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Medication administration evaluation tool design: An expert panel review

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ABSTRACT

Background: Tools currently available to evaluate nurse medication administration practices have limitations and are either not validated or have poor reliability.
Aim: To identify criteria and content for inclusion in a tool to evaluate medication administration by nurses in the clinical setting, using an expert panel.
Methods: A peer review process using an expert multidisciplinary panel rated the relevance of the content on three tools; Medication Administration Safety Assessment Tool, Medication with Respect Tool and Clinical Skills Assessment Tool, using a four-point rating scale. Expert opinion was provided on relevance of content, rating scales and frequency of nurse evaluation. The level of agreement was analysed by item content validity index, mean item content validity index, mean expert proportion, scale content validity index with universal agreement, probability of chance agreement and a modified kappa rating. Qualitative themes were also reviewed.
Findings: The item and scale content validity index and the kappa index both rated the Medication Administration Safety Assessment Tool and Clinical Skills Assessment Tool as excellent. For the Medication with Respect Tool less than half of the item content validity index ratings rated as good and the kappa index rated as excellent, therefore the scale content validity did not achieve a good rating.
Conclusions: The expert panel review identified items of high level of agreement for relevance and determined that content needed to be clear, concise, observable, generic and practical to be useful for all nurses. Self-evaluation, feedback and a developmental plan were also key criteria.

Summary of relevance

Problem:
There are few validated and reliable nurse medication administration evaluation tools currently available for use in the clinical setting.

What is already known:
Avoidable medication administration errors are widely reported in nursing literature. Compliance to safe medication practice reduces the potential for error and unintentional patient harm.

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What this Paper Adds:

Development of a relevant and practical medication administration evaluation tool that incorporates self-evaluation, feedback and a developmental plan as key criterion.

1. Introduction

Medication administration is a key component of the medication management process and comprises a significant component of nursing patient care (Jennings et al., 2011; Westbrook et al., 2011). Basic core clinical skills are required to understand and ensure the safe, effective and efficient administration of medications to patients and avoid unintentional harm (Australian Commission on Safety and Quality in Health Care, 2012b; Coyne et al., 2013; Härkänen et al., 2016; Sinclair et al., 2014; Stolic, 2014). The World Health Organisation (WHO) aims to halve avoidable medication-related error over five years by addressing weaknesses in health systems and improving the way medications are managed (World Health Organisation, 2017). Examples of the WHO strategies to achieve this are: 1) the use of tools to help health care professionals, especially when using medications with a high risk of harm if used improperly and enhancing patients understanding of these medications, 2) to strengthen leadership development and skill-building and, 3) to promote patient safety research in this area.

There are many studies demonstrating the potential for medication administration error that can lead to patient harm (Popescu et al., 2011), (Gunningberg et al., 2014). Observational studies undertaken internationally, and locally within Australia and New Zealand have identified factors that are known to contribute to increased potential for error and harm to patients. Distractions caused by external environmental factors such as monitoring alarms, interruptions by nurses, doctors, other staff members, patients and family members have been shown to increase errors (Davies et al., 2015; Härkänen et al., 2015; Westbrook et al., 2010). Simulated scenario-based training of 591 nurses has shown a third of nurses identified all known errors (Coombes et al., 2005). Examples of these errors were 1) incorrect intravenous potassium concentration 2) re-exposure to a severe adverse drug reaction 3) incorrect formulation of a medication 4) no dose documented on the prescription 5) incorrect frequency documented 6) incorrect medications supplied on discharge. Lack of knowledge and deviation from national standards, state legislation and local procedures and policies that underpin safe medication practice have also been shown to contribute to incongruence from accepted safe practice (Westbrook et al., 2011). This leads to perpetuation of poor medication practice through learned and demonstrated behaviours to new staff (Popescu et al., 2011).

