Sonographer training pathways – A discussion paper on curriculum design and implementation

CHRISTOPHER EDWARDS[1]
RICKY TUNNY
HEATHER ALLEN
Queensland University of Technology, Brisbane, Australia
DANIELLE BOWLES
M*etro South Hospital and Health Service*, Brisbane, Australia
ANGELA FARLEY
University of South Australia, Adelaide, Australia
SANDRA O'HARA
SKG Radiology, Perth, Australia
JANE WARDLE
CQUniversity, Brisbane, Australia
TRISTAN REDDAN
Children's Health Queensland Hospital and Health Service, Brisbane, Australia

Sonography is a highly specialized diagnostic imaging profession facing significant workforce challenges due to increased service delivery demands and a shortage of clinical training opportunities. Developing sustainable solutions is crucial for workforce growth. Using examples from the Australian workforce and education context, this paper explores the current sonography training pathways available and the benefits and challenges of each, highlighting the importance of work-integrated learning (WIL) in facilitating the development of professional identity, clinical competence and the quality of sonographer education. Conclusions are drawn that WIL is integral to the future of the sonography profession to improve patient outcomes and address workforce shortages. However, effective implementation requires careful planning and consideration of many factors, including regulatory requirements, industry partnerships, student and supervisor/tutor support, and issues related to equitable access and participation in WIL. Key recommendations are provided to encourage ethical student learning, university-industry collaboration, effective resource allocation, and WIL-specific research.

Keywords: Sonography education, work-integrated learning, student support, competence, curriculum design

The sonography workforce faces significant challenges internationally, with the literature reporting stagnate workforce growth in Australia (McGregor et al., 2020), the United Kingdom (Parker & Harrison, 2015) and the United States (Hagen-Ansert & Billick, 2023). Factors influencing the shortage include a lack of clinical training opportunities, an aging / retiring workforce, and an increasing demand for imaging services. In Australia, the profession has been plagued with workforce shortages for many years and is identified as a national shortage on the National Skills Commission - Skills Priority List (Australian Government, Jobs and Skills Australia, 2022). The annualized growth rate of sonographers entering the Australian Sonographer Accreditation Registry (ASAR) is 4.36% (Australian Sonographers Accreditation Registry, 2023). According to national health data, the demand for ultrasound examinations has increased steadily over the past two decades, with approximately 7% annualized growth (Australian Government, Services Australia, 2022). To the year ending December

[1] Corresponding author: Christopher Edwards, c8.edwards@qut.edu.au

2022, ultrasound was the most frequently utilized diagnostic imaging modality, reporting 11.6 million services (Australian Government, Services Australia, 2022).

Workforce growth is unlikely to meet the increasing demands for diagnostic imaging to support patient care. According to an Australasian Sonographers Association (ASA) - Sonographers Employment and Salary survey conducted in 2021, 20-25% of the sonography workforce is expected to reach retirement age in the next ten years, and more sonographers are opting for part-time work (53% of the current workforce), an increasing trend since 2010 (Australasian Sonographers Association, 2022b).

The ASA, in its 2018 submission to the Federal Government Senate Standing Committee's inquiry investigating the availability and accessibility of diagnostic imaging equipment in Australia, stated the most significant barrier to meeting workforce demands is the "lack of available clinical training places" (Australasian Sonographers Association, 2018, p. 3). In Australia, many sonographers work in private diagnostic imaging practices in which services are supported by Australia's universal health insurance scheme (Medicare). Medicare funds many types of tests, including diagnostic ultrasound, through a 'fee-for-service' model (Australian Government, Department of Health and Aged Care, 2024). The Australian government contributes a fixed amount, known as a Medicare rebate, for each service depending on the type and complexity of the scan performed. The value of the Medicare system has recently come under scrutiny. An independent review commissioned by the Australian Health Minister describes significant waste in the system due to repeated servicing of patients utilizing low-value care (Philip, 2023). This report also argues waste and health system inefficiencies will negatively impact future training opportunities of health professionals and students.

