

Pharmaceutical Care in NICUs in Australia and Poland: Attitudes and Perspectives of Doctors and Nurses

ABSTRACT

BACKGROUND: A multidisciplinary and collaborative team network is essential in ensuring positive health outcomes for critically ill neonatal patients.

OBJECTIVE: To investigate the perceptions of neonatal intensive care unit (NICU) doctors and nurses in Australia and Poland towards pharmaceutical care services in the NICU.

METHOD: A cross-sectional, anonymous electronic-based survey was distributed between January and April 2017 among a sample of NICU doctors, nurses and midwives.

RESULTS: A total of 77 participants from Australia and 93 from Poland completed the survey. Overall, from the perspectives of medical and nursing staff, it is apparent that clinical pharmacy practice on the NICU is more established in Australia than in Poland. Only 8.6% of Polish participants reported that a pharmacist worked directly on the NICU, in comparison with 87% of Australian participants ($p < 0.001$). The main roles performed by pharmacists in Polish NICUs related to the provision of medicines, whereas Australian pharmacists were highly involved in all aspects of pharmacotherapy, particularly in the clinical and education domains.

CONCLUSION: Future efforts should focus on how practice is structured in each country, and what support can be implemented from educational, cultural and legislative levels to enable better pharmacist integration into the NICU therapeutic team.

KEY WORDS: Inter-disciplinary collaboration, NICU/neonates, clinical pharmacist, pharmaceutical care

PRECIS: Statistically significant differences were observed among the opinions and perspectives of medical and nursing staff across Australia and Poland towards pharmaceutical care in the NICU.

INTRODUCTION

Due to the complex nature of the neonatal intensive care unit (NICU), a multidisciplinary and collaborative team network is essential in ensuring positive health outcomes for critically ill newborn patients.¹ Alongside nursing and medical staff, the pharmacist plays an important role in guiding the safe, effective and appropriate use of medicines and in preventing any adverse effects. Several studies have documented the positive effects of collaborative relationships in healthcare, with the pharmacist included within the team facilitating better patient care and clinical results.²⁻⁴ Makowsky et.al. highlighted that pharmacist integration into the therapeutic team enhanced patient outcomes by improving team pharmacotherapy decision-making, continuity of care and patient safety.⁵

A recent literature review highlighted that pharmacist roles performed in NICUs internationally varied significantly. Pharmacy practice in the USA, UK, South Africa and Australia was found to be more interactive with patients and the ward environment with a broad range of roles identified, in comparison to the European countries which did not have an extensive scope of practice.⁶ This diversity in practice may have varying impacts upon neonatal patient outcomes. The World Health Organization (WHO) is a strong advocate for health equity and encourages healthcare systems on a global scale to provide universal and standardised safe, high-quality and effective services.⁷ They further highlight that international collaboration in health research is a valuable mechanism for advancing knowledge, promoting the standardisation of healthcare services and strengthening research capacity.⁸ When considering Australia and an industrialised Eastern European country, such as Poland, there is not a strong collaborative research background identified within published literature – particularly within the domain of pharmaceutical care services. The subsequent differences in health care systems and practice cultures between the two countries may influence medication management on this ward. Indeed, a recent study by Krzyzaniak et.al. reported that the focus of pharmaceutical care services differed between the two countries, ranging from clinically-centered services in Australia to traditional, dispensary-based medication supply duties in Poland.⁹

Considering the disparities in practice, there has been little investigation conducted into exploring the practice context affecting the services being provided in either country. In particular, there is no corresponding literature investigating doctor-nurse-pharmacist relationships in the NICU. Due to the multidisciplinary nature of the NICU, there is a need to explore these relationships and identify how other health professionals view and understand the role of the pharmacist in the NICU. The perspectives of doctors and nurses are helpful in better understanding the current situation of pharmaceutical care in the NICU as well as the pharmacy practice culture in each country. Furthermore, they have potential in identifying areas where attention is needed and what improvements are required to advance practice.¹⁰

AIM OF THE STUDY

The aim of this study was to explore the attitudes and perceptions of medical and nursing health care professionals towards the role of the pharmacist and the provision of pharmaceutical care in the NICU. Specific objectives include:

- Identifying which pharmacists roles are currently provided to NICUs in Australia and Poland
- Understanding which pharmaceutical care services are perceived by doctors and nurses to be essential in the NICU
- Identifying what changes are needed to improve pharmaceutical care

ETHICS APPROVAL

A cross-sectional survey was distributed among doctors and nurses working in NICUs across Australia and Poland between January 2017 and April 2017. Ethics approval was sought and obtained from the respective ethics committees at the University of Technology Sydney (UTS), Australia (UTS HREC REF NO. ETH16-1033) and the Medical University of Gdansk (GUMed), Poland (GUMed HREC REF NO. NKBBN/424/2016).

