THE ROLE OF THE SONOGRAPHER

An Investigation of the Scope of Practice of the Sonographer Internationally. January 2020

A report for ISRRRT based on final year project submitted to Department of Medical Imaging and Radiation Sciences, Monash University Australia

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The Role of the Sonographer
An Investigation of the Scope of Practice of the Sonographer Internationally

Executive Report
There is global variance in the role of a practicing sonographer. Literature examining global sonographic roles and scope of practice is limited, despite the international applicability of ultrasound imaging. This study aimed to examine the common and divergent features of a practicing sonographer internationally, and their impact upon the development of a global standard of practice. The [International Society of Radiographers and Radiological Technologists], an international professional body (ISRRT), had shown interest in this subject, specifically the countries within Asia. This project was completed with the close cooperation and collaboration of The President and CEO of the organisation.

An ethically approved mixed-methods online survey was conducted during 2019. The purposive sample included all 75 current elected council members of the ISRRT.

36 individuals from at least 32 different countries responded, reflecting the sonography profession in all four ISRRT regions. The results suggest that sonographer education requirements differ widely, from on the job training (16%, 6/36) to undergraduate or graduate schooling (44%, 16/36). Registration and accreditation bodies were present in the jurisdiction of 41% (14/34) and 35% (12/33) of respondents respectively, though many were voluntary, physician-focused or non-specific to sonographers. Five of 11 (45%) of respondents suggested that the sonographer-radiologist relationship is individual-dependent, and not primarily positive or negative. Ten of 28 (36%) suggested that other professionals do not know the role of the sonographer. The majority of ISRRT council members believe that an international scope of practice could benefit and be implemented in their jurisdiction (26/28, 93% and 22/23, 67%). The key advantages noted were standardisation of education and improved professional mobility. However, lack of sonographer education and radiologist acceptance are important potential barriers.
1.1 Introduction
The role of a practicing sonographer is globally diverse. There have been few previous studies explicitly examining global sonographic roles and scope of practice, despite ultrasound being a widespread and internationally applicable imaging technology (1, 2). The last sizeable examination of international ultrasound standards was conducted by the World Health Organisation [WHO] in 1998 (3). It was concurrent with a review performed by the American Registry of Diagnostic Medical Sonographers [ARDMS] recommending components of an international scope of practice (4). Recent global sonography research has been focused instead upon clinical methodology, training opportunities, remote and portable applications (1, 3). Both the ARDMS and WHO study are today twenty-one years outdated. As neither was used to formulate a global standard of practice, none currently exists.

A small selection of transnational literature can be used to create a limited portrayal of sonographers worldwide (3, 5-8). Importantly, a valuable generic ultrasound competence scale was produced by international expert consensus by Tolsgaard et al. (2013) (5). However, the report concentrated upon physician-performed ultrasound, with debate regarding the inclusion of allied health professionals. A significant literature review and two surveys were also conducted examining sonography in low and middle income countries [LMIC] in Asia, South America and Africa, and radiology practice in Europe respectively (6-8). However, none were explicitly focused upon sonographer performed ultrasound or scope of practice. All were also limited by their geographic locale. Informal global literature reviews have additionally been conducted to inform national policy, namely in Australia and Canada (2, 9).

A scope of practice delineates what members of a professional body are educated for and clinically competent of upon graduation (10, 11). A recognised international scope of practice, reflective of regional differences, could inform a global assessment standard and certification (1, 6, 12). Formal definition of competencies would enable objective measurement of exam quality, image acquisition and interpretation (1). This could potentially reduce technology misuse and inaccurate diagnosis, hence improving patient outcomes (1). A global sonographic scope of practice could identify countries striving for professional recognition of sonographers and highlight those who could implement an advanced practitioner sonographic role (4, 12). However, it can be difficult implementing global benchmarks for medical imaging which are sensitive to contextual differences (13, 14). There are vast differences, for instance, between the roles of a consultant sonographer in the United Kingdom and a non-physician sonographer in Haiti (7, 15).
Review of existing literature suggests that specialist comprehensive sonographers have a growing presence in many nations, despite the prevalence of physician performed ultrasound (1, 6, 8). They originate from a range of professional backgrounds, including radiography, nursing and physiotherapy, and operate under variable nomenclature (3, 6, 8, 16).

Sonographer education is dichotomous – some nations have stringent, well defined education standards with vocational, undergraduate or postgraduate qualifications (10, 17-19). However, the majority of non-physician sonographers do not undertake formal training, instead relying upon ‘on the job’ training and short courses (2, 6).

