostic radiology; Anxiety

Introduction

Approximately ten percent of diagnostic MRI scans are aborted or incomplete due to symptoms of anxiety or claustrophobia [1]. Most institutions offer some form of pharmacological and nonpharmacological treatment options, such as sedation, anesthesia, or coaching from staff, for patients if anxiety or claustrophobia is "flagged", *via* patient or provider notification, prior to the exam start. Magnetic Resonance Imaging (MRI) is a form of radiologic imaging that can be used for diagnostic and/or interventional purposes based on the indication of the exam. MRI uses a magnetic field to create images of organs and tissues [2], whereas Computed Tomography (CT) and x-ray use radiation to generate images. The MRI machine is a "tube like" structure that has imaging coils built in. The image may also require the use of surface coils (cage like devices) that are placed around the area of imaging, (face, abdomen, chest, etc.) these can lead to unanticipated events such as motion, discomfort, claustrophobia, and anxiety due to the patient feeling "trapped" or restrained [1]. A typical MRI exam, patient workflow, consists of patients completing a safety screening questionnaire to identify if they have any ferromagnetic objects or implants, the patient changes into a gown, and then completes the exam that can take roughly 30 minutes to an hour or longer. Anxiety, discomfort, and feelings of claustrophobia, often lead to early abortion of exams and incomplete imaging, thus impacting patient outcomes, satisfaction for patients and clinicians, as well as diagnosis and treatment [1,3]. If exams are rescheduled due to incompletion or the need for sedation, this can lead to additional operational cost for the institution and decrease productivity.

The prevalence of patient events related to claustrophobia, anxiety,

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Table 1: Database Search.

Date Searched	Row ID	Keywords	Restrictions (e.g. Peer-Reviewed Journals)	Dates Included in Search	Number of Hits CINAHL	Number of Hits OVID	Number of Hits Pub Med	Number of Hits PsycINFO
6/12/2017	1	MRI and anxiety		2010-present	8			
6/17/2017	2	MRI and patient events		2010-present		37		
7/20/2017	3	MRI and anxiety screening		2010-present	3			
7/20/2017	4	Anxiety screening for MRI		2010-present		8		
7/21/2017	5	MRI and anxiety screening		All dates	5			
7/21/2017	6	Anxiety screening for MRI		All dates		10		
7/29/2017	7	Anxiety screening		2010-present	419			
8/27/2017	8	Anxiety screening tools		2012-present			24	
9/15/2017	9	Anxiety, sedation, and MRI		All dates	21		21	
9/15/2017	10	Search 9	Not pediatrics		14			
12/30/2017	11	GAD-7 and validity		All dates			5	
12/30/2017	12	GAD-7 and GAD-2		All dates			2	
12/30/2017	13	K10 and validity		All dates			4	
2/20/2018	14	Ambulatory and anxiety screening		All dates				5
2/25/2018	15	Screening development and anxiety		All dates				13

and patient motion was found in one study to be approximately 10.4%, which makes this the largest category of unanticipated events associated with MRI exams [1]. Other MRI safety risks and patient events described by the Joint Commission on Accreditation of Healthcare Organizations [4] are events in which patients need urgent or emergent medical care, implanted metallic devices are found after imaging beings, or ferromagnetic objects entering the MRI environment unexpectedly. These types of events are found to occur in less than 4% of exams [1]. Many institutions are looking at ways to screen and prepare for such unanticipated events to reduce time to diagnosis and improve patient outcomes [1].

Anxiety screening tools can identify if a patient has symptoms of anxiety related to MRI exams. These specific screening tools can further define the extent of the level of anxiety based on the results. There are multiple anxiety screening tools available depending on the clinical setting where they are utilized. Studies show that 14-29% of all individuals will experience a type of diagnosed anxiety disorder, based on screening, during their lifetime [5]. According to Plummer et al. (2016), if clinicians in clinical practice settings implement the use of standardized anxiety screening questionnaires, they may identify patients with anxiety disorders who have not previously been identified, leading to improved care. The literature available regarding anxiety screening tools in the clinical diagnostic radiology setting, specifically for MRI exams, is limited. However, the author chose to review the literature further to identify possible anxiety screening tools to use in the MRI setting for anxiety symptom screening, rather than for diagnosing purposes.

Background

The focus of this scholarly inquiry paper was to determine an appropriate prescreening tool to screen for anxiety prior to MRI exam to decrease the number of early aborted or incomplete exams. JCAHO created new diagnostic imaging requirements and standards for MRI procedures in 2015 that include management and tracking of patient incidents, since these were not tracked previously, this is an important updated.

These requirements relate directly to the need to monitor and try to prevent unfinished exams related to anxiety and claustrophobia. JCAHO updated their environment of care standards on elements of performance (see, EC.02.01.01) to include the management of MRI safety risks such as those associated with claustrophobia, anxiety, or emotional distress.

Pre-screening for medical problems, including anxiety symptoms, and preparing for interventions such as sedation, coaching, music therapy, or alternative therapy, may help reduce aborted and/or incomplete exams. If pre-screening is not completed, you many add additional costs to the institution such as rescheduling, anesthesia needs, or additional staffing. There is a lack of evidence available regarding specific anxiety pre-screening tools for the use in diagnostic radiology settings. The purpose of this integrated literature review was to further investigate this phenomenon and available tools.

Purpose

The primary purpose of this scholarly inquiry paper was to assess identified anxiety screening tools with the intent to provide a recommendation for use in the diagnostic MRI clinical practice setting through an integrated literature review. The secondary purpose was to determine which anxiety screening tools would allow for timely screening, not diagnosing, and easy interpretation of results in the MRI setting. The ultimate goal of this scholarly inquiry was to identify patients with anxiety prior to their radiologic imaging procedures in an effort to reduce the prevalence of aborted and/or incomplete exams. With the ability to determine if a patient has

Table 2: Librarian Assisted Primary Search: MRI and Anxiety Search.

Search ID#	Search Terms	Search Options	Last Run *Via*	Results
1	Magnetic Resonance Imaging		6/1/2017: Database(s): Embase 1988 to 2017 Week 22, PsycINFO 1806 to May Week 4 2017, EBM Reviews - Cochrane Central Register of Controlled Trials April 2017, EBM Reviews - Cochrane Database of Systematic Reviews 2005 to May 24, 2017, Ovid MEDLINE(R) Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) 1946 to Present	1,154,034
2	Anxiety		" "	281,983
3	Stress, Psychological		" "	175,670
4	2 or 3		" "	442,034
5	1 and 4		" "	6,663
6	screen*.ti,ab,hw,kw.		" "	1,726,465
7	Mass Screening/		" "	302,014
8	"selfreport*".ti,ab,hw,kw.		" "	414,819
9	6 or 7 or 8		" "	2,118,346
10	5 and 9		" "	691
11	5 and 9	Limited to abstracts	" "	664
12	11	Limited to English language	" "	
13	12	Limited to 2012-Current	" "	455
14	13	Not "conference abstract"	" "	297
15	14	Remove duplicates	" "	227
16	15	From search keep 10, 70, 127, 164, 168, 202	" "	6
17	"magnetic resonance".ti.		" "	156,774
18	(anxiety or distress*).ti.		" "	198,615
19	17 and 18		" "	174
20	19	Not "anxiety disorder"	" "	116
21	Anxiety/pc or Stress, Psychological/pc		" "	20,129
22	1 and 21		" "	77
23	20 or 22		" "	181
24	23	Limited to abstracts	" "	149
25	24	Limited to English language	" "	137
26	25	Limited to 2012-Current	" "	47
27	26	Not "conference abstract"	" "	45
28	27	Remove duplicates	" "	29
29	28	From search keep 1-4, 6-8, 14, 17, 20	" "	10
30	Questionnaire		" "	1,598,184
31	5 and 30		" "	634
32	31	Not 10 or 23	" "	467
33	32	Limited to abstracts	" "	452
34	33	Limited to English language	" "	444
35	34	Limited to 2012-Current	" "	291
36	35	Not "conference abstract''	" "	182
37	36	Remove duplicates	" "	148
38	37	From search keep 80, 106, 119, 130, 139	" "	5
39	16 or 29 or 38		" "	19

Table 3: Librarian Assisted Secondary Search: Anxiety Screening Tool Search.