Participants were assured of confidentiality and were informed that their responses would be de-identified.

METHOD

PARTICIPANTS

The study population was made up of doctors, nurses and midwives who were currently working within level 3 NICUs in Australia and Poland. Participants were identified through publicly available registers in Poland and Australia (Register of Facilities delivering Medical Activities - Rejestr Podmiotów Wykonujących Działalność Leczniczą – RPWDL, and the Australian New Zealand Neonatal Network - ANZNN), which list hospitals with neonatal intensive care units.

To determine an appropriate sample frame, a sample size calculation was performed for each question using a significance level of 5% and a desired power of 80%. The calculation was based on the precision around the point of estimate of effect, i.e., the anticipated response to specific survey questions, guided by the results of previous research.¹¹⁻¹³ The target sample size needed was found to be 64 participants total.

SURVEY

The electronically-based questionnaires were self-administered and were distributed to participants via email by one researcher (NK). Participants who preferred a hard-copy version of the survey were forwarded a version by post. The surveys were made available to participants in the languages of their respective countries i.e. English and Polish. For all surveys that were administered in Polish, the results were translated into English via a tiered process; survey results were translated from Polish to English by one researcher (NK); these translations were edited and verified by two researchers (IP, BB) to determine whether the language was correct.

The survey comprised 20 questions and the majority of questions were fixed binary 'agree/disagree' answers, supplemented by open-ended questions. This research was exploratory in nature and a

mixed methods approach was adopted (involving both qualitative and quantitative data collection) to ensure a more comprehensive insight into current practice. The questionnaire included items relating to demographic characteristics, pharmacy services currently provided in the NICU, essential pharmaceutical care services in the NICU, and changes that are required to improve pharmaceutical care. The questions in the survey were adapted from a validated survey instrument used in a previous study by Katoue et.al. that assessed pharmacist perspectives on pharmaceutical care in hospitals in Kuwait.¹⁴ Modifications were made to the survey questions to make them more applicable to the NICU setting and as such, the survey does not have reliability or validity values to report. All questions were pre-coded for data entry. The survey was pre-tested for content, design and readability on a small group of Australian pharmacists, and was adjusted accordingly.

The survey was conducted between January 2017 and April 2017. As an incentive for an early response, a textbook prize was offered. Reminders were sent by email to participants one month and one week before the end of the study period. Incomplete responses were considered as missing values.

DATA ANALYSIS

Quantitative data were analysed using descriptive statistics (percentages, frequencies) using the Statistical Package for the Social Sciences (SPSS) Version 22. The Chi-square test was used to test the association between independent categorical variables (e.g., Nationality - Australian and Polish) and dependent variables (e.g., proportion of agree/disagree responses to questions relating to: current pharmacy services, essential pharmacist roles that should be performed in the NICU, and changes needed to improve pharmacy services). Statistical significance was accepted at a p value of <0.05 .

Qualitative data (i.e., responses to open-answer questions) were thematically analysed. Manual inductive coding was used, which involved the identification of significant statements in participants responses and subsequent categorisation into key themes around the study objectives.¹⁵ To ensure correct interpretation and coding of data into emerging themes, three researchers (NK, IP, BB)

independently analysed the data before comparing the themes to attain consensus. The analysis was guided by Braun and Clarke's approach i.e. an essentialist/realist theoretical framework was adopted to reflect on the experiences, meanings and the reality of participants.¹⁶ To ensure comprehension, the responses recorded were read several times and patterns were coded into non-overlapping themes and subthemes. The qualitative responses of participants are represented by the code 'PN' for Polish nurses and 'PD' for Polish doctors, and 'AN' for Australian nurses and 'AD' for Australian doctors.

RESULTS

The survey was completed by 77 participants in Australia and 93 in Poland. As depicted in Table 1, more than half of participants from each country were female (Aus = 68.8%, Pol = 86%). Nursing staff made up 45.5% and 60.2% of participants from Australia and Poland respectively. More than half of all professionals had more than 5 years' experience, and most participants possessed specialised training related to neonatal practice, ranging from post-graduate neonatal nursing degrees to medical specialties.

In Australia, the majority of participants worked in level 3 NICU settings, however some were found to work in level 4 and level 6 units – which included surgical as well as medical patients. Poland also has a three-tiered neonatal care specification system, and all participants were found to work in a level 3 or higher. The number of NICU beds available at settings in each country ranged from 4 - 79 in Australia, and 4 – 70 in Poland.

PHARMACIST INVOLVEMENT IN THE NICU

According to the experiences of doctors and nurses, there are significant differences perceived between Australia and Poland regarding the type of pharmaceutical care services provided in NICUs. It is apparent that pharmacists do not commonly participate in ward-based practice in Polish NICUs.