When gaps in practice are identified, feedback is required to enable the nurse to implement strategies to improve practice (Spector, 2014). For feedback to be effective multiple factors need to be considered; whether the nurse is willing and engaged to receive feedback, the environment in which feedback takes place, the timing of feedback and if the task is something the nurse is required to do or wants to do, as well as the relationship between the nurse and the reviewer. Feedback needs to be formative, not summative, with information about their performance communicated to the learner that is intended to modify their thinking or behaviour for the purpose of improving learning and patient outcomes. Summative feedback is usually cumulative feedback over time from multiple assessments and is often graded with a mark. This type of feedback is often less descriptive in providing examples of individual performance opportunities for improvement (Butler & Winne, 1995; Molloy & Boud, 2013; Wikander & Bouchoucha, 2018). Local observational audit studies have demonstrated that combining intermittent nurse observation of medication administration as well as providing direct individual feedback can improve practice. Examples include: increased checking of patient identification and adverse drug reactions, decreased medication error selection, decreased wrong rate administrations, decreased omissions of medications, decreased forgetting to sign medication charts after administration, decreased interruptions (Davies et al., 2015).

Other professions including Pharmacy have demonstrated improvement in pharmacist's performance facilitated by an adapted competency-based general level framework (GLF). The GLF is a tool used to evaluate pharmacist's performance and incorporates tailored feedback and individualised training plan to guide professional development (Coombes et al., 2010; Stacey et al., 2014). However, there is a lack of validated and reliable tools to conduct self-evaluation, observation and provide formative feedback of *nursing* medication administration practice in the clinical setting, such as: the hospital inpatient setting, residential aged care facility, community or general practice.

2. Literature review

The literature review of medication administration assessment tools synthesises the various methods and tools used to assess nurses medication administration practice and has identified a lack of validated and reliable competency measures in the clinical setting (Ličen & Plazar, 2015). Tools identified were either: a) not specific to medication administration, b) developed for students, new graduates or nursing specialties only, c) medication calculation focused, d) lacked self-assessment, e) had no developmental plan, f) were not validated or g) had poor reliability (Bull et al., 2017; Coates & Chambers, 1992; Fisher & Parolin, 2000; Long et al., 2013; Sinclair et al., 2014). Three tools were identified that contained many of these criteria and were used to assess nurse medication administration. Therefore, these three tools were chosen to be included in this study.

The tool from the United Kingdom was a medication administration competency tool, Medication with Respect Tool (MwRT), adapted from an established assessment framework used to evaluate orally administered medications in the mental health area. (Hemingway et al., 2011; Turner et al., 2007, 2008). The format used evidence- based structured criteria aiming to minimise the risk of medication errors by defining and setting procedures for safe administration. Two assessments were used (1) Observed Structured Clinical Examination (OSCE) and (2), an assessment of Administration of Medicine Competency Frameworks (Oral and Intramuscular). Only the Oral tool was reviewed in this study. The content was comprehensive including additional environmental components such as cleaning, restocking and secure locking of medication storage, as well as the administration of the medication. However, the research was undertaken with mental health nurses only and further work would be required to validate in other clinical areas such as the general hospital inpatient setting, specialty fields such as intensive care and paediatric, as well as community and aged care facilities.

The medication administration safety assessment tool (MASAT) from the United States of America (US) is a binomial scale used to evaluate accurate medication administration performance (Goodstone & Goodstone, 2013). The researchers conducted a literature search of the "6 rights" of medication administration to develop the content and identify specific behaviours related to performing them. Reliability of the tool was conducted using simulation scenarios and a simple five-point anchored likert scale. The content was a checklist format of 8 rights for safe medication administration. Three were for checking the correct patient and one each for checking the right drug, dose, route, time and documentation. The authors concluded the MASAT check list for medication

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administration assessment was reliable (Cronbach's alpha 0.90) in a simulated and clinical hospital ward setting with an undergraduate nursing student cohort. It was not however, used with Registered Nurses.

The Australian Clinical Skills Assessment Tool (CSAT) was developed by nurse educators for the purpose of supporting new staff, post induction as part of a medication resource package (O'Brien, 2015). The main components identify key medication procedures to inform standards of practice, assesses foundation knowledge by case scenario examples, then observes the nurse in practice to ensure that the steps for safe administration are adhered to. The content included checking the correct rights of the medication as well as the validity of the prescription, knowledge of the medication and assessment of the patient pre and post administration. Formative feedback is provided, and any knowledge practice gaps are discussed for further improvement. The CSAT has not however been validated to determine reliability, reproducibility, usefulness and efficacy. The package has 5 hours of Continuing Professional Development (CPD) allocated to complete the module knowledge component and three assessments. Importantly, the time required to complete the package limits its broader use, precluding all nurses from the opportunity to benefit.