Search ID#	Search Terms	Search Options	Last Run *Via*	Results
1	Magnetic Resonance Imaging		6/12/17: Database: Embase <1988 to 2017 Week 24>, PsycINFO <1806 to June Week 1 2017>, EBM Reviews - Cochrane Central Register of Controlled Trials <April 2017>, EBM Reviews - Cochrane Database of Systematic Reviews <2005 to June 9, 2017>, Ovid MEDLINE(R) Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) <1946 to Present>	1,160,530
2	Anxiety		" "	283,257
3	Stress, Psychological		" "	176,205
4	Anxiety or distress		" "	199,412
5	2 or 3 or 4		" "	548,066
6	Assess or screen		" "	8,740,664
7	Mass screening		" "	303,269
8	6 or 7		" "	8,748,137
9	1 and 5 and 8		" "	2,559
10	Tools or tools or questionnaire		" "	2,907,407
11	9 and 10		" "	504
12	11	Limited to English language	" "	493
13	12	Limited to 2007-Current	" "	453
14	13	Limited to conference abstract or editorial or erratum or letter or note or addresses or autobiography or bibliography or biography or blogs or comment or dictionary or directory or interactive tutorial or interview or lectures or legal cases or legislation or news or newspaper article or overall or patient education handout or periodical index or portraits or published erratum or video-audio media or webcasts	" "	159
15	13 not 14		" "	294
16	15	Remove duplicates	" "	236
17	16	From search keep 12, 48, 63, 69-10, 136, 156, 181-182, 199	" "	10
18	Data Collection		" "	3,066,698
19	9 and 18 (not 11)		" "	163
20	19	Limited to English language	" "	160
21	20	Limited to 2007-Current	" "	136
22	21	Limited to conference abstract or editorial or erratum or letter or note or addresses or autobiography or bibliography or biography or blogs or comment or dictionary or directory or interactive tutorial or interview or lectures or legal cases or legislation or news or newspaper article or overall or patient education handout or periodical index or portraits or published erratum or video-audio media or webcasts.	" "	55
23	21 not 22		" "	81
24	23	Remove duplicates	" "	236
25	Magnetic Resonance Imaging/px		" "	380
26	9 and 25		" "	38
27	26	Limited to English language	" "	35
28	27	Limited to 2007-Current	" "	23

29	28	Limited to conference abstract or editorial or erratum or letter or note or addresses or autobiography or bibliography or biography or blogs or comment or dictionary or directory or interactive tutorial or interview or lectures or legal cases or legislation or news or newspaper article or overall or patient education handout or periodical index or portraits or published erratum or video-audio media or webcasts	" "	0
30	28 not 29		" "	23
31	30	Remove duplicates	" "	23
32	31	From search keep 3, 6, 8-9	" "	4
33	17 or 32		" "	12
34	33	From search keep 1, 4	" "	2
35	33 not 34		" "	10

experienced episodes of anxiety in the past or has a medical history of anxiety, this knowledge may assist radiology staff in providing interventions to ensure the patient is properly prepared for the MRI exam. Radiology nursing staff often view MRI exams as routine and non-threating; however, patients bring a different perspective, often viewing the exam as terrifying or constricting, in turn causing anxiety [6]. A summary of the data abstraction process and literature search can be found in (Tables 1,2,3) as well as (Figure 1). The explanation of the tools and statistical analysis can be found in (Tables 4,5). (Table 6) explains the background MRI literature reviewed when developing the clinical practice question.

Research Question Guiding Purpose

To guide this review and provide a framework for the purpose, a research question was created: "In patients undergoing diagnostic radiology studies, specifically MRI, is there a pre-screening anxiety tool that could be used to better prepare for successful exam completion?" The initial research question that was formed was: "In patients undergoing diagnostic radiology studies (MRI), how does the use of an anxiety screening tool better prepare the patient and improve patient outcomes?" As in an evidence-based practice process the question may change as the evidence is reviewed further, that is what happened in this case.

Method of Inquiry and EBP Model

The method of inquiry was an integrated review of literature to answer this clinical question. The Stetler Model of Research Utilization was used to facilitate Evidence-Based Practice (EBP) as a guiding tool for this scholarly inquiry paper [7]. There are five phases encompassed by The Stetler Model of Research Utilization in EBP see (Figure 2). The first phase consists of preparation, second is validation, third is comparative evaluation and decision making, the fourth phase is translation and application, and the fifth phase is evaluation [7]. The author's intention for this paper was to focus on the first three phases of The Stetler Model of Research Utilization, as there was no intervention at this time, along with recommendations for future application and evaluation (phases four and five).

Eight anxiety screening tools were identified during the first phase of preparation. These tools were further examined during the second phase for applicability to the population of interest to this inquiry paper and quality.

Table 4: Statistical Data Summary.

Study	Anxiety Screening Tool	N	Sensitivity	Specificity	PPV	NPV
[16]	K10	1,811	0.794	0.664	NA	NA
[11]	K10	1,607	0.8	0.81	0.63	0.91
[16]	GAD-7	1,811	0.709	0.568	NA	NA
[5]	GAD-7	5,000+	0.74	0.83	NA	NA
[12]	GAD-7	502	0.83	0.65	0.36	0.94
[5]	GAD-2	5,000+	0.76	0.751	NA	NA
[12]	GAD-2	502	0.83	0.61	0.34	0.94

Note: n= Number of participants in the study, PPV= Positive Predictive Value (as close to 1.0 as possible is favorable), NPV = Negative Predictive Value (as close to 1.0 as possible is favorable)

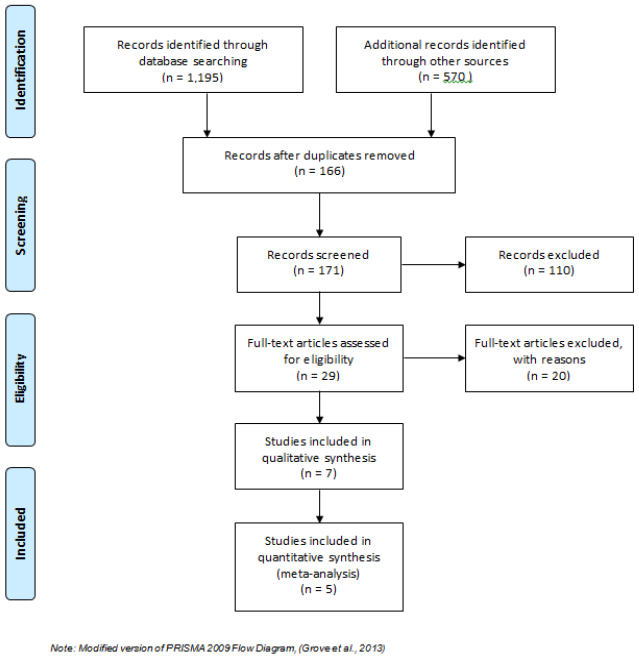

Figure 1: Combined Results Flow Diagram [8].

These initial tools are outlined in (Figure 3).

Based on feasibility, ease of interpretation and use, these eight tools were narrowed down in the third phase to focus on the K10, GAD-7, and GAD-2 for further evaluation. Details of each phase are