Approximately 91.4% of Polish participants identified that pharmacists are not present on the NICU ward at their settings, in comparison with 13% of participants in Australia ($p < 0.001$). As a result, 74% of professionals in Australia agreed that they had a high level of interaction with pharmacists in their daily practice. Alternatively, in Poland, 38% of participants agreed that they did not collaborate with the pharmacist at all. When asked whether pharmacists were meeting the medication management needs of NICU patients, similar variances were noted. Significantly more Polish professionals (82.4%) identified that pharmacists were not meeting the pharmacotherapy needs of neonatal patients, whereas in Australia 82.9% of medical and nursing staff felt that these services were adequate ($p < 0.001$).

A high proportion of Australian NICU professionals had more positive responses when considering their perceptions towards inter-professional relationships with the pharmacy team. Again, the majority of Australian participants perceived having a good relationship with the NICU pharmacist (81.6%), compared with 31.2% of Polish participants who considered pharmacy liaisons to be poor. However, similar responses between the two countries were identified when considering direct pharmacist positions on the NICU. Rates of agreement were higher than 90% when considering whether pharmacists should be included and consulted during pharmacotherapy-related decision making on the NICU. Furthermore, 67.1% of Australian and 76.1% of Polish professionals agreed that pharmacists should have a visiting position on the NICU ward. (Table 2)

ROLES THAT ARE CURRENTLY PERFORMED IN THE NICU

Participants were asked to identify which pharmacist roles were performed within the NICU settings they worked in. The perceived types of NICU pharmaceutical care services offered varied widely, and statistically significant values were identified for the majority of roles in each of the domains, aside from the provision of medicines. (Figure 1) According to nurses and doctors in Poland, the main roles performed by pharmacists in the NICU are related to traditional, dispensary-based practice i.e.

dispensing, compounding and stocking the ward with the necessary medications, as well as monitoring the TPN of neonatal patients. Significantly more Australian participants agreed that pharmacists delivered clinical roles, such as participation in medication chart review (91.8% vs. 40.4%, $p < 0.001$), ward rounds (79.1% vs. 10.1%, $p < 0.001$) and therapeutic drug monitoring (82.6% vs. 33.3%, $p < 0.001$) in NICUs compared to Polish participants. Furthermore, it is evident that direct input into pharmacotherapy-related decision-making is not a common practice for pharmacists in Poland. Less than 30% of Polish medical and nursing staff agreed that pharmacists were involved in recommending doses ($p < 0.001$), off-label and unlicensed prescribing ($p < 0.001$), drug selection ($p < 0.001$) and performing pharmacotherapeutic interventions ($p < 0.001$).

Alternatively, a significantly high proportion of Australian doctors and nurses agreed that pharmacists were highly involved in all aspects of pharmacotherapy, particularly in the clinical and education domains. Professionals most commonly identified Australian pharmacist involvement in: collaborating with doctors and nurses on specific neonatal patients (93.1%, $p < 0.001$), performing interventions (94.4%, $p < 0.001$), providing medication-related information (95.8%, $p < 0.001$) and dispensing (93%, $p = 0.045$). Quality assurance measures were performed by four times as many Australians (83.1%) as Polish pharmacists (19.1%, $p < 0.001$), along with counselling of parents (76.1% vs. 18.9%, $p < 0.001$) and the provision of training/education for NICU health professionals (85.9% vs. 24.4%, $p < 0.001$).

Involvement in immunisations was not a normal duty in either country, with less than 50% involvement. The only role perceived by medical and nursing staff as being performed more commonly by Polish pharmacists than Australian pharmacists was the monitoring of TPN regimens (76.9% vs. 67.6%).

MEDICAL AND NURSING STAFF EXPECTATIONS OF PHARMACIST ROLES IN THE NICU

Medical and nursing professionals in Australia and Poland both share high expectations relating to roles to be performed by pharmacists. All participants had higher than 80% agreement rates for pharmacists to perform the majority of clinical roles (12/15), in particular medication chart review, therapeutic drug monitoring, documenting medication errors and therapeutic drug monitoring. (Table 3) Statistically significant differences between countries were observed when considering participation in ward rounds (Aus = 86.3%, Pol = 67.5%, $p < 0.016$,) and TPN (Aus = 70.8%, Pol = 93.8%, $p < 0.001$,). Interestingly, a higher proportion of Polish participants agreed to expecting pharmacists to perform; counselling of parents (78.9% vs. 85.9%), documenting adverse drug reactions (93.9% vs. 96.3%), and monitoring the efficacy of pharmacotherapy in patients (88.2% vs. 93.7%). This is of particular interest as these roles were previously identified by participants as those that were not highly performed by Polish pharmacists in NICUs. These findings indicate, that despite pharmacists not having a high level of direct input into neonatal pharmacotherapy, these services are perceived as essential by medical and nursing staff.