There is a need for a practical, user friendly medication administration evaluation tool for all nurses that allows self-evaluation, observation in clinical practice, provision of formative feedback and development of a mutually agreed plan for improving performance.

3. Methods

3.1. Aim

To identify criteria and content for inclusion in a tool to evaluate safe, effective and efficient medication administration by nurses in the clinical setting to ensure all procedures are being followed, using an expert panel.

3.2. Study design

A peer review process was employed using an expert multidisciplinary panel to review the content of three tools identified in the literature used to evaluate medication administration by nurses. The expert review was conducted as described by (Polit & Beck, 2008) by invited medication experts asked to rate the content of items and overall scales for relevance in the development of a medication administration evaluation tool. This study received a waiver of Human Research Ethics Committee (HREC) review from the Hospital and Health Service HREC (HREC/16/QRBW/351). The funder for the study did not contribute to the study protocol, design, data collection, analysis of results or the manuscript.

3.3. Study settings

The expert panel review was held at a tertiary metropolitan hospital in July 2016 over two hours. Expert panel members either attended face to face, via videoconference or teleconference. Experts unable to attend were offered the opportunity for one on one interview with the same agenda questions as the expert panel meeting.

3.4. Data collection

Invitations for the panel were sent via email to 22 potential experts that met the criteria as experts in medication administration or had evaluated medication assessment tools previously. Sixteen of the twenty-two invited experts who were from a range of multidisciplinary (nursing, pharmacy and medical) backgrounds and roles including clinical, academic, research, education and safety and quality professions participated. Consent was provided by acceptance of the invitation.

The expert panel members were provided four questionnaires via email prior to the meeting. A brief demographic questionnaire included data about their profession, role, years of experience, whether they managed medications or whether or not they had validated an assessment tool previously. There were also three structured questionnaires of the chosen tools to complete prior to the discussion panel:

- MwRT (Hemingway et al., 2011),
- MASAT (Goodstone & Goodstone, 2013)
- CSAT (O'Brien, 2015)

The questionnaires asked the panel to rate the individual content for relevancy to safe medication administration practice using the following scale:

1 not relevant,
2 somewhat relevant,
3 quite relevant to
4 highly relevant.

The questionnaires also asked the panel to rate the individual content on a four-point rating scale from:

- delete item,
- revise item (major),
- revise item (minor)
- keep item as is.

(Polit & Beck, 2008)

The facilitator was a senior academic pharmacist with over 10 years' experience in facilitating large groups of health professionals. The panel meeting was run by the facilitator using an agenda to guide the discussion. Minutes were taken as well as an audio recording to capture content of the discussion. The panel were divided into three groups of four participants to allow constructive discussion around the eight agenda questions. The panel discussion focused on the following areas:

- type of content to be included such as: checking the right medication and procedural steps in medication administration.
- the format of the tool, whether binomial or likert scales should be used for evaluation; whether all routes and types of medication such as: oral, intravenous (IV), intramuscular (IM) and controlled schedule 8 drugs (CD) should be included in one tool or should there be multiple tools.
- number of patients to adequately assess each nurse.
- number of medications to adequately assess each nurse
- number of routes of medications to adequately assess each nurse
- length of time to adequately assess each nurse and allow the tool to be practical and useful
- frequency of observations

Based on the results of the recommended content from the expert panel a medication administration tool was designed. The designed tool was then sent to the expert panel for face validity evaluation.

3.5. Data analysis

Data were collated using Microsoft Excel and the item content validity index (I-CVI) was calculated by the proportion of items rated relevant by each expert. The description for calculating I-CVI