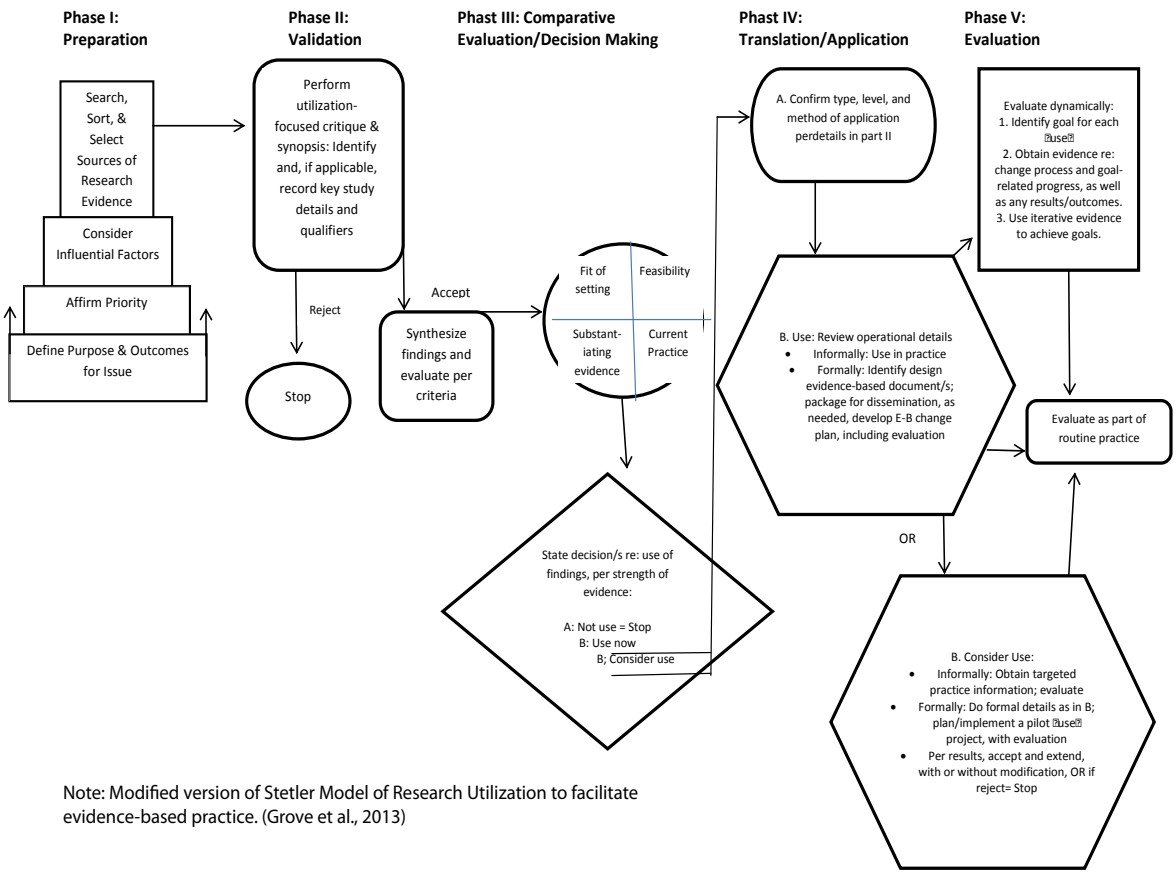

Figure 2: Stetler Model Diagram [8].

explained in the next section.

Phase 1: Preparation

According to [8], preparation phase, involves identifying the purpose, as well as the context and sources of the evidence sought. Details of the thorough search were described in the data abstraction process, primary, and secondary reviews, as well as outlined in (Tables 1,2,3). (Tables 4 and 7) describe the process used to determine the strength and level of evidence. During this phase, the clinical question evolved based on available data and literature. The initial clinical question formed was: "In patients undergoing diagnostic radiology studies (MRI), how does the use of an anxiety screening tool better prepare the patient and improve patient outcomes?"

Phase 2: Validation/Literature Search

Following a comprehensive literature review, the sources were further examined to determine the level of evidence.

The validation phase includes an extensive literature search with verification of literature reviewed [8]. The literature review completed is described in detail below. A database search was completed to help guide the purpose and develop the research question and further review selected anxiety screening tools. A primary literature review was completed to identify the link between MRI and anxiety as well as pre-assessment screening tools used. At a later date, a secondary literature review was completed to further identify anxiety screening tools used in the clinical outpatient setting. (Tables 1,2,3) as well as (Figure 1), outline this process in detail.

Database Search

The goal of the database search was to help identify an appropriate research question. The search began with MRI and anxiety, then was continued to identify patient events that may occur during diagnostic MRI which are related to anxiety, and lastly continued to identify if there were any psychology articles published on screening tools or tool development. These searches yielded 48 articles once duplicates were removed. The literature was reviewed and the research question was created. A total of 16 articles were found, none of these identified a specific pre-screening tool for use in the MRI setting. A primary and secondary review with librarian assistance was completed in hopes to yield better results. After a subsequent search, the three anxiety screening tools were identified and were included in the database search (Table 1).

Primary Review

The goal of the primary literature review was to evaluate the link between MRI exams, patient anxiety and aborted or incomplete exams, as well as pre-screening tools used in this specific setting. (Table 2), explains in detail the librarian assisted search using the following databases: Embase (1988-2017), PsycINFO (1806-2017),

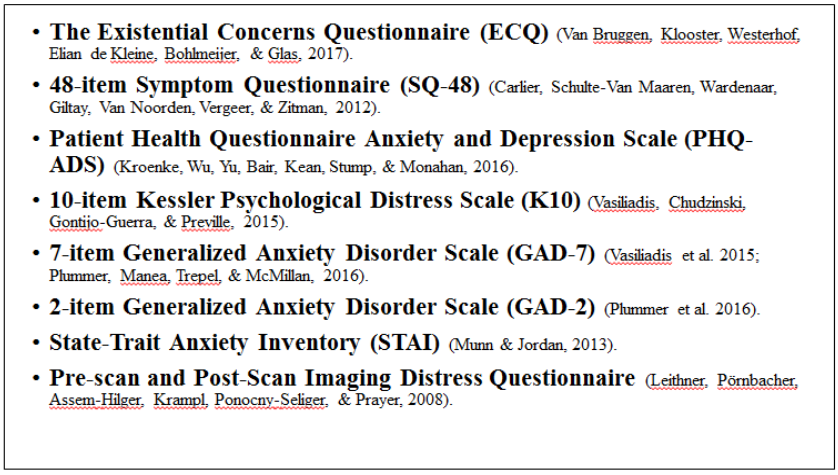

Figure 3: Initial Anxiety Screening Tools.

EBM Reviews (2005-2017), Ovid MEDLINE and Epub (1946-2017). A search of anxiety and mass screening yielded a significant number of results, 302,014, which created the need for limitations. Results were limited to English language and publications from 2012-2017. Conference abstracts and duplicates were removed from the results and this reduced the number to 227 articles.

The 227 articles found were further examined and the search criteria were once again reduced to exclude articles referring to anxiety disorders. Duplicate articles were removed, 19 results involving MRI and anxiety, patient events related to anxiety and anxiety screening were included. Ten anxiety screening tools were identified in the 19 articles; eight of the tools were selected for further evaluation (Table 7).

Secondary Review

The aim of the secondary review was to further explore and validate anxiety screening tools suited for use in the clinical diagnostic radiology MRI setting (Table 3). A second librarian assisted search was completed using the following databases: Embase (1988-2017), PsycINFO (1806-2017), EBM Reviews (2005-2017), Ovid MEDLINE and Epub (1946-2017), which resulted in an additional 10 studies being identified. The search criteria included Magnetic Resonance Imaging, anxiety, stress, distress, assessment, and screening. The results were limited to English language, publications from 2007-2017, and only tools or questionnaires were kept.

This secondary review allowed for a final research question to be created: During this time the final clinical question was created: "In patients undergoing diagnostic radiology studies, specifically MRI, is there a pre-screening anxiety tool that could be used to better prepare for successful exam completion?" This review also solidified the selection of the initial eight anxiety screening tools, see (Figure 3).

Numerical data combined from the primary and secondary librarian assisted search are outlined in (Figure 1).

Phase 3: Comprehensive Evaluation and Decision Making

Phase 3 of The Stetler Model of Research Utilization in evidence-based practice describes the evaluation of the literature to assist in providing a recommendation for evidence-based practice change [8]. A literature review table was created (Table 5) to explain and evaluate the level of evidence of each article reviewed, as outlined by [9]. The following sections explain in detail the process for evaluating the anxiety screening tools. A recommendation was formulated based on statistical findings, validity, and reliability found in the literature (Tables 4 and 7).

Literature Review

The literature on the use of anxiety screening tools in the diagnostic radiology MRI practice is limited and did not yield a high number of available evidence. Evidence does exist regarding ways in which anxiety can impact or impair MRI exam completion rates or image quality. One prospective cohort study, with a level IV evidence, found that up to 37% of patients undergoing MRI can experience some level of anxiety reaction that relate to extended exam times, noise levels, and temperature [10]. The literature suggests the use of pre-screening tools to flag anxiety or claustrophobia, to better prepare staff and patients for possible interventions during MRI. Interventions available include: psychological preparation through detailed information and education on what to expect prior to, during, and following the exam; the use of hypnosis; and/or positioning devices to allow for comfortable or strategic patient positioning when possible during the exam, such as allowing the patients head to be outside the tube so that they do not feel enclosed [6]. Manipulation of the environment is also a successful intervention with prism glasses, soft or low lighting levels, soothing music using headsets, aromatherapy use, and the movement of air with the use of fans in the room and scanner [6]. Munn and Jordan also found that interventions, such as allowing family or friends in the room, having panic buttons available for patient use, sedation, may be beneficial.

A systematic review using the GAD-7 and GAD-2 screening tools in 12 different patient samples across various patient care populations, showed high specificity and sensitivity in identifying anxiety disorders or symptoms of anxiety in patients who have not been previously flagged from their history or the medical record [5].

Table 5: Anxiety Screening Tool Literature Review Table.