CHANGES NEEDED TO IMPROVE PHARMACIST PRACTICE IN THE NICU

The majority of Polish medical and nursing staff (80.6%) stated that it was necessary for changes to be made to pharmacist practice in the NICU. (Table 2) However, 52% of Australian participants were satisfied with current service provision and did not want to see any changes to pharmacist roles. Nevertheless, all proposed changes listed achieved high acceptance rates from both Australia and Poland. The most commonly identified changes needed to improve pharmaceutical care in the NICU across both countries included increased levels of staffing (Aus = 92.5%, Pol = 95.2%), provision of neonatal specific training opportunities for pharmacists (Aus = 86.8%, Pol = 95.2%) and the creation of NICU pharmacist positions on the ward (Aus = 90.6%, Pol = 91.7%). The changes that were commonly chosen by Polish participants related to increasing doctor and nurse awareness of

pharmacist roles, greater administrative support from the hospital and increased channels of communication with pharmacists.

THEMES

The themes that emerged from Polish participants are as follows:

THEME P1: Pharmacists Are Needed On The NICU To Improve Pharmacotherapy

Polish medical and nursing staff commonly highlighted that they perceived a need for the clinical pharmacist to be present on the NICU and to be available to perform pharmaceutical care services.

Sub-theme P1.1: Needed to Assist Medical and Nursing Staff

The activities perceived to be the most important by these health care professionals related to the preparation of medicines for neonatal patients, which in some settings are prepared by nursing staff on the ward, as well as involvement in planning pharmacotherapy regimens. Interestingly, quite a few participants wanted the pharmacist to absorb some of their current roles to 'free up' their time for more meaningful activities. This indicates that some medical and nursing staff do not see the pharmacist as being able to contribute as an independent expert, but rather as an assistant.

'I would like the pharmacists to do all the medicines, and prepare them according to procedures and not like how it is at the moment. The nurses prepare medications in the patients room.' **PN18**

Polish doctors (especially those with overseas experience) were supportive of having the pharmacist as part of the team – and were less focused on prescribing and preventing errors, and more focused on optimising treatment and providing tailored advice. Doctors appeared to have insight into the specialist knowledge of pharmacist – referring to pharmacokinetics, pharmacodynamics, drug

effectiveness, off-label drug use, improving the quality of treatment, better patient care, and referred to better inter-disciplinary collaboration. Interestingly, nurses were slightly greater advocates for changing the existing system to allow pharmacists on the ward.

‘Constant contact and collaboration whilst treating patients is needed, especially in the NICU between doctors and pharmacists.’ PD14

Sub-theme P1.2: Benefits of Pharmacist Contributions

Some practitioners also identified several benefits to pharmacist involvement, including more individualised medication regimens, increased medication safety and improved quality of care.

‘A pharmacist on the NICU would result in better-matched medicines for children. Ability to prepare medicines according to the individual needs of the child.’ PN23

‘Pharmacists should be employed in the NICU to improve and facilitate care provided to patients.’ PN46

THEME P2: Minimal To No Pharmacy Support On The NICU

Polish practitioners highlighted that pharmacists are not normally present on NICU wards, and as such there was no pharmacy support delivered to the NICU. A team-approach was reported to not exist at all, some practitioners noted that access to pharmacists was limited to telephone calls to the main hospital pharmacy as needed. As such, this restricted level of communication was attributed to leading to poor inter-professional relationships with the pharmacist. Furthermore, the level of services provided was identified as minimal; usually comprising preparation of TPN and the ordering of necessary medicines.

‘An inter-professional relationship does not exist because there is no direct collaboration between midwives/nurses and the pharmacist.’ PN6

‘Contact with the pharmacist is limited to ordering medicines and receiving TPN and PPN.’

PD2

THEME P3: Lack Of Structure/Support System For Clinical Pharmacists To Be Able To Practice On The NICU

Most participants felt that the hospital was unable to support pharmacists being on wards due to limited funding. Other barriers to the performance of clinical pharmacy services on the NICU were attributed to the lack of support and structure from the hospital administration, in failing to create paediatric or neonatal specific clinical pharmacist positions. Furthermore, a lack of hospital pharmacy staff was also attributed to the absence of pharmacist involvement in the ward.

‘The number of pharmacists working in the hospital pharmacy is too small.’ **PD5**

Other participants identified that pharmacists were not adequately trained in neonatal pharmacotherapy and did not possess the relevant knowledge necessary to make appropriate decisions in the NICU. Interestingly, one doctor also identified that education was needed for medical staff themselves to improve their understanding of the pharmacists role and what services they are able to provide to the NICU to assist practitioners in medication management.