Likewise, registration and accreditation standards are inconsistent. Few nations have established - though often voluntary - regulatory bodies for sonographers, including those in Australia, the United States, England, Canada, New Zealand, Japan and some European nations (2, 3, 8, 10, 11, 20, 21). In the rest of the world, sonography practice is largely unregulated (6, 7). Only two jurisdictions - in New Zealand and Ontario, Canada - have protective legislation for the sonographer title (2, 21).

Although many national standards advocate for interprofessional communication as a key constituent of the sonographer role, minimal scientific literature is dedicated to the topic (10, 17, 18, 21). Role ambiguity may detriment the relationship between sonographers, physicians and other healthcare practitioners (22, 23). However, this may be mitigated via clarification of professional expectations (23).

In addition to these global variances in the sonographer role, there are major barriers to enactment of a global practice standard. Cultural differences and applicability to nations desiring both advancement and basic recognition could would be difficult to reconcile (13). The historical prevalence of two international social phenomena - pre-natal sex selection, and ultrasound commercialization – demonstrate the complexities of establishing an interculturally appropriate scope of practice (24-26). Global acceptance and compliance to a standard, particularly regarding financial and logistical considerations, would also be challenging (6, 7, 13).

The lived experience of sonographers on a global scale is under-examined. This study will provide a snapshot into current international ultrasound standards of practice. It was executed in partnership with, and to inform, the ISRRT [International Society of Radiographers and Radiological Technologists]. The ISRRT is a non-for-profit organisation that promotes global progression of the
medical imaging profession, with at least 75 active council members (27). It is a professional affiliate of the World Health Organization (13, 14, 27), and a vital reflection of international medical imaging.

The survey methodology is based upon that of a prior project entitled ‘The Role of an International Professional Organisation in Radiography’ conducted by Huynh & Cowling in 2016 (28). It was administered in collaboration with the ISRRT in a similar timeframe, and provided valuable insights into the radiographic profession on a global scale.

1.2. Aims and Research Questions

The aim of this project is to determine the common and diverse features of a practicing sonographer internationally, and their impact upon the development of a global standard of practice. There are two key questions under investigation. Question one is further subdivided.

1. What are the similarities and differences between the role of the sonographer in different nations?

Three elements of the sonographic role were examined in response to the first research question, as detailed in Table 1 below;

Table 1: Elements of the Sonographer Role

<table>
<thead>
<tr>
<th>No.</th>
<th>Element of the Sonographer Role</th>
<th>Specific Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Demographic characteristics</td>
<td>Country, professional title, education</td>
</tr>
<tr>
<td>2</td>
<td>Contextual Factors</td>
<td>Registration, accreditation and role requirements</td>
</tr>
<tr>
<td>3</td>
<td>Conceptual Factors</td>
<td>Attitudes towards work, interprofessional relationships and cultural impact upon practice</td>
</tr>
</tbody>
</table>

2. What factors impact the ability of the sonographic profession to reach an international global standard of practice?

Attitudes regarding the implementation and feasibility of a global standard of practice, alongside nation-specific barriers and benefits, were investigated.
2.1. Methodology
An online cross-sectional survey was used to gather the perspectives of council members of the International Society of Radiographers and Radiological Technologists (ISRRT). Each council member represents a participating organisation or nation [full list of represented jurisdictions available in Appendix 1]. Qualitative text-response questions were emphasized to create a holistic, individualistic perspective of the lived experiences of international sonographers (29). Quantitative Likert scale and nominal responses were collected alongside short answer qualitative text-box responses. Between-methods triangulation was used to increase validity and systemize observations.

There were seven sections of the survey. The initial six scrutinized respondent and jurisdictional sonographer demographics, sonographer regulation, clinical duties, employment attitudes, interprofessional relationships and cultural impact upon practice. The final survey section requested qualitative responses to the perceived barriers and benefits of implementing a global scope of practice. The complete survey is provided in Appendix 2.

2.2. Participants
A purposive [selective] sampling technique was used, with all 75 current active council members from the ISRRT invited to participate. As elected spokespeople for their member societies, they were assumed knowledgeable of sonographic practice within their jurisdiction.

2.3 Ethical Considerations
This project was submitted for ethical approval by the Monash University Human Research Ethics Committee (Project ID 21807) as per NHMRC guidelines for research involving human subjects (30). Participation in the study was voluntary, non-compensated and without obligation. Negligible risk beyond participant inconvenience was anticipated. Consent was implied upon questionnaire return.