Citation	Purpose/ Objectives	Study population/ Sample/ Setting	Study Design/ Methods/ Major Variables/ Instruments and Measures	Result(s)/ Main Findings	Implications /critique	Comments Themes	Level of Evidence
[14]	To develop and validate an existential anxiety measure that can be used in research and clinical practice.	Nonclinical sample was composed of psychology students and their relatives or acquaintances. The participants were asked to complete a 25-item questionnaire and then complete it again after 2 weeks. 389 nonclinical participants were included. Clinical sample was composed of people that visited an outpatient anxiety and depressive treatment clinic. 99 clinical patients who were invited to participate by their provider agreed to participate and completed a 22-item questionnaire.	Prospective Study: The Existential Concerns Questionnaire (ECQ) was tested in a nonclinical sample of 389 adults and a clinical sample of 99 adults. The nonclinical group completed a 25-item questionnaire and the clinical group completed a 22-item. A final 13-item questionnaire was created and measured death anxiety, intolerance of uncertainty, neuroticism, distress, meaning, and life events. 99 adults who had an anxiety and/or depressive disorder completed the final version of the ECQ.	The 25-item questionnaire was reduced to the 22-item questionnaire based off findings, and then the final 13 item questionnaire was created based off combined findings from the nonclinical and clinical samples. In the nonclinical sample, the mean score for ECQ was 42.92 (SD=12.59, range: 22-85). In the clinical sample, the mean score for ECQ was 58.34 (SD= 13.75, range: 27-94). This finding provided support for the known groups (clinical) reliability and validity.	The study participants in both groups lacked randomization. The nonclinical group were offered extra credit for their grades and the clinical group were selected by their provider. Also, the nonclinical group were students and cannot be termed as a representation of the general population	Based on the summary and key items this tool covers, this seems to be geared toward individuals with preexisting psychological issues. According to the authors, additional research is needed to further examine the tools psychometric qualities and applicability.	Level VI
[13]	To develop and validate a brief psychological distress instrument (SQ-48), which also includes measures of vitality and work functioning. Development of this questionnaire so that it is freely available to clinicians and researchers.	Patients and non-patients from two large studies were randomly selected: a Routing Outcome Monitoring (ROM) sample of psychiatric outpatients and a RIM reference sample of the general population. Loyola University Medical Center (LUMC) Department of Psychiatry in Maywood, IL. ROM group: 242 outpatients (61/2% females; mean age= 38.8 years; SD= 14.0) ROM reference-group: 516 participants (67/2% females, mean age=38.8, SD= 12/8)	Randomized Control Trial Two phases: instrument development of the SQ-48 and the psychometric evaluation Construct validity was evaluated using Confirmatory Factor Analysis (CFA) on the large samples. Internal Consistency was investigated using Cronbach's alphas for the subsamples and total samples. Spearman's (p) correlation coefficients were computed for intercorrelations of the SQ-48 and other instruments.	Confirmatory factor analyses: Reference Group: (CFI=0.96; RMSEA=0.05) Patient Group: (CFI=0.97; RMSEA= 0.08). Internal consistency coefficients found that none of the subscales had alphas below the critical cut-off of 0.70, indicating adequate to high internal consistency. Results indicated that the two samples had satisfactory properties and therefore the SQ-48 is recommended for use in clinical, research, and service settings.	Based on existing questionnaires and the most common psychopathological symptoms, the SQ-48 focused on nine categories: depression, anxiety, somatization, cognitive problems, social phobia, agoraphobia, aggression, work functioning and vitality/optimism.	Self-reporting measures of anxiety are widely used and can be easily be implemented as screening tools. The SQ-48 is a screening tool to improve diagnostic recognition in clinical and nonclinical settings/samples.	Level II
[15]	Examine the reliability and validity of the Patient Health Questionnaire Anxiety & Depression Scale (PHQ-ADS), which is a combination of the 9 item-Patient Health Questionnaire (PHQ-9) and the Generalized Anxiety Disorder Scale (GAD-7).	896 patients across three trials, two primary care based trials and one oncology practice based trial, of depression and pain were analyzed.	A retrospective meta-analysis of three studies on depression and pain. Data from each study were analyzed separately and compared. Cronbach a was used to measure the Standard Deviation (SD) and internal reliability. The Pearson correlation coefficient of the PHQ-ADS/9 and GAD-7 were calculated to construct validity. Cutpoints (scores) were divided into groups and measured. They were identified as minimal (0-9), mild (10-19), moderate 20-29), and severe (30-48) symptoms for all three tools (PHQ-9, GAD-7, & PHQ-ADS)	All three scales showed favorable internal reliability with Cronbach a values from .8-.9. When reviewing the cutpoints of the PHQ-9 versus the GAD-7, the most commonly used on both was 10 or greater. In all three trials, the number of patients who fell in the 10 or greater on BOTH the PHQ-9 and GAD-7 was 286 (PHQ-9 only= 265, GAD-7 only=21). 323 patients did not fall within that cutpoint. Therefore, If only the PHQ-9 was used 307 patients would have been missed. This supported the use of a combined tool PHQ-ADS.	Each of the trials that were reviewed had a focus on patients experiencing pain versus patients with depression or anxiety.	A tool combined with the PHQ-9 and the GAD-7, such as the PHQ-ADS, works to capture anxiety and depression in patients on a more reliable basis. Recommend evaluation on patients without pain.	Level I

[16]	Review the 10-Item Kessler Psychological Distress Scale (K10) and the Generalized Anxiety Disorder Scale (GAD-7) and establish cutoff scores and reliability when screening older adults for depression and anxiety.	Community living older adults, age 65 and over. Primary Health Clinics in Quebec, Canada: Patients recruited in waiting rooms of primary health clinics: Family medicine, local community service centers, private medical clinics. Of the 1811 patients that participated and were interviewed only 1611 had complete information for the K10 and 1715 complete for the GAD-7.	Comparison Study: Cross-sectional survey of older adults recruited. Patients 65 years and over waiting in clinics were given a pamphlet that explained the study and objectives inviting them to participate. If patient consented, they completed both the K10 and GAD-7 and were later interviewed for their prospective. Statistical analysis was done using the IBM SPSS Statistics version 21. t-tests were used to compare means of the screening tools for gender and age. Chi squared (X 2) tests were used to compare participants in different subgroups or with different diagnoses. Receiver operating curve (ROC) analysis was used to validate the K10 and GAD-7.	Mean K10 score in the sample was 17.6 (S.D.= 6.36), (t= 0.396, p= 0.692) Mean GAD-7 score in the sample was 4.33 (S.D.= 3.23), (t= 1.142, p= 0.156). ROC analysis of the major depression K10 scores: sensitivity of 0.692 and specificity of 0.811, ROC analysis of the minor depression K10 scores: sensitivity of 0.794 and specificity of 0.664. The comparison of the two did not yield statistical significance (p=0.07). ROC analysis of the GAD-7 scores: sensitivity of 0.709 and specificity of 0.568. Both tools were found to yield results consistent with self-reported depression or anxiety.	Study only applied to older adults, age 65 and over and previous studies mentioned in this article shared that anxiety disorders are more prevalent in younger adults with a mean age of 47.4. However, the clinical setting and patient population was targeted. The main focus of the K10 is to screen for depression not anxiety.	Older populations struggle with completing longer questionnaires. Scores from both screening tools were consistent with self-reported depression or anxiety.	Level IV
[5]	Review the accuracy of the GAD-7 and GAD-2 anxiety questionnaires through a systematic review. Determine if the use of these tools as screening devices should be advocated.	2344 citations were screened, after reviewing a total of 12 samples met the criteria. The 12 samples included over 5,000 participants. Adults age 18 years and older. Settings varied: general population, primary care, secondary care, community treatment service, and occupational health services.	Systematic Review of 12 samples where the administration of the GAD-7 or GAD-2 was assessed. GAD-7- 11 studies reviewed for sensitivity and specificity, as well as AUC. GAD-2- 6 studies reviewed for sensitivity and specify, as well as AUC. The review used cross-sectional validation studies.	GAD-7: 10 out of 11 studies showed high levels of sensitivity (0.74) and specificity (0.83) with scores under the curve (AUC) against the "gold standard" GAD diagnosis. The AUC ranged from 0.650-0.963. If the cut-off score of 8 was used, the GAD-7 should correctly identify 42 of 50 cases. GAD-2: All studies found the specify level high and sensitivity was found to be 0.76. All 6 studies showed scores under the curve (AUC) against the "gold standard" GAD diagnosis. The AUC ranged from 0.751-0.937. If the cutoff score of 3 was used it provides a high balance of sensitivity and specificity.	A variety of settings were used and really did now hone in on the clinical population. Limited studies exist looking at the validation of these tools. The cutoff points recommended varied from study to study, therefore, consistency was not indicated.	The national clinical guidance in the US recommends the use of the GAD-7 and GAD-2.	Level I
[6]	Determine what strategies are effective in reducing fear, anxiety and claustrophobia, and the need for sedation in adults undergoing magnetic resonance imaging (MRI).	Adults (18 years and older) with pre-existing conditions or disabilities undergoing MRI. 26 studies were reviewed, but only 21 used based off criteria determined by authors. Of the 21 studies reviewed, 14 studies were randomized or pseudorandomized controlled trials and controlled cross-over trials; 7 were of varying designs with a comparison group.	Quantitative systematic review. The studies were assessed using the Joanna Briggs Institute of Meta-Analysis of Statistics Assessment & Review Instrument.	MRI design features, cognitive-behavioral strategies, positioning, patient information, team training, and screening of patients allow for positive impact and successful exam completion.	Did not go into detail as to what the inclusion criteria was for the studies reviewed. The synthesis reviewed studies published from 2010 and prior, diagnostic imaging techniques have changed greatly since then.	Many of the studies reviewed used the Spielberger State-Trait Anxiety Inventory (STAI) to measure anxiety. Found that patients with low levels of constructive thinking who are exposed to stressful situations, such as MRI, tend to react with automatic thoughts that augment their stressful experience and trigger feelings of anxiety.	Level I