‘I think the main barriers are finances. Education is also needed – we doctors do not know we need pharmacists.’ **PD3**

‘At the present time, there is no group of pharmacists available that is adequately prepared for clinical practice.’ **PD6**

Furthermore, differences in practice culture were identified among Polish participants. Approximately one third of participants didn’t feel that there was a need to change current practice and/or engage the pharmacist more than currently. Some felt that dispensing was all the pharmacist

needed to do, whereas others felt that doctors or nurses were capable of fulfilling the tasks of a pharmacist.

'They fulfil their role working in the dispensary.' **PD10**

'There is no need for changes regarding the role of the pharmacist, as these are performed by a nurse and midwife.' **PN19**

The two themes identified in the Australian responses are as follows:

THEME A1: The Pharmacist Is An Effective Member Of The Multi-Disciplinary NICU Team

Pharmacists were acknowledged in Australian settings as being valuable members of the NICU therapeutic team and both doctors and nurses described positive experiences of having a pharmacist on the ward. The majority of medical and nursing staff who identified that they had a full-time pharmacist on the ward, were able to describe specific roles that they performed for example, reviewing patient medication charts, supplying medications, minimising medication errors etc. They highlighted that pharmacists were actively involved in ward-based roles and were an invaluable source of advice. Participants commonly expressed that they often collaborated with the pharmacist, and found interactions to be of great assistance to medication management in the NICU. In particular, it was frequently emphasised that pharmacists are respected and included as a part of the team. Pharmacists were commonly referred to as professional, dedicated, collaborative, approachable, involved and approachable.

'Personally in our unit the pharmacist is an integral part of our service that is relied upon, trusted and utilised to its full potential... They are experienced and part of the team. We rely on them for their expertise in the field.' **AN8**

'We have a permanent full time pharmacist for the NICU and Special Care Nursery who contribute greatly to the multi-disciplinary team, service decisions and research and quality and safety. Invaluable service.' **AD11**

Whilst both medical and nursing staff had positive responses relating to pharmacist involvement, nurses were more likely to describe the issues relating to a lack of pharmacist services. This may be attributed to the fact that nurses may liaise more frequently with pharmacists than doctors on the ward.

THEME A2: Need For A Dedicated Pharmacist Position With Regular/Routine NICU Hours

Some participants in Australia reported that there were no pharmacists specifically allocated to their NICU, or that pharmacists were restricted with the amount of time they were able to dedicate to the ward. This was most commonly attributed to financing issues and was seen as a significant barrier to the provision of the necessary level of pharmaceutical care. Other reasons for having no pharmacist on the ward related to pharmacy department rosters, where in some instances, no pharmacists were scheduled to cover the ward when the main NICU pharmacist was away or new pharmacists were scheduled on a rotational basis, disrupting the continuity of care. As such practitioners called for the employment of more hospital pharmacists as well as the creation of NICU specific pharmacist positions that allowed pharmacists to spend the necessary amount of time needed to provide clinical services. It was identified that the therapeutic team values having a pharmacist more often on the ward, and that contributions were more favourably accepted from a pharmacist familiar with the medical and nursing staff.

'Pharmacist should be in NICU every weekday, attending rounds, reviewing charts, providing education, discussing discharge meds with parents.' **AN15**

'Need consistency in the staff number, not changing every few weeks as is the current practice....By being permanently appointed they are able to develop relationships with the staff which ultimately leads to best patient care and outcomes.' **AN25**

'There is no-one allocated to the role of pharmacist for NICU. There needs to be a dedicated pharmacist with NICU knowledge, even if part time.' **AD24**

COMPARISON BETWEEN COUNTRIES

Overall, the participants responses highlight significant differences in the type of pharmacy practice that undertaken in each country. (Table 3) According to Polish medical and nursing staff, the concept of clinical pharmacy is not yet well established, highlighted by the lack of clinical and educational services provided by pharmacists directly on the ward. Polish pharmacists are based in the dispensary, not on the ward, where their services are focused on the supply of medicines. Although this was the understood and currently accepted form of pharmacy practice, nearly all Polish participants felt that their pharmacists could do more to meet the specific medication management needs of the vulnerable NICU patient population.

In contrast, Australian participants strongly emphasised that clinical pharmacy practice was well established in the NICU, highlighting their reliance on the pharmacist during routine decision-making around pharmacotherapy. Australian doctors and nurses felt that their NICU pharmacists provided a highly-integrated service across each phase of the medication use process. Participants expressed that they had a good interdisciplinary relationship with their ward-based NICU pharmacists.