2.4 Data Collection and Recording Procedures
An online survey was conducted with the Qualtrics Insight Platform software package. Participants were invited via email by the CEO of the ISRRT, with no disclosure of identifying details to researchers. Responses were recorded in aggregate form, and all individual replies were deidentified. All surveys, complete and incomplete, were analysed. Two rounds were distributed, with a first round of two weeks duration, and a second round of one week. The survey took 20-30 minutes for participants to complete.
Once data collection was initiated, only research team members had access to hard copy and digital data. Digital components were computer-password protected. Any physical spreadsheets were securely stored in a locked cabinet in the office of head investigator, Dr. Cynthia Cowling. Both hard and soft copies will be destroyed after five years.

2.5 Statistical Analyses
The parallel mixed-methods approach warranted a three-phase analysis (31). Qualitative and quantitative components of the data were analysed separately, with a final triangulation of the two data types with professional literature.

A frequency analysis – including counts and percentages – was undertaken using the Microsoft Excel software package for all quantitative data. ISRRT region was cross-tabulated with sonographer accreditation and regulation requirements.

In the second phase, an interpretative phenomenological analysis was performed upon qualitative survey elements. Phenomenological inquiry seeks to gain understanding of psychosocial processes (32). It explores the significance and meaning of an event to an individual (32). This method was chosen because it is the qualitative approach best suited to understanding mutual experiences of a phenomenon (33). An interpretative analytic technique was used, acknowledging that understanding of the participants ‘inner world’ is subject to researcher interpretation (32).

Qualitative responses were hand coded, with extended answers aggregated to between five and seven key themes, as per Tesch’s Coding Process (1990) (34). Following coding, analytic themes present in multiple perspectives were shaped into generalized trends (34, 35). Qualitative and quantitative data types were triangulated with the available literature in the third phase.

3.1 Results

3.2 Demographic Characteristics
The response rate was reasonable, with 36 individuals of the possible 75 ISRRT active council members. Participants hailed from at least 32 different countries [2 respondents did not state their nation], representing all four global regions of the ISRRT.

Demographic characteristics are listed below.
Table 2: Demographic Characteristics of Participants

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Number</th>
<th>Total Respondents</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Region of the ISRRT</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Africa</td>
<td>6</td>
<td>36</td>
<td>17</td>
</tr>
<tr>
<td>The Americas</td>
<td>3</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Asia/Australasia</td>
<td>14</td>
<td>39</td>
<td>39</td>
</tr>
<tr>
<td>Europe</td>
<td>13</td>
<td>36</td>
<td>36</td>
</tr>
<tr>
<td><strong>Role in the ISRRT</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Responding on behalf of organization</td>
<td>28</td>
<td>36</td>
<td>78</td>
</tr>
<tr>
<td>Associate member of the ISRRT</td>
<td>8</td>
<td></td>
<td>22</td>
</tr>
<tr>
<td><strong>Professional Role [Multiple Choices Possible]</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sonographer</td>
<td>7</td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>Radiographer/Medical Imaging Technologist Manager</td>
<td>25</td>
<td>58</td>
<td>43</td>
</tr>
<tr>
<td>Physician</td>
<td>0</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Educator</td>
<td>14</td>
<td></td>
<td>24</td>
</tr>
<tr>
<td>Other</td>
<td>4</td>
<td></td>
<td>7</td>
</tr>
</tbody>
</table>

See Appendix 1 for additional information regarding the represented nations.

3.3. Contextual Differences

**Professional Title and Clinical Role**

Physician performed general ultrasound was present in the jurisdiction of the majority of participants (31/36, 86%), followed by ultrasound performed by radiographers with additional qualifications (17/36, 47%) and dedicated sonographers (15/36, 42%). Nurses, physiotherapists and radiographers with no additional ultrasound qualifications were also present in 28%, 14% and 14% of nations respectively.
The most common professional titles for an allied health ultrasound specialist were ‘sonographer’ (13/36, 36%), ‘radiographer’ (4/36, 11%), or a combination; ‘radiographer/sonographer’ (2/36, 6%). Ten of 36 (28%) participants only provided specialist physician titles - for instance, radiologist or sonologist.

As demonstrated in Figure 2 below, the ultrasound examinations most frequently performed in each participants jurisdiction were abdominal (75%), thyroid (67%) and vascular imaging (64%). The most common specialist ultrasound techniques were general echocardiography (44%), paediatric echocardiography (28%). Point of care ultrasound was performed in 28% of participating nations.
Figure 2: Examinations Typically Performed by Sonographers in ISRRT Member Nations

Education
There was global incongruity in the education requirement for sonographers, as demonstrated in Figure 3, with 17% (6/36) of participants noting that sonographers were most commonly taught ‘on the job’ in their nation. Forty four percent (16/36) of participants reported undergraduate or graduate education requirements.