[10]	Investigate women's psychological reaction when undergoing fetal magnetic resonance imaging (MRI), and to evaluate if certain groups differ in their subjective experiences based on clinical and sociodemographic variables.	During a 6-month period between February 2006 and July 2006, 72 patients were scheduled to undergo fetal MRI in the Department of Radiology at Vienna Medical University, Austria. Of the 72 exams, ten were not included (6 because of language barriers and 4 because of refusal for private reasons). 62 women were included in the study before and after fetal magnetic resonance imaging.	Prospective cohort investigation of 62 women. Anxiety levels and subjective experiences were measured by Pre-Scan and Post-Scan Imaging Distress Questionnaire. Anxiety levels were measured pre-and-post using the Spielberger State-Trait Anxiety Inventory. The Beck Depression Inventory was used to exclude underlying depressive disorders. A modified pre-and post- Imaging Distress Questionnaire was used to assess patients' attitudes and expectations toward the MRI.	Anxiety scores pre-scan for fetal MRI women were 8.8 points higher than the scores of female nonclinical, norm population (P<.001). The referral diagnosis showed an increasing effect on anxiety pre-scan (P=.025). Only 3 women (4.8%) had previous claustrophobia, none had a psychiatric history. Major distressing factors contributing to increased anxiety levels were physical restraint (49.9%), noise level (53.2%), anxiety for infant (53.2%), and the duration of the exam (51.6%).	This study compared fetal MRI patients with the "general population" MRI patients. This minimizes the information regarding pre-scan anxiety for general MRI exams because fetal anxiety was pronounced (53.2%) but in general pregnant mothers would have heightened anxiety regarding results and could have contributed to most of the findings.	In the general population, including fetal MRI patients, anxiety reactions were found in up to 37% of patients. High initial levels of anxiety, long exam times, noise, and temperature were found to be predictive for the occurrence of psychological problems during MRI. The pre- and post-scan Imaging Distress Questionnaire was used but slightly modified.	Level IV
[11]	To test the validity of the Kessler 10-item (K10) depression and anxiety screening tool.	1,607 participants, ages 18-65 years (68.8% female participants). This sample included patients who screened positive on the K10 as well as 400 patients who screened negative, these were used for comparison. Primary care participants were recruited form general practitioners. Amsterdam, Groningen, and Leiden, the Netherlands	8-year prospective longitudinal cohort study (NESDA). Patients who consulted their practitioners were selected and were given a brief phone interview and asked to complete the K10. Patients who screened positive were included, a sample of patients who screened negative was also include as a comparison. All analyses were conducted in SPSS version 13.0 for Windows.	Based on three categories: any depressive disorder, and anxiety disorder, or any disorder that involves anxiety or depression. The best cut-off score was found to be 20. Based off cut-off scores of 20 when screening for any depressive or anxiety disorder: Sensitivity- 0.80 Specificity- 0.81 PPV- 0.63 NPV- 0.91 The reliability of the K10 was found to be 0.94. The AUC was 0.87.	Authors note that it is still unknown if the K10 is as effective in screening for anxiety disorders as it is in screening for depressive disorders. Non-randomized, sample pulled from individuals who agreed to participate. There was a high level of refusals and incomplete questionnaires.	K10 is a 10-question tool that takes about 2-3 minutes to complete. It is graded on a 5-point likert scale that generates scores from 10 (no distress) to 50 (severe distress).	Level IV
[12]	To validate the web-based GAD-7 and GAD-2 in comparison with the validation of the paper based forms.	Participants from the general population were recruited from the internet by using banners. Adults l8 and older with anxious behaviors were targeted. - 502 participants responded to this banner. A control group sample was also created. Undergraduate psychology students were targeted via a web-based banner. - 20 participants responded to this banner. Majority of respondents were Dutch from the Netherlands (94%).	Prospective cohort study based off a larger study of a brief web-based screening questionnaire for common mental disorders. Respondents to the web-based questionnaire were contacted to complete a phone interview and if screened positive, a paper form was completed. Data were analyzed comparing the paper based form with the web-based form, these findings were also compared to patient reported diagnoses.	Paper-form GAD-7- AUC 0.91. An optimal cut-off point of 12 was found, this created a sensitivity score of 0.83 and a specificity of 0.65, PPV of 0.36, and NPV of 0.94. GAD-2- AUC 0.91. Optimal cut-off point of 4 generated a sensitivity of 0.83, specificity of 0.61, PPV of 0.34, and NPV of 0.94. Web-based cut-offs were higher. However, there were no significant differences between the web-based tool and paper tool (P>0.05)	Findings were based on people who volunteered to answer questions. Also, people are more likely to respond honestly when completing web-based forms vs. in person or paper forms- therefore the increase in the cut-off points is to be expected.	The GAD-7 and GAD-2, regardless of web-based or paper forms, were identified as reliable and valid.	Level IV

Table 6: Background Literature Review Table.

Citation	Purpose/ Objectives	Study population/ Sample/ Setting	Study Design/ Methods/ Major Variables/ Instruments and Measures	Result(s)/ Main Findings	Implications /critique	Comments Themes	Level of Evidence
[2]	To review the principles of MRI and clinical implications that may occur.	A meta-analysis of 54 scholarly articles regarding patients undergoing MRI and MRI key pints.	Integrated physics, practice experts, images/sequences, and techniques to provide a broad overview of MRI.	Identifies MRI safety issues, such as projectile hazards posed by certain metallic devices. Discusses MRI adverse events such as aborted exams due to claustrophobia and anxiety, noting that this occurs (10-20% of patients).	The suggestion mentioned in this article to aid in aborted exams related to claustrophobia or anxiety is to have an "open" bore MRI scanner or a short-bore scanner which may decrease the chance of anxiety. It was mentioned that by having this, the patients experience less symptoms of being trapped or enclosed. However, open bore scanners do not produce the best images.	10-20% of patient experience anxiety/ claustrophobia in MRI.	Level II
[1]	To identify the prevalence of unanticipated events (UE) associated with MRI exams in a multicenter academic radiology department.	UE's reported between June 2013 and November 2014 on 17 MRI scanners in a university and community affiliated single health system.	Review/analysis of UE events. Events were categorized into categories: - Order/schedule - Scan delays - Foreign bodies - Non-contrast events: motion discomfort, anxiety, claustrophobia, and need for sedation. - contrast related events - Technical issues. Randomized trial in that 17 different scanners (34,587 exams) were included and all patients were involved.	34,587 exams (87% university; 58% OP facilities) completed with 5775 UE (16.7%)- this was then divided up based on location. The rate of UE's was significantly higher in the university facilitated sites (coefficient, 0.09 [95% CI, 0.07-0.01]; *p*<.001), in scans in the OP setting (coefficient, 0.09 [95% CI, 0.08-0.09]; *p*<.001). **The majority of these UE's were classified as non-contrast events, with majority being anxiety related (16.7%).**	Subgroups anxiety with other UE events. Really hones in on the prevalence and implications of UE related to anxiety and claustrophobia.	Since 2015, there are new Joint Commission diagnostic imaging requirements for MRI safety that include management and tracking of patient anxiety. Suggests improving pre-exam activities or relaxation and clear communication to lead to reduced time to diagnosis and improve patient care and satisfaction.	Level II
[3]	Identify different reasons for scan related anxiety and aborted scans. Identify interventions to screen and reduce scan related anxiety and aborted scans.	Patients undergoing MRI scans. No sample size, population, or locations were mentioned. The number of articles reviewed in the meta-synthesis as well as the search terms and databases utilized were not identified.	Meta-synthesis of available literature and patient reported experiences. The data discussed in the article were not clearly identified as to what pieces of literature they were pulled from. The design types were also not identified.	It's important to collaborate with patients on an individual basis- not all strategies work. Screening for and identifying patient needs prior to exam start are important. Communication and patient preparation are key aspects to exam completion.	Patient anxiety levels and experiences are subjective and there are many environmental factors, such as lighting, temperature, and loud noises that can lead to feelings of anxiety. Focus on improving these may help to reduce scan related anxiety.	If screening identifies that a patient has anxiety, verbal communication, a relaxing environment, calming voices, and comfort are key to successful exam completion.	Level V