Despite apparent differences, there were some key similarities between the two countries. The first relates to expectations towards pharmacist practice in the NICU; the majority of participants strongly perceived that there was a need for pharmacists to be directly involved in clinical practice on the ward. The second similarity was that both Polish and Australian participants felt that there

was a need to further improve the provision of services in their respective settings. However, the barriers that needed to be addressed differed in each setting. Polish participants focused on the foundational elements required to enable the provision of clinical pharmacy services, for example, support from the hospital administration in creating and funding hospital pharmacist positions. In contrast, Australian participants identified areas of current practice that require further improvement, i.e. staffing issues and increasing amounts of time allocated to the NICU.

DISCUSSION

This study explored the opinions, attitudes and perceptions of Australian and Polish medical and nursing staff towards the provision of pharmaceutical care services on the NICU. This research was exploratory in nature and to our knowledge, this is the first study to compare the perspectives of doctors and nurses towards pharmacist services provided in NICUs across two countries. This research clearly demonstrates how widely practice can differ in healthcare settings around the world, with key differences in pharmacist roles between Australia and Poland. Polish participants commonly referred to a traditional, dispensary-based type of practice in comparison with Australian participants who described a well-established clinical pharmacy practice. These findings are similar to those reported in other studies in both Poland and Australia describing hospital pharmacy practice on other hospital wards.^{11,12,17-20}

The differences found between countries can be attributed to a number of reasons. Firstly, Australia has a longer history of pharmacy involvement not only in the NICU, but also in clinical pharmacy positions in the hospital setting. Dunkley performed a foundational nation-wide study in 1991 that found that Australian pharmacists were involved in providing ward-based services in NICUs, including medication chart reviews, therapeutic drug monitoring and adverse drug reaction monitoring.²¹ Clinical pharmacy has progressed significantly in the 26 years since, and as a result, practice is more established and more readily accepted into the ward environment. Alternatively,

clinical pharmacy is not well developed in Poland, and pharmacists may face many cultural, educational and legislative barriers to practice. As highlighted by Polish participants in this study, pharmacists are perceived as being inadequately prepared for practice on the NICU and do not receive the necessary support from hospital administration to be able to fulfil practice as a clinical pharmacist on the NICU. The differences perceived between the two countries highlight that these findings may also be applicable outside of Poland and Australia, to countries that have similar pharmacy practice structures and practice cultures. The perceptions held by Polish participants may be similar to those held by nursing and medical staff in Eastern European countries with comparable healthcare systems. These findings may serve to improve awareness of the status of clinical pharmacy worldwide and the opportunity to increase the presence of clinical pharmacist in the NICU. Likewise, in Western countries such as New Zealand, UK and USA, with more advanced clinical pharmacy practice frameworks, these findings may help to reinforce the need for the pharmacist in the NICU.

The results also found that the majority of Polish medical and nursing staff expressed that they were unaware of what pharmaceutical care services a pharmacist could provide to the NICU. As the concept of pharmaceutical care is developing within this country, it is important for the pharmacist to be recognised as a valuable contributor to patient care. McDonough and Doucette highlight that the initial step towards initiating a collaborative, ward-based practice is to establish professional awareness among staff.²² Education should be provided to doctors and nurses to improve understanding of pharmacist competencies. Sjölander et.al highlight that in addition to training medical and nursing staff, pharmacists also require appropriate training as well as clinical experience in patient care to be able to make high-quality clinical recommendations.²³ This in turn helps to foster trust needed between healthcare professionals to be able to collaborate and willingness to share responsibilities.²³

Another interesting finding of the study is that pharmacists were viewed by participants in both countries as essential members of the NICU therapeutic team. Furthermore, Polish participants identified that they felt a need for changes to be made to pharmacist practice to better integrate them into the NICU. These attitudes are encouraging, particularly when considering the complex environment of the NICU, and highlights that medical and nursing staff are aware of the value of pharmacist involvement. The pharmacist has a great opportunity to become involved in pharmacotherapeutic-care processes on this ward, due to the need for specialised dosing, dilutions/calculations and formulations that are dependent on patient gestational ages, weights and surface areas. The roles of the pharmacist, doctor and nurses, in this capacity, are complementary. Therefore, the findings from the manuscript highlight the need for the development of multi-disciplinary teams in the NICU that include clinical pharmacists. "The practice of pharmaceutical care does not exist and should not exist in isolation from other health care services. It must be provided in collaboration with patients, doctors, nurses, and other health care providers."¹⁰ The establishment of a respectful and collaborative relationship between these professionals is important for the delivery of individualised and effective pharmaceutical care.²⁴