Work-integrated learning (WIL) is an educational approach that combines academic learning with structured real-world experiences, integrating and applying theoretical knowledge and skills to practical work-based situations. As part of WIL, students typically participate in internships/ cooperative education, or other forms of work-based learning that allow them to build on their knowledge gained at university whilst developing professional skills in their chosen field. WIL helps bridge the gap between academic learning and the workplace and is recognized as an effective way to prepare students for the future workforce (Smith & Worsfold, 2013). Workforce challenges require the development of equitable and sustainable sonographer training pathways to ensure the longevity of the profession through embedding and scaffolding WIL activities throughout the curriculum. Without the availability of well-resourced WIL, there is a significant impediment to growing the workforce.

This paper provides insights into policy and issues impacting the quality and availability of clinical training for sonography students, drawing on contemporary literature to describe how WIL is critical to developing quality learning and opportunities for feedback and reflection. It explores how experience over time is essential to developing tacit knowledge and performance improvement. Focusing on the Australian context, it articulates how collaboration between sonography course providers, policymakers, and the industry is recommended to implement sustainable clinical training and address dire workforce shortages and student equity concerns. Finally, examples of contemporary training pathways are shared, drawing on the author's experience offering sustainable solutions to balance patient, student, and industry needs. This paper aims to advance the sonography profession by promoting ethical student learning, fostering university-industry collaboration, effectively allocating resources, and encouraging research specific to WIL.

METHODOLOGY

The methodology employed in this review is designed to draw upon a diverse range of literature sources and incorporate the collective professional experience of experts in the field. A literature search was conducted across reputable academic databases, including [PubMed, Scopus, and Google Scholar], to identify relevant studies, articles, and reviews related to WIL and the training of sonography students and other healthcare professionals. Beyond the academic literature, insights from practitioners and experts in the field were sought to complement and enrich the content. The review focuses on WIL within the Australian context, including Australian workforce data and leverages specific examples derived from local practices. However, recognizing the global relevance of WIL, the methodology incorporates international examples to support recommendations for advancing sonography training and workforce growth.

SONOGRAPHY TRAINING PATHWAYS

Several training pathways exist for students to gain a sonography qualification in Australasia and internationally. Within the Australian university sector, two pathways exist. The first is offered at the postgraduate level, referred to as postgraduate entry pathway in this paper, and is available to health professionals who have completed a relevant undergraduate health degree and have autonomously secured a training position to meet course entry requirements. In this approach, most students are offered direct employment at a training site and concurrently engage in postgraduate academic education, including undertaking WIL activities. This pathway parallels post-qualification medical training in some countries, where specialist training occurs whilst embedded within a training hospital or clinical site (Australian Medical Council, 2015). Sonography training sites include public or private hospitals, and radiology, cardiac, vascular or obstetric practices. Training positions are highly competitive, and sites employ a range of mechanisms to choose students, including relevant prior experience with the site, recent professional experience in health, sonography knowledge examinations, probation periods, portfolio, and face-to-face interviews.

An alternative pathway is the direct entry pathway (DEP), available to high school graduates or those transitioning from outside the health field. These include three or four-year Bachelor, Bachelor with Honors, or Masters degrees. Accreditation of sonography courses in Australia requires post-graduate qualification. Therefore, the design of Australian courses typically involves students completing a three-year Bachelor of Health Science degree embedded within a fourth-year Graduate Diploma in Medical Sonography. Learning first occurs exclusively within the university setting, using lab-based simulated activities. Once requisite thresholds are reached, students are offered clinical placement opportunities from the second year. The education provider directly negotiates clinical placements with the industry on the student's behalf. The structure aims to provide students without experience in health a pathway to the profession through specialized coursework and hands-on simulated training before undertaking WIL activities. This arrangement of WIL placements is comparable to many other undergraduate entry health courses.

WORK-INTEGRATED LEARNING AND SONOGRAPHY

Importance

The skills required of a sonographer are complex, multidimensional, and unique to the profession (Nicholls et al., 2016). The time needed to develop the requisite skills, even for base-level competency, requires lengthy periods of sustained, deliberate, and scaffolded practice (Edwards et al., 2018).

Sonographers combine psychomotor, communication, image optimization, clinical interpretation, and real-time image analysis skills across various examinations (Nicholls et al., 2014). Developing each of these skills requires significant immersion within the clinical environment and cannot be fully developed by rote or simulation. The open psychomotor skills of transducer manipulation vary from patient to patient and depend on the clinical scenario (Nicholls et al., 2014). Complications of patient habitus, anatomical variation, and pathological conditions require exposure to a body of visualized exemplars before the student is competent.