Statistical data were considered while reviewing the literature, as these are important considerations for making decisions about quality tools, and are explained in (Table 4). Sensitivity means the probability that a person who suffers from an identified disorder will screen positive for that disorder [11,12]. Specificity is defined as the probability that a person who does not suffer from an identified disorder will screen negative for that disorder [11,12]. Positive Predictive Value (PPV) is the probability that positive screening leads to a positive diagnosis [11,12]. Negative Predictive Value (NPV) is the probability that negative screening leads to a negative screening [11,12].

Anxiety Screening Tools

Most of anxiety screening tools are self-report and are often referred to as subjective data. However, one can argue that self-reported data are sufficient as these results the patient's subjective experience of anxiety that will trigger their responses and reactions during the MRI scan [6]. Anxiety can be related to psychological distress that may trigger the reaction one may experience in response to internal and external stressors [13]. Patients undergoing MRI may experience psychological distress due to fear of the unknown or fear of the findings for diagnosis. Existing evidence on screening tools specifically for anxiety is limited due to the overwhelming focus on screening for mental health problems related to depression and anxiety. Furthermore, few trials have examined the efficacy of anxiety screening tools [5]. Anxiety screening tools and studies found during the literature review are described in detail below are found in (Table 5). Eight anxiety screening tools were identified when reviewing the literature, see (Figure 3).

All were reviewed for ease of use and length in consideration for applicability in the diagnostic radiology MRI clinical setting and are explained in more detail later in the literature review section. When evaluating the tools for use, the following criteria were considered: length of screening form, study setting, patient population, ease of interpreting results (for staff), as well as strengths and weaknesses (Table 8). By using the previous criteria listed, five screening forms were eliminated from the recommendations. Tools identified with an asterisk (*) in the following narrative were considered in the final recommendations.

Existential Concerns Questionnaire

The Existential Concerns Questionnaire (ECQ) was developed and reviewed by [14]. The ECQ was created to measure Existential Anxiety (EA), which is a type of anxiety that derives from existence as a whole [14]. The 13-item questionnaire was designed to measure feelings of anxiety "in reaction to death, guilt, and meaninglessness, social isolation and identity" [14]. A prospective study was completed to evaluate the validity of the ECQ. The study involved a non-clinical, control, sample of 389 participants that was composed of psychology students and their relatives or acquaintances who were asked to complete a 25-item questionnaire [14]. A clinical sample was also examined and this was composed of 99 clinical patients who were visiting an outpatient anxiety and depressive treatment clinic for diagnoses and/or treatment. These participants were asked to complete a 22-item questionnaire. Upon review of the two groups and the mean scores, the questionnaire was reduced to 13-items. The level of evidence assigned to this study was Level VI; [14] concluded that additional research was recommended to examine the tool's psychometric qualities and applicability. These findings led to the decision not to include the ECQ as a recommended screening tool for use in the diagnostic radiology MRI practice.

48-Item Symptom Questionnaire

The 48-item Symptom Questionnaire (SQ-48) is a screening tool developed to measure and assist diagnosis of psychological distress [13]. Carlier's study focused on randomly selected patients and non-patients and was composed of two phases, instrument development and construct validity evaluation. Participants were asked to complete a 48-item questionnaire that focused on nine categories: depression, anxiety, somatization, cognitive problems, social phobia, agoraphobia, aggression, work functioning, and vitality/optimism [13]. Results indicated that the two samples showed satisfactory properties and validated the use of the SQ-48 in the clinical, research, and service settings [13]. The level of evidence assigned to this study was Level II. Due to the length of the form (48 questions) and limited literature on additional studies utilizing this tool, the author did not recommend the SQ-48 as a screening device in the diagnostic radiology MRI practice.

Patient Health Questionnaire Anxiety and Depression Scale

The Patient Health Questionnaire Anxiety and Depression Scale (PHQ-ADS) is a tool derived from combining the GAD-7 and the nine-item Patient Health Questionnaire depression scale (PHQ-9) [15]. Kroenke et al. completed a retrospective meta-analysis of three studies on depression and pain involving 896 patients was completed. Data from each study were analyzed separately [15]. Three tools, the PHQ-9, GAD-7, and PHQ-ADS were analyzed measuring the standard deviation and internal reliability of each, and then compared. All three scales were identified as having favorable internal reliability. However, the authors noted that if the PHQ-9 alone were used, 307 patients would have been missed.

This supported the use of a combined tool, such as the PHQ-ADS [15]. The level of evidence assigned to this study was Level I. The limitations to this study, such as the sample of patients experiencing pain *versus* patients with depression or anxiety, led to the decision not to include the PHQ-ADS as a recommended tool in the diagnostic radiology MRI practice setting.

*Kessler 10 Item Scale Screening Tool: Comparison Study

The Kessler 10 item scale (K10) is a screening tool to measure psychological distress, which, in turn, can lead to symptoms of anxiety [15]. A comparison study, cross-sectional survey was completed by [16], reviewing the K10 and the GAD-7. A total of 1,811 patients, age 65 years and older, were asked to complete both the K10 and GAD-7, and were later interviewed for their perspective [16]. The sensitivity and specificity of each tool were compared, and results from the interviews were considered. Both the K10 and GAD-7 yield results consistent with self-reported depression or anxiety (Table 4) [16]. The level of evidence assigned to this study was Level II. A limitation was that this study could not be generalized beyond adults aged 65 and older. Another limitation of the K10 tool was its main focus on depression, not anxiety and this tool has not been proven to screen

Table 7: Level of Evidence Summary Table.

Anxiety Screening Tool	SupportiveLiterature/Evidence	Study Design	Level of Evidence
State-Trait Anxiety Inventory (STAI)	[6]	Quantitative Systematic Review	Level I
	[10]	Prospective Cohort Study	Level IV
Pre-Scan and Post-Scan ImagingDistress Questionnaire (IDQ)	[10]	Prospective Cohort Study	Level IV
Existential Concerns Questionnaire (ECQ)	[14]	Prospective Study	Level VI
48-item Symptom Questionnaire (SQ-48)	[13]	Randomized Control Study	Level II
Patient Health Questionnaire Anxiety and Depression Scale (PHQ-ADS)	[15]	Retrospective Meta-analysis	Level I
10-item Kessler Psychological Distress Scale (K10)	[16]	Comparison Study	Level IV
	[11]	Prospective Cohort Study	Level IV
7-item Generalized Anxiety Disorder Scale (GAD-7)	[16]	Comparison Study	Level IV
	[5]	Systematic Review	Level I
	[12]	Prospective Cohort Study	Level IV
2-item Generalized Anxiety Disorder Scale (GAD-2)	[5]	Systematic Review	Level I
	[12]	Prospective Cohort Study	Level IV

Tables 6 & 7: Continued
Level of Evidence Determination Tool:
Level I: Evidence from a systematic review or meta- analysis of all relevant RCTs (randomized controlled trial) or evidence-based clinical practice guidelines based on systematic reviews of RCTs or three or more RCTs of good quality that have similar results.
Level II: Evidence obtained from at least one well-designed RCT (e.g. large multi-site RCT).
Level III: Evidence obtained from well-designed controlled trials without randomization (i.e. quasi-experimental).
Level IV: Evidence from well-designed case-control or cohort studies.
Level V: Evidence from systematic reviews of descriptive and qualitative studies (meta-synthesis).
Level VI: Evidence from a single descriptive or qualitative study.
Level VII: Evidence from the opinion of authorities and/or reports of expert committees.
This level of effectiveness rating scheme is based on: [9].

as successfully for anxiety symptoms alone as it has for depressive disorders. However, this tool was considered because during this study they used the tool for anxiety screening, considering a measure of psychological distress can lead to anxiety. Further evidence was pulled during a database search and was reviewed to support the validity and recommendation of using the K10 tool; this is discussed in the following validity review.