From the perspectives of the participating nurses and doctors, the integration of pharmacists into the NICU team was felt to be a positive concept, and was thought to support the provision of quality patient care, medication management and patient safety. The findings of this study inform neonatal nursing practice as they increase the awareness of the potential roles and contributions of clinical pharmacists on the NICU, and highlight that pharmacists, nurses and doctors could play a part in and benefit from working together as a team. This study has provided a baseline level comparison of pharmacy practice as well as medical and nursing staff attitudes between two countries, a practice encouraged by the International Pharmaceutical Federation (FIP). The FIP states: 'pharmacy needs a global vision that encompasses the sharing of experiences, gathering of evidence and collaborative guidance to facilitate country-level initiatives.'²⁵ Future efforts should focus on how practice is structured in each country, and what support can be implemented from educational, cultural and

legislative levels to enable better pharmacist integration into the NICU therapeutic team. The barriers to the implementation of pharmaceutical care in the NICU, as identified by the participants, are only able to be overcome through a collaborative effort from government policy makers, hospital administrators, directors of pharmacy, NICU medical and nursing staff, and, importantly, clinical pharmacists.

Further research is needed, particularly in Poland, which focuses on redefining the role of the clinical pharmacist within the NICU multi-disciplinary team as well as identifying strategies that promote successful team-based care.

LIMITATIONS

Participants were recruited from a select sample of Polish and Australian hospitals that contained a NICU and as such, results may not be representative of the population of medical and nursing professionals of Australia and Poland, and should be interpreted with caution. Some questions in the survey may have been misunderstood and were not able to be clarified by the researchers. Furthermore, it is acknowledged that participant responses were self-reported, and may be subject to bias. The survey was adapted from a validated survey instrument from a previous study and modified to suit the NICU setting, and as such does not have validity or reliability values to report. Therefore, results should be interpreted with caution.

CONCLUSION

Statistically significant differences were observed among the opinions and perspectives of medical and nursing staff across Australia and Poland. Australian settings were found to implement ward-based clinical pharmacy services more commonly than Polish units. Most Polish participants identified that the extent of medication management was not meeting neonatal patient needs and that they had no contact with pharmacists on the ward. Future efforts should focus on how practice

is structured in each country, and what support can be implemented from educational, cultural and legislative levels to enable better pharmacist integration into the NICU therapeutic team.

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TABLE 1 - DEMOGRAPHIC INFORMATION

		AUSTRALIA (%)	POLAND (%)
NUMBER OF PARTICIPANTS		77	93
<u>GENDER OF PARTICIPANTS</u>			
Female		53 (68.8)	80 (86.0)
<u>QUALIFICATIONS</u>			
Bachelors Degree		33 (42.9)	36 (38.7)
Masters Degree		26 (33.8)	28 (30.1)
PhD Degree		11 (14.3)	15 (16.1)
Other		7 (9.1)	14 (15.1)
<u>SPECIALISED QUALIFICATIONS</u>			
Yes		60 (77.9)	44 (47.3)
No		17 (22.1)	49 (52.7)
Specialisation in neonatology/paediatrics – FRACP, MRCPCH		38 (63.3)	17 (38.6)
TRAINING COURSES	Post-graduate course in Neonatal/Perinatal Nursing	25 (41.7)	18 (40.9)
	Ultrasound and aviation	1 (1.7)	
	American Board of Neonatal/Perinatal Medicine	1 (1.7)	
	Neonatal Immunisation training		4 (9.1)
	Lactation training		1 (2.3)
	Other medical specialisations i.e. neurology, cardiology		2 (4.5)
	Ultrasound training		1 (2.3)
<u>POSITION IN THE HOSPITAL</u>			
NICU Nurse		21 (27.3)	23 (24.7)
Midwife		2 (2.6)	30 (32.3)
Nurse/Midwife Unit Manager		4 (5.2)	3 (3.2)
Other Specialist Nursing Positions – Educator/Consultant/Clinical Support/Practitioner		8 (10.4)	
Neonatologist		31 (40.3)	23 (24.7)
NICU Doctor		10 (13.0)	13 (14)
Consultant Paediatrician/Neonatologist		1 (1.3)	1 (1.1)
<u>EXPERIENCE</u>			
< 1 Year		3 (3.9)	3 (3.2)
Between 1-5 Years		21 (27.3)	11 (11.8)
Between 6-10 Years		18 (23.4)	16 (17.2)
> 10 Years		35 (45.5)	63 (67.7)
<u>NUMBER OF BEDS IN NICU (RANGE)</u>		4 - 79	4 – 70