Figure 3: Education Requirement for Sonographers in ISRRT Member Nations
Length of education ranged between 2 months in Vietnam, to 48 months in Ghana. Responses were complicated by occasional inclusion of only the clinical or graduate components of training. Some nations also had intranational variance, including the United Kingdom (12-24 months), the Netherlands (6-24 months) and Canada (36-48 months).

For nations with dedicated sonographers, ultrasound education is most frequently conducted in educational institutions (20/32, 63%) and clinical sites (13/32, 41%). A small minority used simulated labs (3/32, 9%).

Accreditation and Regulation
A registration body was present in the jurisdiction of almost half of respondents (14/34, 41%). 8/14 (57%) of participants with a registration body named organisations not specific to sonographers – either a generalised allied health professional organisation (4/14, 31%), or one for physicians (4/14, 31%). Eleven percent (4/34) of respondents were unsure if a registration body was present.

Approximately one third of respondents reported the presence of an accreditation body (12/33, 35%), with 16/33 (47%) that believed none was present, and 6/34 (18%) unsure. Some nations named their accreditation programs – some government supported and others private - including the UK, USA, Canada, Ghana, Australia, the Netherlands, Malaysia and Hong Kong.

Figure 4: Presence of Accreditation and Registration Bodies by ISRRT Region
As demonstrated in Figure 4, registration bodies were frequently not present in Asia (7/12, 58%) and Europe (5/11, 45%). Accreditation bodies were frequently not present in Africa and Europe (4/7, 57% and 6/11, 54%).

3.3 Conceptual Factors
Interprofessional Relationships between Sonographer and Radiologists
As demonstrated by Figure 5, responses regarding the relationship between sonographers and radiologists were mixed, with many participants unsure. However, the majority (21/29, 72%) agreed that the radiologist/sonographer relationship was dependent upon whom the sonographer worked with. Around half suggested that sonographers and radiologists are not equal partners in the care and diagnosis of the patient (15/29, 52%).

Figure 5: Perception of Relationships between Sonographers and Radiologists in ISRRT Member Nations

There were mixed textual responses regarding the sonographer/radiologist relationship. 5/11 (45%) suggested variable relationships. For instance, responses included:

‘[There is] huge variation in the country’ (Manager, Europe)
‘Radiologist is still in pros and cons about existing sonographer’ [sic] (Radiographer, Asia)

One participant suggested that there was variance depending upon radiologist age;

‘For the old generation radiologists, they are not so supportive... But for the younger generation, they welcome the ideas that preliminary study can be done by radiographers... Usually they can work well with the sonographers’. (Educator, Asia)

27% (3/11) textual responses suggested that the relationships between sonographers and radiologists were primarily negative.

Interprofessional Relationships between Sonographers, Radiographers and Other Healthcare Practitioners

Figure 6 demonstrates responses to five Likert questions regarding the sonographer/radiographer relationship. Seventeen out of 26 (65%) suggested that sonographers work closely with physicians. Sixteen out of 26 (61%) respondents did not believe that sonographers required greater patient care skills than radiographers, though 11/26 (42%) and 13/26 (50%) believed that sonographers are more knowledgeable of anatomy and pathology respectively. Between 15% (4/26) and 50% (13/26) of participants were unsure for each question.

Figure 6: Likert Statements Comparing the Sonographer and Radiographer Role
As shown in Figure 7 above, 10/28 (36%) and 11/28 (39%) of participants suggested that other professionals do not know the role of the sonographer, or recognise their expertise outside of the medical imaging department respectively.

The two text responses regarding the relationship of sonographers with other allied health professionals were conflicting. One stated that ‘there is still a long journey... to achieve [professional] status’ (Educator, Asia). The second response stated ‘Most other professionals are aware of the sonographer profession and willing and interested in cooperation’ (Sonographer, Europe).

Existing Scope of Practice

Fourteen out of 33 (42%) participants believed that a ‘Scope of Practice’ or ‘Professional Capabilities’ document was present or under development in their nation. However, 13/33 (39%) of respondents also suggested that their jurisdiction did not have either document. Six out of 33 (18%) respondents were unsure.

Respondents from Britain, the USA, the Netherlands, Ireland, Finland and Canada all stated that complete ‘Scope of Practice’ documentation was present in their countries.
Historical and Cultural Impacts Upon Developing a Global Standard of Practice

Most respondents (17/30, 57%) suggested that they were unaware of specific historical/cultural aspects of their nation that could impact ultrasound practice. Of eleven text explanations, five suggested that sonography is ‘a profession reserved for doctors’ (Radiographer, Africa).