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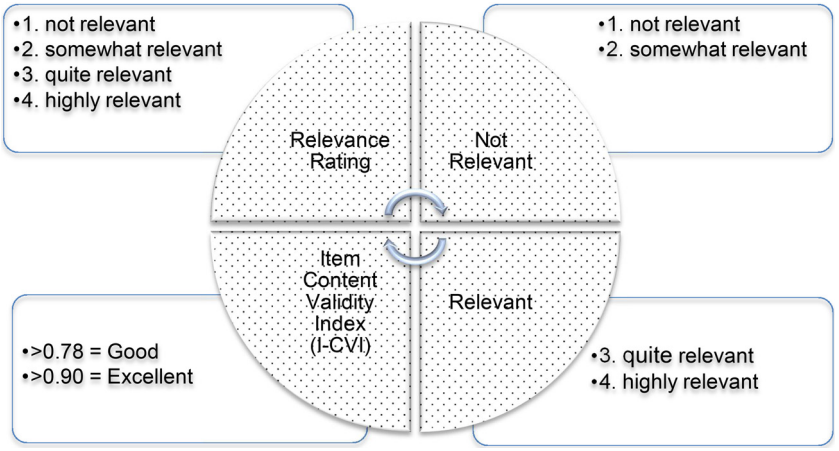

Fig. 1. Data Analysis. (Polit & Beck, 2006)

Table 1
Data Analysis Measures of Agreement and Acceptable Ratings.

Measure	Calculation	Validity Rating
I-CVI = Item content validity index	Number of items rated relevant (3 or 4)/number of expert responders	Good = >0.78; Excellent = >0.90
S-CVI/Ave = Scale content validity index average	Average of all I-CVI	Excellent = >0.90
Mean Expert Proportion	Average of expert proportion rated relevant by all experts	Excellent = >0.90
S-CVI/AU = Scale content validity index universal agreement	Number of items rated relevant (3 or 4) by ALL experts /number of items	Good = >0.70
Pc = Probability of chance agreement on relevance	N = number of experts and A = number agreeing on relevance [N!/A!(N-A)]x0.5N	Good = <0.070
k^* = Kappa chance corrected for agreement on relevance	(I-CVI-Pc)/(1-Pc)	Poor = k^*<0.40; Fair = k^* 0.40-0.59; Good = k^* 0.60-0.74; Excellent = k^* >0.74

is in Fig. 1. The validity of each scale overall, the mean item content validity index (S-CVI/Ave), the mean of the expert proportion relevant by all experts and the scale content validity index with universal agreement (S-CVI/UA) by all experts were all calculated. In order to account for the possibility of agreement or disagreement on relevance being by chance the Probability of Chance (Pc) was calculated. Then a modified kappa, for use with multiple raters, a statistical index adjusting for chance agreement was calculated. Data analysis measures of agreement and acceptable ratings are detailed in Table 1.

Fig. 1. Item content validity index (I-CVI) for rating relevance (Polit & Beck, 2006)

The contents rated as relevant (3. quite relevant and 4. highly relevant) and recommended to keep item as is, were considered for use in the designed tool. Contents rated as relevant, and revise item were considered for modifying. Contents rated as not relevant were not considered for use in the tool design. During the expert panel meeting all responses to the agenda questions were documented and the majority response was used in the design of the tool.

Qualitative thematic analysis of comments was conducted by collating into common words to determine themes. These themes were used as reasons to alter content or include in the proposed tool design.

4. Findings

4.1. Quantitative

Fourteen of the 16 expert panel completed the demographic questionnaire. They consisted of 5 nurses, 6 pharmacists, 2 medical officers and 1 public health researcher. All had between 10 and 40 years' experience in their professional practice with the majority having 20–30 years' experience. Over half of participants currently manage medicines either prescribing, dispensing or administering. Just under half (6/14) having previous experience with validating a competency tool, of which 67% were medication related.

The data analysis results for relevance and content validity for each of the three medication administration tools are shown in Table 2. All content items rated as excellent in the three tools were consider for use in the proposed tool design.

4.2. MwRT

The MwRT had 45 questions with less than half (22) scoring an I-CVI greater than 0.78 rating the content relevance as good. The S-CVI/Ave did not meet the recommended 0.9 rating and the S-CVI/UA rating of agreement by all experts was only 0.27. Therefore, the kappa index corrected for chance agreement rated only 22/45 items for the scale as excellent.

4.3. MASAT

The MASAT had only eight questions and the I-CVI rating for all eight questions was 100% agreeing on relevance. Therefore, the S-CVI/Ave, mean expert proportion, S-CVI/UA and kappa designating agreement on relevance all rated the scale as excellent.

4.4. CSAT

The I-CVI for all 25 questions in the CSAT rated over 0.78 rating the items relevance as good. The scale content validity rated as excellent for all calculations of S-CVI/Ave, mean expert proportion, S-CVI/UA and kappa.