TABLE 2 - PERCEPTIONS OF PHARMACEUTICAL CARE PROVIDED ON THE NICU

	AUSTRALIA (%)	POLAND (%)	P-value (Comparison of proportions between Australian and Polish participants)
<u>IS THERE A PHARMACIST CURRENTLY WORKING ON THE NICU THAT YOU ARE EMPLOYED IN?</u>	N = 77 (%)	N = 93 (%)	<0.001
Yes	67 (87.0%)	8 (8.6%)	
No	10 (13.0%)	85 (91.4%)	
<u>WHAT IS YOUR CURRENT LEVEL OF INTERACTION WITH THE PHARMACIST?</u>	N = 77 (%)	N = 92 (%)	
High	57 (74.0%)	28 (30.4%)	
Average	10 (13.0%)	7 (7.6%)	
Rare	6 (7.8%)	16 (17.4%)	
None	2 (2.6%)	35 (38.0%)	
Other	2 (2.6%)	6 (6.5%)	
<u>DO YOU BELIEVE THAT THE PHARMACIST IS CURRENTLY MEETING ALL MEDICATION MANAGEMENT NEEDS IN THE NICU?</u>	N = 76 (%)	N = 91 (%)	<0.001
Yes	63 (82.9)	16 (17.6)	
No	13 (17.1)	75 (82.4)	
<u>LEVEL OF CURRENT PHARMACEUTICAL CARE PRACTICE IN THE NICU</u>	N = 76 (%)	N = 93 (%)	
Good	60 (78.9)	21 (22.6)	
Average	7 (9.2)	24 (25.8)	
Poor	5 (6.6)	13 (14.0)	
Non-Existent	4 (5.3)	35 (37.6)	
<u>IS THERE A NEED TO CHANGE PHARMACIST ROLES?</u>	N = 75	N = 93	<0.001
Yes	36 (48.0)	78 (83.9)	
No	39 (52.0)	15 (16.1)	
<u>SHOULD THE PHARMACIST BE CONSULTED AS PART OF THE TREATING TEAM FOR MEDICATION-RELATED DECISION-MAKING IN THE NICU?</u>	N = 76	N = 93	0.467
Yes	71 (93.4)	84 (90.3)	
No	5 (6.6)	9 (9.7)	
<u>SHOULD PHARMACISTS HAVE A VISITING OR PERMANENT POSITION ON THE NICU?</u>	N = 76	N = 92	
Yes – Visiting	51 (67.1)	70 (76.1)	
Yes – Permanent	25 (32.9)	6 (6.5)	
No	0	16 (17.4)	
<u>LEVEL OF CURRENT INTER-PROFESSIONAL RELATIONSHIP BETWEEN PHARMACISTS AND THE MEDICAL AND NURSING STAFF</u>	N = 76	N = 93	
Good	62 (81.6)	22 (23.7)	
Average	6 (7.9)	23 (24.7)	
Poor	3 (3.9)	29 (31.2)	
Non-Existent	5 (6.6)	19 (20.4)	

TABLE 3 - COMPARISON OF PHARMACIST PRACTICE IN NICUS BETWEEN AUSTRALIA AND POLAND

	AUSTRALIA	POLAND
TOP 3 COMMONLY PERFORMED ROLES IN THE NICU	<ol style="list-style-type: none"> 1. Source of drug information - responding to information requests from health professionals on the ward 2. Identifying and performing interventions for individual patients to prevent or resolve drug therapy problems i.e. interactions, incompatibilities, allergies etc. 3. Collaborating and discussing specific patients with doctors and nurses 	<ol style="list-style-type: none"> 1. Extemporaneous compounding of formulations for the NICU 2. Stocking the ward with essential medicines/house-keeping activities i.e. checking expiry dates, fridge temperatures etc. 3. Dispensing prescriptions
TOP 3 COMMONLY EXPECTED ROLES TO BE PERFORMED IN THE NICU	<ol style="list-style-type: none"> 1. Medication chart review 2. Calculating and recommending doses and dosing schedules for specific patients 3. Providing training/in-services for other health professionals on NICU related topics and drug related problems 	<ol style="list-style-type: none"> 1. Providing training/in-services for other health professionals on NICU related topics and drug related problems 2. Extemporaneous compounding of formulations for the NICU 3. Documenting Medication Errors
TOP 3 COMMONLY IDENTIFIED CHANGES NEEDED TO IMPROVE PRACTICE	<ol style="list-style-type: none"> 1. Increased levels of staffing in the pharmacy 2. Creating specific NICU clinical pharmacist positions in the hospital i.e. organisational changes 3. Increasing educational opportunities for the up-skilling of pharmacists in topics related specifically to neonatal/paediatric pharmacotherapy 	<ol style="list-style-type: none"> 1. Increasing nurse/doctor awareness of the roles and services that pharmacists can provide in the NICU 2. Increased communication with pharmacists 3. Administrative support from the hospital i.e. from directors

1 **FIGURE 1 – PHARMACIST ROLES PERFORMED ON NICUS IN AUSTRALIA AND POLAND AS PERCEIVED BY MEDICAL AND NURSING STAFF**