Sonographer sex was noted by two participants; in one Asian country, the respondent suggested that ‘female patients prefer female sonographers’. An African participant stated that in their jurisdiction, ‘some hospital [faith-based] male radiographers have limited access to ultrasound’.

Two respondents in Asia suggested that ‘radiographers... are not allowed to perform sonography due to (government) policy’ and that sonography would ‘check inequality in the male/female ratio... and help in preventing infanticide’ respectively.

Development of an International Scope of Practice

The majority of respondents (26/28, 93%) believed that a global standard of practice would benefit their jurisdiction, as show in Figure 8 below. Three nations suggested that it could be used to ‘standardize the education required for certification’ (Radiographer/Manager/Educator, The Americas).

Figure 8: Percentage of Respondents Who Believe a Global Standard of Practice Would Benefit and Could be Implemented in their Nation

![Percentage of Respondents Who Believe a Global Standard of Practice Would Benefit and Could be Implemented in their Nation](chart.png)
However, the language in some responses (4/28, 14%) was cautious: ‘It is possible’ (Radiographer, Europe); ‘It could be beneficial’ (Sonographer, Europe). One respondent noted that it would need to be ‘subject to local customization’[sic] (Radiographer, Asia).

Sixty seven percent (22/33) of respondents believed that a global standard of practice could be implemented in their nation, as shown in Figure 8 above. This was an important finding – compared to the 26/28 (93%) of participants who believed it would be beneficial, only 67% believed that implementation would be feasible in their country.

The text explanations for how a global standard of practice could be implemented were extensive, with 4/21 (19%) of participants suggesting the involvement of existing regulatory or professional organizations within their nation.

Countries that did not believe that a standard could be implemented in their nation cited radiologist rejection (Radiographer, Asia), ‘difficulty in reaching consensus’ (Professional Officer, Europe) and lack of education (Radiographer, Europe).

The perceived benefits and of a global standard of practice are thematically aggregated in Table 3 and Table 4 below:

**Table 3: Benefits of a Global Standard of Practice**

<table>
<thead>
<tr>
<th>Benefits of a Global Standard of Practice</th>
<th>Number of Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standardization and improvement of education</td>
<td>4</td>
</tr>
<tr>
<td>Professional mobility</td>
<td>3</td>
</tr>
<tr>
<td>Facilitation of ethical/evidence-based practice</td>
<td>2</td>
</tr>
<tr>
<td>Professional recognition</td>
<td>1</td>
</tr>
<tr>
<td>Enhanced patient safety</td>
<td>1</td>
</tr>
<tr>
<td>Reduction of staffing issues</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>12</strong></td>
</tr>
</tbody>
</table>

*Multiple responses to this question were allowed and therefore percentages were not calculated.*
Table 4: Barriers to Developing a Global Standard of Practice

<table>
<thead>
<tr>
<th>Barriers to Developing a Global Standard of Practice</th>
<th>Number of Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of sonographer education/training</td>
<td>6</td>
</tr>
<tr>
<td>Radiologist acceptance</td>
<td>6</td>
</tr>
<tr>
<td>Government/legal barriers</td>
<td>2</td>
</tr>
<tr>
<td>Logistical concerns – technology, funding and time</td>
<td>2</td>
</tr>
<tr>
<td>Uptake of evidence-based practice</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>18</strong></td>
</tr>
</tbody>
</table>

*Multiple responses to this question were allowed and therefore percentages were not calculated.*

In response to perceived barriers, two participants stated that radiologists are ‘strongly against this practice [sonographer-performed ultrasound]’ (Radiographer/Educator, Asia) and that they ‘must allow radiographers [to] do ultrasonography’ (Radiographer, Africa).

‘Lack of formal education and training’ (Radiographer/Educator, Asia) was suggested as a barrier by six respondents, four of whom were from the Asia region.

Participants also noted that ‘access to current technologies’ (Sonographer/Radiographer/Educator, Africa); ‘time, money and required expertise’ (Radiographer, Asia) and ‘limited involvement in research and uptake of new evidence’ (Sonographer/Radiographer/Educator, Africa) were potential limitations.

4.1 Discussion
This study highlighted the common and diverse features of the role of a practicing sonographer globally, and their impact upon development of a global standard of practice. It was intended as a snapshot into current international ultrasound practice.

4.2. Common and Diverse Features of a Practising Sonographer
Our results highlight incongruity in professional roles, background, education, regulation and interprofessional interactions of the sonographers in different nations.

