Pharmacist perspectives towards pharmaceutical care services in neonatal intensive care units in Australia and Poland

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Pharmacist Perspectives Towards Pharmaceutical Care Services in Neonatal Intensive Care Units in Australia and Poland

ABSTRACT

OBJECTIVES: The purpose of this study was to investigate the perceptions of NICU pharmacists and directors of pharmacy in Australia and Poland towards their level of preparation in performing pharmaceutical care services in the NICU as well as to identify practice barriers and changes needed to improve services.

METHOD: A cross-sectional, electronic-based survey was distributed among a NICU pharmacists and directors of pharmacy working in hospitals with a NICU in Australia and Poland. The survey comprised 12 items and the majority of questions were fixed binary 'agree/disagree' answers, supplemented by open-ended questions.

RESULTS: A total of 29 participants from Australia and 20 from Poland completed the survey. Overall, it is apparent that Australian pharmacists felt more competent in the provision of clinical and educational roles than Polish participants. In 14/15 clinical roles listed, more than 70% of Australian participants felt that pharmacists had a 'good' level of preparation to provide services to the NICU, including medication chart reviews (93.1%), performing pharmaceutical interventions (96.6%), and collaborating with medical and nursing staff (93.1%). A significantly higher proportion of Polish pharmacists agreed that changes were needed to improve pharmacist practice in the NICU (Aus = 53.6%, Pol = 90%, p = 0.007).

CONCLUSION: Future efforts should focus on developing guidelines and practice standards for sub-specialties of pharmacist practice, such as neonatology, to promote the standardization of practice.

Keywords: Neonatology, Clinical pharmacy, Quality of pharmacy services, International pharmacy services, Hospital pharmacy competencies, Australia, Poland

KEY POINTS:

- This study provides a preliminary insight into the reality of pharmacist practice in NICUs in Poland and Australia. Polish pharmacists perceived practice barriers at a higher rate than Australian participants, and were also more inclined to want changes to pharmacist roles to be made.
- These findings have implications for the development of standardized pharmacist practice policies for the NICU on a national and international scale to bridge the practice gap between countries.

- It is apparent that Polish pharmacists are unaccustomed to the concept of the pharmacist as a provider of direct patient care, and identify more with the distributive model of practice. Alternatively, Australian pharmacists associate more with the pharmaceutical care practice model, whereby pharmacists assume responsibility for patient care and are members of the inter-disciplinary treating team.

1. INTRODUCTION

The neonatal intensive care unit (NICU) is arguably a high priority ward in the hospital setting. With a vulnerable patient group made up of mostly premature infants experiencing serious comorbidities, who also possess a high risk of experiencing long-term developmental consequences resulting from errors or unsuccessful treatment, the NICU is a high-pressure environment.[1] Furthermore, it is a large consumer of pharmacotherapy resources, with neonatal patients reportedly being prescribed an average of 8.6 medicines per patient.[2] A significant proportion of these medicines are deemed high-risk in terms of the potential to do harm in the case of medication misadventure, and as pharmacotherapy is highly relied upon in these patients, it adds another layer of complexity to the challenging medication use process.[3] As such the sub-specialty of the NICU warrants the performance of not only specialized medical care but also specialized pharmaceutical care services.