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Table 2
Combined Summary of Tool Expert Panel Evaluation of Content Validity.

Tool	Number of Items	Number of Experts	Number of I-CVI >0.78	Mean expert proportion >0.90	Mean I-CVI (S-CVI/Ave) >0.90	S-CVI/UA >0.70	Pc <0.069	Number of k^* >0.74	Kappa Evaluation Rating
MwRT	45	10	22 (0.30-1.00)	0.68 (0.21-0.98)	0.73	0.27	0.001-0.273	22 (0.20-1.00)	22/45 Excellent
MASAT	8	10	8 (1.00)	1.00 (1.00)	1.00	1.00	0.001-0.002	8 (1.00)	8/8 Excellent
CSAT	25	12	25 (0.89-1.00)	1.00 (1.00)	0.97	0.72	0.00-0.018	25 (0.90-1.00)	25/25 Excellent

Table 3
Qualitative Themes from Tools Reviewed.

Tool	Theme	Description
MwRT	"wording needs to be revised" "clarification" "not practical because it was too long" "not relevant to general nursing medication safety" in Australia	Clarification required around questions meaning. It was long with 45 questions. It was specifically for mental health nurses and not general nursing in Australia.
MASAT	"student" "allergies" "acronyms" "outcome"	Specific to student nurses, not generic for all nurses. There was no check of patient allergies. Acronyms used were not clear or generic. Having checked it was not clear if the outcome was "correct".
CSAT	"checking" "correct" "add" "how" "duplication"	Patient identification and allergies were not separate questions to be able to determine if they were correct. More detail needed to be clear on specific components. How is it done to be observable, measurable and concise. Duplication of questions and components in tool.

4.5. Qualitative

There was general agreement by the expert panel that there should be "rights" of medication administration included; right patient, medication, dose, route, time. Comments were that wording needed to be clear and defined as observable tasks by succinctly describing the steps. It was also agreed that there are procedural steps associated with medication administration that need to be included. Such as:

- Appropriate hand hygiene
- Aseptic technique when preparing medication
- Conducting assessment and observations of the patient to determine if it is appropriate and safe to administer the medication.
- Engage the patient in the administration to determine their knowledge and understanding of the medications.
- Appropriately document administration of the medication after it has been administered, or if not, why not, and who was informed and endorsed the decision.

The panel concurred that ideally there should be one rating scale for both components of the tool and that a binomial yes/ no scale, was preferable and practical. It was agreed that one tool should cover all routes and types of medication administered and therefore some questions would not be applicable in all scenarios. An example of this would be oral medication which requires one nurse to administer and would not require labelling of an intravenous line. The question of how many observations or medications would be adequate to evaluate each nurses' practice remained unclear, as it would be dependent on the outcome of the observation. Rigorous discussion was around how this would be determined with all agreeing that it would be dependent on many variables i.e. How safe the nurse's practice was; and whether the observer's expert opinion was that they required more information to determine consistency of practice. Most said they would require at least one observation, with one expert recommending more than two patients, and one recommending five to ten patients. But it was agreed that some nurses may need a repeat evaluation. The panel agreed that an annual assessment would be beneficial. The consensus was that a tool needed to be a meaningful learning tool, that included nurse's self-assessment to enable reflection on their own practice. The panel agreed that articulated feedback in which a plan for any improvement can be discussed and agreed upon was imperative. Overall the tool and process need to be practical and workable, so it will be applied and become part of the normal practice.

Individual qualitative themes for the three tools reviewed are summarised in Table 3. The themes were predominantly around adding items deemed important such as checking patient allergies and clarification to ensure content was concise and not duplicated. Examples of questions deemed not relevant included those that were long and used multiple criteria to make an evaluation, making it unclear on what was being checked. The MwRT content was specific to UK mental health nurses. Half of the content was rated as irrelevant to the general nurse population and would require major revision. How items were measured was not always observable, and what was the outcome once it was checked, was it correct?

Using the results of the feedback from the face validity survey the tool was revised for further evaluation with intra-rater and inter-rater testing (Table 4).

5. Discussion

The aim of this study was to identify suitable and relevant content required for inclusion in an evaluation tool for nursing staff undertaking medication administration in the clinical setting by reviewing the content of three existing tools.