General ultrasound examinations are conducted by a range of allied health professionals, including radiographers, nurses, midwives and physiotherapists. However, comprehensive ultrasound is also frequently performed only by physicians in many countries in Europe, Asia and Latin America (3, 6, 36). Allied health ultrasound specialists operate under a range of titles, typically integrating the
terms sonographer or radiographer (16). There is national variation in ultrasound applications, with diversification from the primarily abdominal and obstetric and gynaecological focus of 1998 WHO ultrasound guidelines (3). Our results suggest that in addition to these critical applications, thyroid, vascular, men’s health and procedural examinations are all internationally prevalent.

Sonographers were unregulated in most participant nations. Triangulation of scholarly and professional literature with our results suggest that a minority of jurisdictions have accreditation bodies, including Australia, the United States, United Kingdom and Canada (2, 3, 10, 11, 20). Additional formal accreditation programs were named by representatives of Ghana, the Netherlands, Malaysia and Hong Kong in this study, though their efficacy and level of compliance were not examined. Professional literature also infers the presence of accreditation programs in Japan and New Zealand, though they did not participate in this study (3, 21). Around 40% of participants suggested the presence of a registration body in their jurisdiction, though many were voluntary, physician focused or non-specific to sonographers.

Inadequate sonographer education was identified as a primary barrier to implementation of a global standard of practice. Inadequate formal education can endanger diagnostic accuracy and be detrimental to interprofessional relationships (4, 6, 23) Present WHO guidelines suggest that non-physician ultrasound trainees should ideally attend 3-6 months of clinical practice encompassing 300-500 ultrasound examinations (3, 8, 37). Sonographers in all participating nations met this recommendation. However, their learning may not be genuinely sufficient. Comparing programs by length is problematic, with competency based frameworks a better indication of educational outcomes (13, 38).

As identified by our participants, a global standard of practice could be used to define key sonographic proficiencies and regulate ultrasound education, hence improving global education outcomes (4). The existing generic Tolsgaard et al. (2013) framework could provide a useful outline to establish key sonographic capabilities (5). However, dissemination of ultrasound education could be problematic. It would require significant funding and demand workplace absence from already-strained practitioners (6, 7, 13).

Development of a global scope of practice for sonographers is also contingent upon strong interprofessional support, particularly from radiologists (22, 23). However, the sonographer/radiologist relationship is globally circumstantial and individual-specific, with variance
within and between countries. Ambiguity in the sonographer role, a lack of legal protection for the sonographer title and limited formal education for sonographers in some LMICs may explain the negative interactions between some sonographers and their physician counterparts (6, 22, 23). However, with enhanced education, autonomy and clarification of professional expectations, sonographers can work effectively alongside physicians (23).

4.3 Development of an International Scope of Practice

A formal global scope of practice could define educational proficiencies, and potentially serve as a precursor to international certification (4, 6). Moreover, it could enhance professional mobility and recognition, as endorsed by professions with existing global competency frameworks, including pharmacy and optometry (39-42)

However, significant challenges could occur in the development and implementation of a standard. In addition to the aforementioned difficulties in education and radiologist acceptance, overcoming legal, logistical and financial barriers to gain international compliance would be difficult (6, 7, 13).

Ensuring cross-cultural applicability could also be problematic. For instance, patient preference for female sonographers in some nations, particularly for transvaginal or invasive procedures, was an unanticipated finding supported by existing literature (43, 44). Additionally, due to historical selective female feticide in some Asian patrilineal cultures - including India, China, Vietnam and South Korea - non-radiologist medical practitioners are discouraged or legally prevented from performing sonography (24, 25, 45, 46).

Despite these barriers, a global scope of practice could be advantageous. In other professions, competency frameworks were developed through synthesis of nation-specific competency guidelines, professional practice literature and regulatory documents (40, 41). Triangulation of the current project with professional literature indicates that a jurisdictional scope of practice is currently present in the United Kingdom, the USA, Australia and Canada (10, 11, 17, 18, 47). Respondents suggested that they also exist in the Netherlands and Finland. These frameworks could inform an international standard.

International surveys, such as those conducted by Tolsgaard et al. (2013), the European Society of Radiologists (2013) and Shah et al. (2015) can all also be useful in unification of international practitioner role guidelines (5, 6, 8). In particular, a global consensus could be formulated using the
multi-phase methodology of the Tolsgaard et al. (2013) competency framework (5). Dissemination and enforcement of a global standard of practice could be achieved in collaboration with existing national regulatory and professional bodies, as suggested by participants.