Current Australian sonography accreditation standards recommend students within an accredited university program obtain a minimum of three days per week of clinical training across two years (Australian Sonographers Accreditation Registry, 2022). The recommendation implies students spend at least 2000 hours within the clinical environment. Recent research into work-based competencies of graduate sonography highlights the wide range of skills expected by the industry and supports the requirement of significant WIL within the curriculum (Edwards et al., 2023). Defining a minimum WIL requirement provides industry guidance on the typical time a student will take to achieve competency. Further, it guides course providers on the structure of assessment milestones, assisting in education planning with limited resources.

Imposing a discrete number of clinical training hours for students, however, does not directly equate to the achievement of competencies, nor should students be constrained if more time is required to reach the required level. Therefore, international accreditation standards for sonography courses are competency-based (Australian Sonographers Accreditation Registry, 2022; Consortium for the Accreditation of Sonographic Education, 2020). The focus is on the student and their observable actions rather than the accumulation of an arbitrary amount of time spent in clinical practice. To this end, these standards are linked to competency documents and frameworks, which comprehensively define each professional competency element (Childs et al., 2021; Edwards et al., 2022). The focus, therefore, should be that competency emerges from an appropriate degree of clinical experience and supervision in the relevant setting. The time and sequencing of WIL opportunities are important considerations, but they cannot be regarded as definitive, nor should they constrain student learning.

The tension between time and competency is not unique to the Australian context, and international accreditation standards also struggle to define an absolute measure. The *Validation and Accreditation Handbook* used for the accreditation of sonography education in the UK summarizes this contention:

> The number is difficult to quantify and can potentially have an adverse effect on student learning. The important issue is the 'first post' or 'baseline' competency of a student upon successful completion of a period of learning, which may not be of the same length of time for all students and trainees. (Consortium for the Accreditation of Sonographic Education, 2020, p. 47)

The importance of WIL is not unique to sonography and has long been essential for health professionals to reach required graduate outcomes (Isba 2013). Convincing quantitative evidence shows WIL with adequate supervision positively affects patient outcomes (Kilminster et al., 2007). Students develop deeper, higher order understanding from authentic learning in the clinical environment (Chabeli et al., 2021). Access to clinical educators during WIL also provides valuable mentoring and learning opportunities for students, particularly where educators who model good clinical decision-making skills are involved (C. Palmer & Naccarato, 2007).

In medical education, the Australian Medical Council (AMC) accredits medical programs in Australia and maintains a strong commitment to WIL. The AMC believes clinical placements are the most effective tool for students to develop the clinical competence and judgment required to practice safely and effectively as interns (Australian Medical Council, 2010). They recommend spending a minimum of two years of full-time equivalent training, primarily in direct contact with patients (Australian Medical Council, 2015). Assuming approximately 250 working days per year, this would equate to about 4000 hours of clinical placement. Interestingly, the Medical Deans of Australia and New Zealand reported that direct entry programs provide more extended periods of full-time clinical placements, with many offering students between 2.5 and 3 years of full-time equivalent clinical placement (Medical Deans Australia and New Zealand, 2008).

Embedding WIL into sonography education provides the mechanism for developing professional competency. The accreditation standards require course providers to demonstrate evidence of "an integration of theory and clinical experience" (Australian Sonographers Accreditation Registry, 2022, p. 11). Therefore, learning must include genuine clinical interactions between the student, patients, and their clinical supervisors, not solely via observation, simulation, or didactic teaching. WIL scaffolds learning obtained at university and is critical for developing tacit knowledge (Engel, 2008). In the sonography context, tacit knowledge is the ability of practitioners to demonstrate problem-solving and action in the clinical context. Once established, it is portable and can be applied to new scenarios, a critically essential element for recent graduates to work independently and safely (Edwards et al., 2022).