The MwRT was very long containing 45 questions and was specific to mental health nurses in the UK. The content was comprehensive including procedural steps for appropriate hand hygiene, consideration of whether it is applicable for the patient condition as well as engaging the patient in the medication administration. Only half of the content was rated as relevant and would therefore need revision for use in the general nurse population. The tool therefore was deemed not practical or relevant to the general nursing medication safety setting.

The MASAT had the fewest questions and rated the highest relevance for all three tools. This ensured it was concise and easy to use. The study was designed specifically for student nurses. Although

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Table 4
Example of Content in Designed MAEFT.

	Right Medication
1	Checked the medication against the medication order and confirmed the medication name and formulation is correct.
2	Confirmed the medication is indicated for the patient diagnosis and checked there are no duplicate orders of the medicine or of similar class of medicine.
3	Checked the medication expiry is within date.
	Right Procedure
1	Nurse conducts patient observations prior to administering the medication as required.
2	Nurse conducts hand hygiene and uses appropriate personal protective equipment as required when administering the medication.
3	Nurse uses standard non-touch or aseptic technique when preparing and administering medication.
4	Nurse confirms if medication requires 2 nurses to check. If so, both nurses perform an independent check and calculation.

this could be extrapolated to the general nurse population. The expert panel identified a number of gaps – such as no checking of the patient "allergies" which is crucial to avert re-exposure of the patient to known adverse drug reactions (ADR) and preventable harm and a key component in Australian Medication Safety Standard 4 (Australian Commission on Safety and Quality in Health Care, 2012b). In addition, there were only two patient identifiers and in Australia, Standard 5. Patient Identification and Procedure Matching requires at least three identifiers to confirm the correct patient; patient name, date of birth and unique hospital record number (Australian Commission on Safety and Quality in Health Care, 2012a). The panel identified that a number of the questions within the tool were unclear and ambiguous.

The CSAT rated as having excellent content validity. The panel did highlight some disadvantages however. Not all components were written as observable and measurable tasks. An example was the checking of the patient identification where the patient chart label, hospital record number, date of birth and allergies were all one question. These would need to be separate criteria in the tool. The tool was found to be comprehensive but some of the content was duplicated such as requirements for single nurse check and two nurse check which were the same. Only the tool for oral, subcutaneous and intramuscular medication administration of the package was reviewed however, the package included two other separate tools for different routes and types of medications that were not reviewed.

Therefore, the literature has identified a dearth of appropriate tools for evaluation of all nurses' medication administration clinical practice that are reliable and validated.

It is important that the design of an evaluation tool is generic to the administration process with generic terms, so it is not country specific to make it as universal as possible. Although there are differences in international practices e.g. USA pre-made and automated dispensed medications, the core checking requirements should remain the same. Nor should the difference between the types of medication administration (e.g. from the original package, a dose administration aid or automated dispensing system) impact the universality of a medication administration evaluation tool. It should also be generic for any medication administration setting, such as; in a hospital ward environment, procedural area, nursing home or community. Medication administration standards of practice should remain the same regardless of profession e.g. Nursing, medical officers and allied health staff such as physiotherapists. Hence there is a need for designing a generic medication administration tool suitable for use by all clinicians.

6. Conclusion

The expert panel identified that the content of a medication administration self-evaluation, observation and feedback tool needed to be clear, concise and observable in order to be useful. Specific criteria were established based on three tools identified in the literature. Such a tool needed to be generic for use by all nurses regardless of experience, specialty and clinical setting. Nurses needed to self-evaluate first to enable reflection on their own practice. Formative, not summative, feedback by the observers was identified as key, as was an agreed developmental plan for the tool to be utilised as a learning tool. Importantly, self-awareness and feedback of clinical practice may provide motivation to maintain and improve standards of care, potentially reducing errors and providing safer medication administration practice and better patient outcomes. Future studies will involve validating for inter-rater and intra-rater reliability and further testing in the clinical setting.

Ethical approval statement

This study did not involve human or animal research and was granted an exemption from High Risk Ethics by the Royal Brisbane and Women's Hospital Human Research Ethics Committee HREC/16/QRBW/351 on 11th July 2016.

Expert Panel Review Article

Conflict of interest statement

There was no conflict of interests in conducting this study for any of the authors.

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