The limitations of this study include the small sample size (36 individuals representing at least 32 nations) and response rate (36/75, 45%), use of an unvalidated survey tool, and potential recall bias from national representatives. Only 7/36 (19%) of respondents were sonographers themselves. Additionally, the questionnaire was conducted in English and therefore possibly subject to cultural and language biases (6).

This project was limited by the brevity of qualitative responses. Further research could involve focus groups or interviews to examine the perspectives of sonographers themselves in respondent nations. Focused examination of ultrasound curricula, regulation standards or global scope of practice implementation strategies could also be beneficial.

5.1 Conclusion
There is global variation in the role of a practicing sonographer. Ultrasound is a ubiquitous imaging technology with international applications, but sonographic scope of practice is nationally divergent.

If respectful of regional differences in regulation, education and interprofessional relationships, an international scope of practice could standardize ultrasound practice. It could define educational proficiencies, enhance professional mobility and potentially precede international certification. However, development and ensuring compliance would be challenging. A lack of existing regional sonographer education, radiologist acceptance, cultural differences and financial and legal impediments are all major potential barriers.

Although this study was limited by sample size and respondent demographics, it provided a unique insight into current international ultrasound practice. It is an important preliminary step in the development of an international standard of practice for the sonographer.

Acknowledgements
I wish to thank Dr. Cynthia Cowling, Ms. Nabita Singh, Prof Michal Schneider and Dr. Paul Lombardo of the DMIRS at Monash University. ISRRT President and CEO, Donna Newman and Dimitris Katsifarakis, were also essential to the project.
References


47. Thomson N. The Scope of Practice in Medical Ultrasound 2009.

**Appendix 1: Jurisdictions Represented**

<table>
<thead>
<tr>
<th>ISRRT Region</th>
<th>Total Respondents</th>
<th>Number of Jurisdictions Represented</th>
<th>Jurisdiction Represented</th>
<th>Professional Role of Respondent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>6</td>
<td>6</td>
<td>Ghana</td>
<td>Sonographer/radiographer</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Malawi</td>
<td>Radiographer/manager</td>
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*Some nations had multiple respondents, and some respondents did not state their country of origin*
Appendix 2: Survey Questions

Q1 Consent statement
Q2 What region of the ISRRT are you located in?
Q3 Which country are you located in?
Q4 What is your role in the ISRRT?
Q5 Which best describes you [tick all that apply]?
Q6 Which best describes the education requirement for a general sonographer in your country?
Q7 If formal education, briefly describe format.
Q8 If formal education, how long in months is sonographer education in your country?
Q9 If formal education is required in your country, where is it conducted [tick all that apply]?
Q10 If sonographers [usually] undergo prior training before practicing ultrasound in your country, which field is this typically in?
Q11 Who performs general ultrasound examinations in your country [tick all that apply]?
Q12 Which type of healthcare worker most commonly performs ultrasound examinations in your country [tick one]?
Q13 What is the most common professional title for an allied health individual who specializes in ultrasound in your country?
Q14 Is/are there registration body(ies) for sonographers in your country? [NOTE: A registration body generally stores health practitioner registration status on a list that is publicly available. This may display registrant information including identity, registration status and type, qualifications and disciplinary history (World Health Organization 2016)].
Q15 Is/are there accreditation body(ies) for sonography education in your country? [NOTE: Accreditation is recognition of a program or institution meeting established standards through review and approval (World Health Organization 2013; World Federation for Medical Education 2005)].
Q16 Are you aware of a formal ‘scope of practice’ or ‘professional capabilities’ document in your country for sonographers?
Q17 Is the average starting salary of a sonographer higher than that of an average radiographer?
Q18 Which of the following ultrasound examinations are typically performed by sonographers in your country [tick all that apply]?
Q19 Which of the following ultrasound examinations are typically performed by sonographers in your country [tick all that apply]?
Q20 For each statement, please select yes, no or unsure in relation to ultrasound practice in your country.
   Sonographers can diagnose and inform patients of results (1)
   Sonographers can provide an opinion or a ‘technical report’ only to the reporting doctor, as opposed to a report or diagnosis (2)
   Sonographers can convey ‘bad news’ [the presence of suspected pathology] to patients (3)
   Sonographers always work under the direct supervision of a radiologist and/or reporting physician (4)
   Sonographers work under the indirect supervision of a radiologist and/or reporting physician (5)
   Sonographers commonly perform clinical teaching (6)
   Sonographers commonly perform research (7)
Q21 Please provide any additional comments here.
Q22 For each statement, please select strongly agree, agree, disagree, strongly disagree or unsure in relation to ultrasound practice in your country.
   Sonographers are valued more than radiographers/ medical imaging technologists (1)
Sonographers work closely with physicians and radiologists (2)
Sonographers are more knowledgeable of anatomy than radiographers (3)
Sonographers are more knowledgeable of pathology than radiographers (4)
Sonographers require greater patient care skills than radiographers (5)