Challenges

Universities that arrange clinical placements for students, and students independently trying to secure a traineeship report significant difficulty (McGregor et al., 2020). National professional bodies have long held the view that a lack of clinical experience opportunities is a significant impediment to developing a sustainable workforce (Australasian Sonographers Association, 2022b). With an 84% increase in student enrolments in undergraduate health courses and a 124% increase in postgraduate health courses from 2008 to 2020, universities continue to face challenges in securing the required clinical placements (Lyons, 2017; Universities Australia, 2022a, 2022b). Within the sonography profession, the timing and quality of clinical placements have been reported negatively in the media (Bita, 2022). Furthermore, the ASA has received reports that some employers request payment from students for clinical training opportunities: "the practice of requiring payment from sonography students to fulfil their training requirements is unethical, and not in keeping with the best interests of the profession" (Australasian Sonographers Association, 2022a, para. 3).

With both postgraduate and direct entry pathways available, the industry has some flexibility to choose which best meets their circumstances in developing sonographers, however, challenges still exist. In the postgraduate pathway, employers can choose a trainee using mechanisms such as structured interviews or scanning trials. Postgraduate courses also offer students the option to complete some foundation units before securing a training position. Due to a lack of training places, many students complete these foundational units to enhance their employability. Although the industry may promote this activity, it also results in many students approaching the industry looking for employment, who may not be successful, incurring significant student debts without the opportunity to complete an accredited program.

WIL activities arranged via the DEP utilize university-led clinical placements. Under this framework, the university is responsible for arranging placements. As part of these arrangements, in Australia, the

Tertiary Education Quality and Standards Agency (TEQSA) requires education providers to apply a framework of equity and diversity (Tertiary Education Quality and Standards Agency, 2022). Students undertaking clinical placements are also covered by student placement agreements or deeds between the university and the clinical site. Within these legal instruments, the education provider is responsible for ensuring the students have completed the mandatory requirements to enter the health service and that they hold the relevant insurance. Alarmingly, students enrolled in some programs can also be forced to undergo a recruitment process and scanning trials to attend clinical placement (J. Wardle, personal communication, March 17, 2023). Such practices could negatively impact students' well-being and create a culture of unhealthy peer competition for students. Positive peer learning, in which students actively engage with each other as equals, is critical to student success and ongoing engagement (Ten Cate & Durning, 2007). It is also reported that in some cases, a student placement will only be offered if that student is the child of a sonographer working in the same organization (J. Wardle, personal communication, March 17, 2023).

An advantage for postgraduate entry students (who secure a traineeship directly with a clinical site) is the opportunity for paid employment; for the DEP, students may need to support themselves financially while completing long periods of WIL. Recent reports in the media have reported that health students who are required to complete lengthy periods of unpaid compulsory WIL feel "burnt out" and "disillusioned" (Cassidy, 2023, para. 5). Students in unpaid WIL activities struggle financially, inadvertently creating inequities for students of lower socioeconomic status (Oke et al., 2023). The risk to the higher education sector and future workforce is further segregation. Only students with the financial means to support themselves whilst on placement will choose health courses (Grant-Smith & de Zwaan, 2019).

Despite the development and implementation of various supports for students, such as: financial assistance schemes; academic and clinical-assistance programs; and access to psychology and counselling services; the degree to which students access these supports varies (Chamunyonga et al., 2020). Education providers incur further costs in many health disciplines through placement fees charged by healthcare facilities to host and supervise students.

In Australia, most sonography training occurs within private clinics, for which funding is based on a fee-for-service model. Activity-based funding is also increasingly popular within the public hospital sector. Like fee-for-service models, hospitals (and indirectly their sonography departments) receive a fixed amount for each care episode, which can include diagnostic imaging services. The danger to the trainee is the requirement for increased output at the expense of learning under these schemes and the potential for an emphasis on "profitable" over "unprofitable" procedures (K. S. Palmer et al., 2014, Introduction section, para. 6).

The Role of Simulation

In recent years, the discussion of simulation has been based on its potential to supplement learning in the absence of available clinical training opportunities (Bridge et al., 2022). Furthermore, simulation has been reported as a means of skills-based assessment as a prerequisite to entering the clinical environment (Bowman et al., 2019).