*Kessler 10 Item Scale Screening Tool: Validity Review

The K10 is amongst only a few instruments that are short, easy to complete for patients, and scored by staff [11]. The K10 focuses on psychological distress, which includes anxiety and depressive disorders, and is designed as an item response theory method [11]. A 5-point Likert scale measures the responses, with total scores ranging from 10, meaning no distress, to 50, which is severe distress, [11]. The most reliable cut-off score was found to be 20. Based on cut-off scores of 20, when screening for any depressive or anxiety disorder, the K10 showed positive sensitivity, specificity, Positive Predictive Value (PPV) and Negative Predictive Value (NPV) [11]. However, Donker et al. found that when screening for anxiety alone, the numbers were reduced. Review of the study, identified as Level IV evidence, found the K10 to be reliable and valid in detecting depressive or anxiety disorders combined, these findings correlate with previous studies [11].

*7 Item Generalized Anxiety Disorder Screening Tool

The 7 item Generalized Anxiety Disorder screening tool (GAD-7) is a tool focusing on anxiety symptoms [16]. Vasiliadis et al. completed a comparison study using a cross-sectional survey consisting of 1,811 patients, age 65 years and older, who completed both the K10 and GAD-7 [16]. The sensitivity and specificity of each tool were then compared. Vasiliadis et al. found that both the K10 and GAD-7 yielded results consistent with self-reported depression or anxiety.

A systematic review and meta-analysis study on the GAD-7 and GAD-2 was completed by Plummer et al. The review consisted of identifying the accuracy of the GAD-7 and GAD-2 anxiety screening questionnaires to determine if the use of these tools should be advocated. The meta-analysis reviewed 12 citations, with over 5,000 participants ranging from 18 years and older in settings that included general population, primary care, secondary care, community treatment service and occupational health service centers [5]. Regarding the GAD-7, 10 out of 11 studies showed high levels of sensitivity and specificity, with scores under the curve against the "gold standard" (Table 4), and identified 42 of 50 cases of anxiety [5]. The level of evidence assigned to this study was Level I. Further evidence was reviewed to support the validity and recommendation of using the GAD-7; this is discussed in the validity review section.

*2 Item Generalized Anxiety Disorder Screening Tool

The 2 item Generalized Anxiety Disorder screening tool (GAD-2) is a tool derived from the first two questions of the GAD-7 [5]. As discussed previously, a systematic review and meta-analysis was completed on the GAD-7 and GAD-2 by [5]. This study reviewed 12 citations, with over 5,000 participants ranging from 18 years and

older in various hospital settings [5]. When reviewing the specific findings of the GAD-2, all studies found the specificity and sensitivity levels to be high, with scores under the curve against the "gold standard" (Table 4) [5]. The level of evidence assigned to this study was Level I. Further evidence was pulled during a database search and was reviewed to support the validity and recommendation of using the GAD-2; this is discussed in the following validity review section.

*7 Item Generalized Anxiety Disorder and 2 Item Generalized Anxiety Disorder Screening Tool: Validity Review

Both the GAD-7 and GAD-2 are proven to be reliable screening tools for generalized anxiety disorder, as well as panic disorder, social phobia, and post-traumatic stress disorder [12]. There are versions of the GAD-7 and GAD-2 available in different languages, and pencil-paper based forms as well as web-based forms. A prospective cohort study completed by [12] looked at the validity and reliability of the paper form compared to the web-based form. The data analyzed for their study were pulled from a larger web-based screening study that recruited participants using an internet banner [12]. After individuals were excluded, based on various exclusion criteria, 502 participants with a mean age of 43, 57% female, and 94% Dutch, were included [12]. The paper-form identified an optimal cut-off score of 12 for the GAD-7 and 4 for the GAD-2, with high sensitivity, specificity, PPV, and NPV scores (Table 6) [12]. When comparing the web-based form, the optimal cut-off scores were increased due to the significant higher mean scores, however, this can be correlated to individuals answering more honestly to a web-based form because they were not "shamed" into answering otherwise [12]. The statistical findings of the paper form compared to the web-based form were significant and did not find a great deal of variance, therefore, both forms for the GAD-7 and GAD-2, were considered reliable and valid [12].

Spiel Berger State-Trait Anxiety Inventory Tool

The Spiel Berger State-Trait Anxiety Inventory (STAI) tool is a 40-question tool designed to measure current state and level of anxiety [6]. A quantitative systematic review (Level V) was completed by [6]. This systematic review was one of only two pieces of literature found and reviewed that linked a specific anxiety screening tool to use in MRI, however, the focus was on interventions once anxiety was identified.

The authors reviewed 21 studies in detail and of those, 14 studies used the STAI to screen anxiety [6]. One limitation noted in this study, although the STAI was found to have high sensitivity and specificity, was the length and the need for the form to be completed in the primary care facility during the referral to radiology.

The intention of this scholarly integrated review was to identify tools that are suitable for use in the diagnostic radiology MRI setting. Therefore, this tool was not considered for further recommendation.

Pre-Scan and Post-Scan Imaging Distress Questionnaire

The Pre-Scan and Post-Scan Imaging Distress Questionnaire was created based on the design of the STAI and focused on pre-scan and post-scan imaging distress in pregnant women undergoing fetal MRI [10]. Leithner et al. (2008) completed a prospective cohort study of 62 women undergoing fetal MRI scans. It was rated as a Level IV, level of evidence. This study was one of only two found during this literature review that discussed a tool used in MRI. Anxiety levels were measured by a pre-scan and a post-scan imaging distress questionnaire and these findings were compared to the STAI completed by the same patient's pre-and post [10]. Results of the pre-scan questionnaire compared to the STAI were consistent, noting that the pre-scan questionnaire focused on anxiety related to the exam and effects of the exam [10]. Limitations of this study were that only pregnant women undergoing fetal MRI were examined and they tend to have an increased anxiety in general, as well as the fact that this questionnaire was created simply for their study so it has not been tested further by other sites or patient populations. Because of these limitations, this questionnaire was not considered for further recommendation for this review.

Statistical Recommendations

A statistical analysis of the literature and anxiety screening tools was completed See (Table 4). Sensitivity, specificity, positive predictive value, and negative predictive value were examined to determine the validity and reliability of the tools. Sensitivity can be explained as the proportion of individuals with a disorder who screen positive for that disorder [8]. Specificity is defined as the proportion of individuals who do not suffer from an identified disorder will screen negative for that disorder [8]. Sensitivity and specificity are proportional in that as the sensitivity increases, the specificity decreases and vice versa, the closer these numbers are to 100, the more favorable as the gold standard [8]. Positive Predictive Value (PPV) is the probability that positive screening leads to a positive diagnosis, this number is more favorable the closer it gets to 100 [11,12]. Negative Predictive Value (NPV) is the probability that negative screening leads to a negative screening, this number is also more favorable the closer it is to 100 [11,12].

Table 4, describes the three potential recommended pre-screening tools, K10, GAD-7, and GAD-2 findings in detail.

Each tool showed similar results. The study completed by [16], explored the K10, which had a total of 1.811 participants and a sensitivity of 0.794, a specificity of 0.664. Neither PPV nor NPV were discussed. The Donker et al. study also reviewed the K10 with a total of 1,607 participants and a sensitivity of 0.80, a specificity of 0.81, a PPV of 0.63, and a NPV of 0.91.

Vasiliadis et al. examined the GAD-7 in the same 1,811 population. They found a sensitivity of 0.709, a specificity of 0.568, with PPV or NPV not discussed. The GAD-7 was reviewed by [5], with a total of 5,000 + participants and was found to have a sensitivity of 0.74, and a specificity of 0.83; PPV or NPV were not discussed. The GAD-7 was also examined by Donker et al. among 502 participants. Their findings showed a sensitivity of 0.83, a specificity of 0.65, a PPV of 0.36, and a NPV of 0.94.

Plummer et al. compared the use of the GAD-7 with the use of the GAD-2 in the same 5,000 + sample. They found the GAD-2 to have a sensitivity of 0.76, a specificity of 0.751, but PPV or NPV were

Table 8: Initial Anxiety Screening Tools Used in Reviewed Literature.