Q23 Select the statements that best reflect the relationship sonographers have with radiologists. In their relationships with sonographers, **radiologists most commonly** [select yes, no or unsure]:
Are collegial and respectful (1)
Are equal partners in the care and diagnosis of the patient (2)
Enable sonographers to feel valued (3)
Have a relationship dependant upon who the sonographer works with (4)
Encourage and support the expansion of skills and knowledge of the sonographer (5)
Prefer sonographers who limit their role to technical scanning, as opposed to reporting and diagnosis (6)

Q24 Please add any comments you might have about the sonographer/radiologist relationship.

Q25 Select the statements that best reflect the relationship sonographers have with radiologists. In their relationships with sonographers, **other medical and health professionals most commonly** [select yes, no or unsure]:
Respect sonographers as equal members within the health community (1)
Know of the role of the sonographer outside the medical imaging department (2)
Recognise the skill and expertise of the sonographer outside the ultrasound department (3)

Q26 Please add any comments you might have about the relationship between sonographers and other health professionals

Q27 Are there any historical/cultural aspects of your country that may impact ultrasound practice? [For instance, radiographers in India are not allowed to perform sonography because of prenatal sexual preferencing]

Q28 Please describe these.

Q29 Do you believe that a global standard of practice for sonographers could be implemented in your country?
Q30 If yes, briefly describe how
Q31 If no, briefly describe why.

Q32 Are there any specific barriers within your country for developing a global standard of practice?
Q33 Do you believe a global standard of practice would benefit your country?

Appendix 3: Explanatory Statement

EXPLANATORY STATEMENT
(Council Members of the International Society of Radiographers and Radiological Technologists)

Project ID: 21807
Project title: A Survey Study Investigating Sonographers’ Scope of Practice Internationally

ISRRT Report Scope of Practice Sonographer Jan 2020
You are invited to take part in this study. Please read this Explanatory Statement in full before deciding whether or not to participate in this research. If you would like further information regarding any aspect of this project, you are encouraged to contact the researchers via the phone numbers or email addresses listed above.

What does the research involve?
The aim of this study is to identify the common and diverse features of a practising sonographer internationally and their impact on developing a global standard of practice. You have been invited to participate in an online survey which asks questions about your perspectives of sonographers’ scope of practice in your country. The survey will be administered online and will take approximately 30 minutes to complete.

Why were you chosen for this research?
You have been chosen for this study because you are a council member of the International Society of Radiographers and Radiological Technologists (ISRRT) and may have knowledge of the extent of sonographers’ scope of practice in your country.

Consenting to participate in the project and withdrawing from the research
When you complete the survey your consent is implied. A participant may withdraw at any time by not completing and returning the survey. However once the survey has been returned, data cannot be withdrawn from the study because these surveys are anonymous and do not contain participant identifying data.

Possible benefits and risks to participants
There are no direct benefits to participating in this study. Participants will be provided with an opportunity to report their perspectives on sonographers’ scope of practice which may help to develop a standard of practice for sonographers globally. Your decision to participate or not in the study will not affect your relationship with the ISRRT.

There are no risks associated with participating in this project beyond the risks associated with everyday life. You may find the time taken to complete the survey to be an inconvenience.

Confidentiality
This survey is completely anonymous. We will not be able to identify you in any reports or articles that may arise from this research.

Storage of data
Data collected will be stored in accordance with Monash University regulations. Data will be kept on Monash University (Clayton Campus) premises, in a locked filing cabinet and in a password protected file for five years by the Chief Investigator. Only the investigators will have access to this data. At the end of the study period both physical and electronic copies of the data will be permanently destroyed.

Results
Aggregate preliminary research findings will be available from December 2019.
Please email Cynthia.cowling@monash.edu for a copy of the results.

Complaints
Should you have any concerns or complaints about the conduct of the project, you are welcome to contact the Executive Officer, Monash University Human Research Ethics Committee (MUHREC):

Executive Officer
Monash University Human Research Ethics Committee (MUHREC)
Room 111, Chancellery Building D,
26 Sports Walk, Clayton Campus
Research Office
Monash University VIC 3800

Tel: +61 3 9905 2052    Email: muhrec@monash.edu    Fax: +61 3 9905 3831

Thank you,

Dr Cynthia Cowling