Simulation in health learning is contemporary and fits with competency-based education. Aspects of competency-based education attempt to codify discrete skills, emphasizing the practical and procedural. Simulated training environments provide the perfect platform for such codification. However, sonography is as much a practical endeavor as it is a descriptive scientific discipline, and

competent practice involves both. Psychomotor skills development early in the practitioner's learning journey is essential but must be developed both in situation-independent general terms and situation-specific clinical terms. Overly discrete competencies increase training specificity, sometimes ignoring the complexity or interconnections between competencies (Hodges, 2013). For sonographers, this is particularly relevant; patient conditions are rarely standardized, and therefore, strict adherence to a predetermined rules-based approach is inadequate.

In the sonography context, reports indicate that simulation improves learner engagement and early development of psychomotor skills (Bradley et al., 2019). More broadly, simulated training activities improve confidence and better prepare students for WIL (Gunn et al., 2021). Despite success in the simulated environment, the need for time and direct exposure of students to diverse clinical cases in the company of an experienced practitioner cannot be ignored. Educators involved in simulated learning activities must engage adult learners to develop translational learning and assess individual activities on the effectiveness of improving patient care outcomes (Clapper, 2010; Okuda et al., 2009). In the medical health literature, there remains a lack of evidence supporting simulation's role in improved patient health outcomes (McFetrich, 2006; Okuda et al., 2009). Specific to the sonography profession, ultrasound simulators cannot assess the student's ability to interact with real patients (Chalouhi et al., 2016).

Competent sonographers must develop the knowledge and skills to deal with complexity. More research is required to understand if acquired 'simulated competencies' are directly transferable to the patient care environment (Bradley et al., 2019; Rystedt & Sjöblom, 2012). Scholars have highlighted the value of workplace assessment in sonography competency and have warned that assessment conducted in a controlled simulated environment might result in graduates incapable of adapting to the diversity of the clinical setting (Edwards et al., 2023). Any scheme that restricts students' placement until some minimum competency is achieved ignores the critical role of WIL in developing base skills. There is a real danger that such practices encourage a belief that the clinical setting in sonography is no longer a place to learn and is focused too heavily on service provision.

Curriculum Design

Scholarship supports the integration of WIL within the curriculum, which is embedded and scaffolded throughout all years of degree courses (Campbell et al., 2021; Dean et al., 2020). Research within the medical radiation science discipline shows the significant value of clinical experience beginning in the first year (Currie & Wheat, 2013). Further, a recent review of international practices in medical radiation sciences, including 121 different pre-registration and entry-level programs, demonstrated WIL occurred across all study years (McNulty et al., 2021). Such practices mirror the recommendations in Australia for health courses accredited under the Australian national regulator AHPRA (Australian Health Practitioner Regulation Agency). The accreditation committee states that students are expected to be provided with "extensive and diverse work-integrated learning" (Medical Radiation Practice Accreditation Committee, 2019, p. 19). This direct clinical experience provides opportunities for students to understand the profession better, to apply theory to practice, and may reduce attrition rates (Clare et al., 2003). The Australian Nursing and Midwifery Accreditation Council (ANMAC) states clinical practice should be "considered essential for promoting cultural acclimatization to the workplace and preventing 'culture shock' that leads to high attrition rates"(Australian Nursing and Midwifery Council, 2009, p. 26).

Early exposure to clinical activities allows students to explore and reflect to ensure the best fit with their career aspirations. Preparatory WIL will enable students to experience authentic learning that develops discipline-specific professional identity and skills applied within a WIL context throughout the course to achieve the necessary practical skills (Jackson, 2016; Jackson et al., 2017). Some students may realize their expectations or personal aptitudes do not align with the profession, resulting in a change of career path without significant investment and resource wastage.

Curricula must be designed with embedded and scaffolded WIL activities to develop competencies such as emotional intelligence, collaboration, interpersonal skills, effective communication, resilience, and ethical practice. Designing a curriculum encouraging students to reflect on professional and practice competencies in the WIL environment promotes values that enhance employability, including developing early career leadership skills. Practitioners identifying as clinical leaders regardless of formal roles aid the development of quality and safety and improve organizational efficiencies (Chamunyonga et al., 2021). Leadership skills also equip practitioners to deal with multiple stakeholders in complex healthcare settings.

Academic-Industry Partnerships

Collaborative relationships between industry and academic institutions are central to successful WIL. Enhancing the WIL experience requires the transparent exchange of feedback, mutual support between parties and a connection built on values of shared responsibility and collaboration. (Venville et al., 2021). The industry benefits of active engagement in WIL have been reported in the literature, including the addition of staff resources and professional development via the opportunity for junior staff to engage in mentoring roles (Jackson et al., 2017).