Anxiety Screening Tools	Length of Screening Form	Setting	Patient Population	Ease of Interpreting Results	Strengths:	Weaknesses:
State-Trait Anxiety Inventory (STAI)	40 questions	Primary Care/Clinical	Adult patients 18 years or older	Likert scale ease	Widely used tool used to assess current state and level of anxiety.	Used for detailed diagnosis of anxiety disorders.
Pre-Scan and Post-Scan Imaging Distress Questionnaire	STAI plus 7 additional questions= 47 questions	Department of Radiology: Fetal MRI practice	Pregnant females	Likert scale ease	Focused on MR related anxiety reactions.	Only assessed fetal MR patients. "Home-grown" tool, only tested in very specific population.
Existential Concerns Questionnaire (ECQ)	22 questions	Primary Care/Clinical	Adult patients 18 years or older	Likert scale ease	Focused on anxiety reactions.	Administered to patients who were seeking treatment for known/ diagnosed anxiety or depression.
48-item Symptom Questionnaire (SQ-48)	48 questions	Primary Care/Clinical	Adult patients 18 years or older	Likert scale ease	Available in public domain to be used for screening and monitoring.	Used for assessing depression, anxiety and somatoform disorders.
Patient Health Questionnaire Anxiety and Depression Scale (PHQ-ADS)	PHQ-9 plus GAD-7= 16 questions	Primary Care/Clinical	Adult patients 18 years or older	Likert scale ease	Combines two validated tools of measurement.	Used to assess depression and anxiety together. Not used widely, therefore validity should be further tested.
10-item Kessler Psychological Distress Scale (K10)	10 questions	Primary Care/Clinical	Adult patients 18 years or older	Likert scale ease	Only 10 questions, quick for patients to complete. Commonly used and validated tool for measuring psychological stress.	Designed to measure psychological stress vs. anxiety- however, can cause anxiety.
7-item Generalized Anxiety Disorder Scale (GAD-7)	7 questions	Primary Care/Clinical	Adult patients 18 years or older (have pediatric based tools as well)	Likert scale ease	Only 7 questions, easy and quick for patients to complete. Available in more than 80 different translations. Among the best validated and most commonly used tools for measuring anxiety.	No literature discussing use in the radiology diagnostic imaging setting (MRI).
2-item Generalized Anxiety Disorder Scale (GAD-2)	2 questions (first two core questions of the GAD-7)	Primary Care/Clinical	Adult patients 18 years or older.	Likert scale ease	Easily administered and answered by patients. Available in more than 80 different translations.	Limited screening, only first two questions of GAD-7. No literature discussing use in the radiology diagnostic imaging setting (MRI).

not discussed. Lastly, [11] also compared the use of the GAD-7 with the GAD-2 in their 502 sample. Their findings of the GAD-2 showed a sensitivity of 0.83, a specificity of 0.61, a PPV of 0.34 and a NPV of 0.94. Refer to Table 4 for a collation of these findings.

Literature Summary & Conclusion

Evidence on specific anxiety screening tools used in the diagnostic radiology clinical setting is limited. Most of the studies reviewed were prospective cohort studies with an average level of evidence of IV. After examining the literature and the screening tools identified (Table 5&8), the author chose the K10, GAD-7, and GAD-2 as potential recommended tools for anxiety screening in the diagnostic radiology MRI practice. These tools are designed for use in the clinical setting serving the adult population and have multiple language options, as well as online-versions for use. These tools can assist in identifying if an intervention should be planned to facilitate successful exam completion. Each tool consists of 10 items or less and are easy to complete with an average of 2-3 minutes. One limitation noted in the study completed by [11] was that that the K10 has not been proven to screen as successfully for anxiety symptoms alone as it has for depressive disorders. The GAD-7 and GAD-2 are widely used recommended tools, and proven reliable and valid in screening for generalized anxiety disorders. The GAD-2 is limited to only the first two core questions of the GAD-7, "feeling nervous, anxious, or on edge" and "not being able to stop or control worrying", which may lead to missed items that can be beneficial to know in the MRI practice, such as trouble relaxing or being restless [5].

Based on screening tools identified and reviewed within the

literature, the K10, GAD-7, and GAD-2, were found to be reliable and valid tools that are easy to use and do not require an extended amount of time to complete. Each tool was identified as having acceptable sensitivity, specificity, PPV, and NPV, with variable AUC's due to the different populations these tools were tested in. The additional five tools reviewed, ECQ, SQ-48, PHQ-ADS, STAI, and the Pre-scan and Post-Scan Imaging Distress Questionnaire, were ruled out due to length, ease of scoring, and patient population they were designed for. The tool design, length/time to complete, ease of scoring, weaknesses, strengths, statistical analysis, and evidence reviewed (Tables 4,5 & 8) led the author to recommend a comparison trial of the use of the GAD-7 and GAD-2 as a screening tool in the diagnostic radiology MRI practice.

Implications for Nursing

Radiology nurses in the MRI practice play an instrumental role in patient assessment and intervention. In the author's current practice, nurses offer information/education, coaching, and/or sedation to patients who express concerns about claustrophobia, symptoms of anxiety, or who have been flagged by the ordering provider. This places burdens on the front-line nurses in identifying patient anxiety or claustrophobia to better prepare the patient and allow for successful exam completion and improved patient experience. If nurses fail to recognize symptoms of anxiety in the patient, the patient may experience unexpected anxiety during their scan with no interventions prepared, leading to poor outcomes for imaging. Adding a pre-assessment tool that could potentially screen for anxiety within this setting provides nurses with adequate information and ample time to discuss and prepare interventions for the patient. It is important to note that the intention of using an anxiety screening form in the diagnostic imaging, MRI practice, is not to diagnosis anxiety but to rather flag anxiety symptoms associated with the MRI exam. Nurses administering the screening form would not be making diagnoses; they would be capturing anxiety symptoms and planning interventions based on their findings. By implementing this process, a cost savings related to reduced rescheduled exams or those reschedule with anesthesia may be found. The two anxiety screening tools chosen, GAD-7 and GAD-2, provide two to seven questions with responses ranging from zero (not at all) to 3 (nearly every day) [16] . The nurses would total these scores to help identify the severity of the patient's anxiety. For example, scores for the GAD-7 are as follows: >15 (severe), 10-14 (moderate), 5-9 (mild), <5 (none), [16]. This knowledge will improve nursing workflows and, most likely, improve patient outcomes.

Recommendations

The primary purpose of this scholarly inquiry paper and integrated literature review was to identify recommended anxiety screening tools that could be used in the diagnostic radiology MRI setting to flag anxiety and improve patient outcomes. The future recommendation is to continue applying the Stetler Model of Research Utilization in evidence-based practice with phase four (translation and application) and phase five (evaluation) [7] at a later time.

The fourth phase, translation and application, would involve planning a pilot to examine both the GAD-7 and GAD-2 within the radiology MRI practice [8]. The GAD-7 and GAD-2 are the tools recommended by the author based on findings of this integrative literature review. These tools are also recommended for use by the national clinical guidelines in the United States due to their validity [5]. The pilot project could elicit the perspectives from patients, nurses, technologists, and clinicians regarding the feasibility and clinical preference, taking into account the validity of the tool for the MRI population [7].

This phase would encompass patient outcomes and identify if screening for anxiety with one of these tools assists in the preparation of interventions that lead to successfully completed exams. A retro-review on cost analysis should also be completed during this phase. Lastly, the fifth phase, evaluation, would lead to a recommended practice change based on findings and cost benefit analysis.

Summary

Of patients undergoing MRI, up to 37% can experience some level of anxiety reaction that relate to extended exam times, noise levels, and temperature [10]. Anxiety is a common experience associated with diagnostic MRI exam that accounts for unanticipated patient events or aborted scans on average 10.4% of the time [1]. A pre-assessment screening tool may help to identify at risk patients for anxiety exacerbation during MRI exams. The use of a pre-assessment screening tool, that includes symptoms of anxiety, is recommended to help staff identify appropriate interventions that may assist patients in cooping and lead to successful completion of MRI exams. After examining eight anxiety screening tools, three were chosen for further examination, the K10, GAD-7, and GAD-2. Within the data and criteria reviewed, only two, the GAD-7 and GAD-2, were recommended for use in the diagnostic radiology MRI setting. It is important to note that not only the author recommends the GAD-7 and GAD-2, but the national clinical guideline in the United States also recommends these tools [5]. The recommendation is to pilot the two anxiety screening tools and consider practice preference, feasibility, and patient outcomes.

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