Identified obstacles to industry partnerships in WIL include financial and time commitments linked to student supervision, unfamiliarity with WIL teaching and learning methods, divergent expectations regarding WIL outcomes and advantages, and limited adaptability and responsiveness of educational institutions to employer business requirements (McGregor et al., 2020). Under a fee-for-service health funding model, students face specific challenges regarding adequate supervision. For example, the practice of bonus payments per number of scans performed may be a disincentive to qualified staff engaging in clinical education as supervision could limit the volume of exams they can complete in a shift. Furthermore, medico-legal concerns tied to the real-time nature of the modality may result in clinical staff opting out of training students.

The teaching experience of clinical staff has also been reported as a barrier to student training. A recent survey found that less than half of sonographers in a supervisory role have formal qualifications in clinical education, highlighting a need for greater recognition and support (Burnley & Kumar, 2019). In the sonography profession, qualified staff generally balance their clinical duties with student training. However, in other professions, such as nursing, there are clearly defined roles for nurse educators in which university educators work in partnership with clinical staff to educate students (McBride et al., 2020). Such schemes may be more suitable to larger professional groups due to resource impacts; however, departmental mentoring and preceptorship programs in other health domains have demonstrated improvements in the culture of teaching and sharing knowledge (Burgess et al., 2018). In addition, train-the-trainer programs promote the role of the clinical educator and facilitate staff development in areas such as supervision, feedback, and assessment skills (Poitras et al., 2021).

Developing greater collaborations between industry and academia can also improve the efficiency of WIL processes; one example is co-designing standard assessment instruments, such as those developed

in nursing, used for student competency assessment (Ossenberg et al., 2016). The formalization and standardization of assessment processes are highlighted as a strategic need to reduce the burden of completing different assessment documentation for the same discipline for different universities (Venville et al., 2021).

The success of any partnership initiative requires demonstrating that the outcomes it sets out to achieve are measurable. Therefore, a consistent and verifiable national workforce trend data set is needed. The ASAR provides current data on active accredited and student sonographer numbers. Still, it does not provide trend data on the number of students successfully transitioning to the workforce or information on which institution or WIL pathway was utilized. Appraisal of the trend data could enable strategic-level responses to ensure that stakeholder collaborations, leadership, and governance are effective.

EXAMPLES OF WORK-INTEGRATED LEARNING

Several examples of effective local WIL exist in sonography, and two examples are provided in this paper. One is a long-established approach within the private sector underpinned by a deliberate and responsive approach to workforce needs. Although this has required a substantial investment, a company-wide culture focusing on the professional development of its workforce demonstrates a sustainable solution. Another example is an initiative within Queensland's public health sector. Still in its preliminary stages, this strategy challenges existing norms by providing a sonographer-led solution to address workforce shortages. The creation of a sonographer clinical educator role supports students across several hospitals within a single health district.

SKG Radiology – Private Radiology Practice – Perth, Western Australia

SKG Radiology, a subsidiary of Sonic Healthcare Limited, is a large private radiology company based in Western Australia. SKG has 18 branches encompassing community and private hospital sites and facilitates a successful ultrasound training program. Currently there are 110 Sonographers practicing at SKG with 81 (73%) of these having commenced as students in the training program.

The current arrangement employs six student sonographers per annum. This intake level is manageable for the practice and maintains a sustainable workforce. Entry into the program is highly competitive, with an average of one application per week. Preferred entry is a medical imaging background or an undergraduate degree strong in human anatomy and physics; historically, backgrounds with these strengths result in the best outcomes for the students. All candidates undertake work experience at SKG before a formal interview. Students are SKG employees and complete a postgraduate degree facilitated by a university that complements the structured in-house practical training program over a period of 2.5 years.

This program represents a significant financial investment from the management of SKG Radiology, with students receiving structured training from a dedicated group of tutors. There is also considerable time invested to complete educational requirements of the university course, and due to this, the choice of educational program must meet the needs of the organization.

The culture of learning at SKG promotes the opportunity for qualified sonographers to extend their skillset in their chosen field of expertise. The outcome of this investment in training is a highly skilled group of sonographers who are committed to working towards excellence and remain loyal to SKG.

Metro South Hospital and Health Service – Queensland Health

Queensland Health is the government-run health service for the state of Queensland in Australia, servicing a population of 5.2 million (Australian Bureau of Statistics, 2024). This public health service is split across 16 Hospital and Health Services (HHS), of which Metro South HHS (MSHHS) caters for 1.2 million people on the south-side of Brisbane, the state capital (Queensland Government, 2023). Across MSHHS, decisions to train sonographers are often complex, needing to balance the perceived training burden against current and forecast staffing requirements. The selection of trainee sonographers is usually from within an existing establishment of radiography staff, which can reduce onboarding commitments with a trainee already familiar with departmental protocols and permits rotation of trainees through existing modality skillsets.

Recently, a new sonographer clinical educator role has been established within MSHHS. This role aims to facilitate face-to-face training, provide mentorship and support to trainees, senior sonographers, and ultrasound team leaders, and develop a structured training framework, learning resources, and tasks to improve trainee learning and patient care. Although the development of this role does not fully address leadership bias amongst professional groups, it demonstrates a willingness to implement sonography-led training solutions. To date, senior sonographers have primarily provided clinical training within this environment, balancing training with their normal clinical load. While dedicated radiographer clinical educators are employed, they focus primarily on managing radiographer student placements and training, with little cross-over into ultrasound training.

MSHHS employs one to two ultrasound trainees per site per year. There are three hospital sites within MSHHS. Expressions of interest in the positions are invited from hospital radiographers; however, there is a move towards advertising to the broader community to improve inclusivity and diversity amongst trainees and increase trainee numbers. Like private practice, preferred prior qualifications are a medical imaging background or an allied health degree with a strong background in anatomy and physics.

Ultrasound trainees in MSHHS complete a postgraduate degree while undertaking work-based training that aligns with the postgraduate degree. Like private practice, students are limited in course choice to improve alignment in training and trainee outcomes.

The benefits of having a dedicated ultrasound clinical educator are multifaceted. Anecdotally, feedback from the trainees has identified that having a dedicated clinical educator providing face-to-face training in the clinical learning environment provides improved direction and structure and reduces anxiety about assessments. Other benefits include developing mentorship relationships to foster engagement, providing authentic learning through patient scanning and worksheet development and producing educational resources that align closely with the learning outcomes of the degree. The role, however, has some limitations, as the clinical educator has no autonomy over the trainee roster. Trainees can be removed from the ultrasound roster to support other medical imaging services; greater flexibility would provide opportunities for periods of dedicated training or allow a student to travel to a site that offers specialized training.

RECOMMENDATIONS

Enhancing WIL opportunities for sonography students represents a positive investment in workforce growth and staff professional development. The following recommendations provide a framework for sonography clinical education based on scholarship and key WIL stakeholders' feedback. The four

recommendations follow key themes: an ethical approach to student learning, the collaboration between universities and industry, additional resource allocation, and support of new initiatives via research specific to WIL.

Recommendation 1:
All parties must recognize the primary philosophy of WIL is centered on student learning and building a sustainable future workforce. Therefore, all students admitted to a sonography education degree deserve an ethically grounded quality learning experience.

To achieve this, traineeship arrangements and clinical placements must be well governed and resourced to balance workforce needs, workload strain, and learning opportunities. Universities should ensure WIL opportunities are embedded and scaffolded throughout the curriculum (Campbell et al., 2021). Early preparatory WIL activities assist students in developing discipline-specific professional identities and clinically focused technical skills (Jackson, 2016). Innovation in simulation and using on-campus physical environments engages students and prepares them for challenging workplaces.

Industry must embrace a more ethical, future-focused approach to WIL. Workplaces must ensure they can adapt and support all students, not solely those who meet arbitrary skill thresholds necessary to fill workplace shortages. Postgraduate programs integrating paid traineeships with WIL must ensure students are not exclusively focused on the work activity and there is time for learning activities that allow for peer interactions, supervisor feedback and reflection (Edwards et al., 2023). WIL is as much about work readiness as it is about developing student employability (Jackson, 2015). Access to WIL provides the vehicle to build student confidence and develop a resilient, sustainable workforce (Drysdale et al., 2021).

Recommendation 2:
Effective, sustainable, and equitable sonography education is not the sole responsibility of one group and requires collaboration between industry and education providers.

Sustainable sonography education can be achieved via tailored initiatives and collaboration between industry and education providers. Stakeholders highly value industry-specific responses (McBride et al., 2020), and some examples of local initiatives are provided above. In addition, universities should assist clinical education capacity building by offering clinical education development and training opportunities for clinical supervisors and tutors. Dedicated clinical supervisors should be developed and recognized as an essential, respected career path for sonographers. Such initiatives should be championed and led by campaigns by professional organizations. Greater recognition of the role of clinical educators, underpinned by solid academic-industry partnerships, by accrediting and professional bodies is also required. Co-funded joint appointments between universities and health centers focusing on leadership and governance specific to sonography training are a potential solution.

Recommendation 3:
Funding is required to support greater clinical training capacity and reduce the financial burden for students. Funding initiatives must incentivize quality training and not utilize students as a proxy workforce.

Financial support can facilitate more equitable access to and participation in WIL. Such funding may be provided by the government, educational institutions, or professional and industry associations and should be carefully planned to optimize benefits and mitigate potential risks for students and stakeholders (Cameron & Hewitt, 2022). Funding can be directed to students to assist them in

undertaking the clinical experiences required to graduate and register as professionals. For example, the New South Wales Government recently announced student nurses can apply for up to $12,000 in financial support (NSW Government, NSW Health, 2024). Alternative funding could be linked to federal health services to support additional training capacity. For example, the Australian Department of Health and Aged Care provides funding to both general practice (GP) registrars, their supervisors and the practice in which they work (Australian Government, Department of Health and Aged Care, 2023). These payments are tiered such that the more remote the location, the higher the payments to incentivize rural and remote medicine.

As well as considering additional financial assistance, universities and healthcare facilities need to explore alternative placement structures to limit extended periods of unpaid WIL associated with financial strain (Grant-Smith & de Zwaan, 2019). Most WIL activities are undertaken in block mode, which provides little flexibility for a diverse student cohort (Peach et al., 2016). More flexibility is needed if universities wish to retain students and the healthcare industry wishes to replenish its workforce.

*Recommendation 4***:**
Conduct research into WIL specific to the sonography profession to build capacity within universities and industry to help inform best practices.

Research activities focusing on specific strategies utilized in each training pathway are desperately needed. These should concentrate on the effectiveness of initiatives to expand student capacity and strategies to educate qualified clinical staff to provide supervision. Additional research themes should include or incorporate the impact of WIL on patient-reported outcomes, industry and education provider partnerships, barriers and enablers of clinical placements, validity of simulated competencies, and exploitation of students. Ideas regarding innovation should be sourced from other allied health professions that have demonstrated increased WIL capacity via research initiatives. For example, physiotherapy WIL research has concluded the benefits of hosting students, including the value to client care, diversity in service provision, improved future planning and positive impacts on staff workload diversity and satisfaction (Forbes et al., 2022). Research activities can be enriched by incorporating national workforce and enrollment trend data to understand future capacity requirements. In Australia, there is the opportunity to utilize the data available on the National Registry of Sonographers to enhance this work.

CONCLUSION

The paper has explored various sonography training pathways and their benefits and challenges, concluding that WIL is an effective approach to educating the future sonography workforce. Recommendations have also been provided for effective, sustainable and equitable sonography education. WIL allows students to apply theoretical knowledge practically, develop clinical confidence and improve patient outcomes. However, the effective implementation of equitable sonography training requires careful planning and consideration of a range of factors, including regulatory requirements, enhanced sonography-led academic-industry partnerships and collaborations, student and supervisor/tutor support, and issues related to equitable access and participation in WIL for all students.

Further discussion and research are required to guide future directions. For example, reporting on successful student training pathways, conducting WIL research specific to the sonography profession, and utilizing readily available national data to assess academic and workforce needs. Strong academic-

industry collaborations are essential to assist stakeholders in increasing capacity and addressing workforce demands. The continued adoption of WIL, which is equitable to students and focused on education, enhances the profession and will result in positive patient outcomes.

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