The modern role of the pharmacist is built upon the concept of pharmaceutical care. Defined as: "the extent to which pharmacy services deliver effective, efficient, patient-centered, equitable and safe pharmacotherapy", pharmaceutical care is a widely adopted practice worldwide.[4] However, due to the lack of minimum practice standards, protocols or key performance indicators, specifically tailored to the NICU, the quality and type of pharmacy services provided may vary within and between countries.[1] The World Health Organization emphasizes that global collaboration is essential in identifying best practices and in promoting the implementation of uniform services across settings.[5] Whilst there are significant differences in practice between third and first world countries, it is apparent that there are also variances in pharmacy practice between industrialized countries in Eastern Europe, as well as the US, UK, Australia, New Zealand and Canada.[6] In Eastern European countries, such as Poland, the implementation of ward based pharmaceutical services in hospitals is not extensively developed, with most efforts concentrated on dispensary based functions.[7, 8] Alternatively, in Australia a 1991 study by Dunkley highlighted that pharmacists in NICUs performed a range of services ranging from participation in multi-disciplinary ward rounds to reviews of patient medication charts.[9] The disparities in practice may be attributed to differing levels of emphasis placed on clinical pharmacy services during tertiary training. It is apparent that in Poland, pharmacy programs are strongly focused on the traditional scope of pharmacist services i.e. dispensary based compounding activities, with little to no focus on clinical pharmacy practice.[10] Alternatively, Australian universities seek to prepare pharmacy students for more integrated roles on ward environments, including simulation-based sessions relating to patient care, as well as interdisciplinary teamwork.[11-13] These variances may influence the capability of the pharmacists to deliver clinical roles.

A recent study by Krzyzaniak et.al. demonstrated that the focus of NICU pharmaceutical care services in Australia and Poland varied significantly.[14] Australian pharmacists were seen to be mostly dedicated to clinical, ward-based services, whereas Polish pharmacists were accustomed to a compounding and distributive model of practice.[14] These differences may lead to varying levels of impact upon neonatal patient outcomes and medication error rates. Pharmacists are key members of the NICU treating team and have significant potential to improve pharmacotherapy related outcomes and reduce costs associated with the use of resources.[15] Therefore, there is a need to better understand the current state of pharmacy services in NICUs in each country, to identify specific pharmacy practice issues that lead to these significant differences. No studies have been performed that investigate pharmacist opinions on performing these services in NICUs and their perceived competencies in providing tailored clinical services to neonatal patients.

2. AIM OF THE STUDY

The purpose of this study was to identify the opinions and perceptions of NICU pharmacists and directors of pharmacy in Australia and Poland towards the provision of pharmaceutical care services in the NICU. This research follows on from a previously published study, which identified pharmaceutical care services provided in NICUs in these countries.[14] This research intended to provide greater context and understanding to the pharmacy practice system functioning in NICUs in each Australia and Poland. Specific objectives included:

- Understanding pharmacists perceived levels of preparedness to provide clinical services in the NICU
- Identifying what changes are needed to improve pharmaceutical care
- Identifying what barriers currently limit the implementation of pharmaceutical care in the NICU.

3. ETHICS APPROVAL

Ethics approval was obtained from the respective ethics committees at the University of Technology Sydney (UTS), Australia (REF NO. ETH16-1033) and the Medical University of Gdansk, Poland (REF NO. NKBBN/424/2016).

Participants were made aware that their responses would be de-identified.

4. METHOD

A cross-sectional, online survey was distributed between January and May 2017 to hospital pharmacists and directors of pharmacy departments based in Australian and Polish hospitals with a NICU. The survey was created using SurveyMonkey and comprised 12 questions which were developed from the findings of a literature review and adapted previous study by Katoue et.al. that assessed pharmacist perspectives on pharmaceutical care in hospitals in Kuwait.[16, 1] The majority of questions were fixed binary 'agree/disagree', and were accompanied by open-ended questions. It is important to highlight that this research is exploratory in nature, and as such a mixed-methods approach involving both quantitative and qualitative data collection, was adopted to ensure a fuller understanding of practice. The questions collected information on the participant characteristics, perceptions of the preparedness of pharmacists to provide pharmaceutical care, opinions on the barriers to the provision of pharmaceutical services and changes that are required to improve pharmaceutical care. All questions were pre-coded for data entry. The survey was pre-tested on a small group of Australian pharmacists for question clarity, and was refined accordingly. Participants were provided with surveys in their respective languages i.e., English or 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), then these translations were edited and verified by two co-researchers (IP, BB).

Emails containing a unique online survey link and a brief description of the survey were emailed to pharmacists. Respondents who requested a hard-copy version of the survey were sent one by post. Reminders were emailed to participants one month and one week before the end of the study period.

Responses from participants who completed at least 50% of the survey were included in the analysis. Incomplete responses were considered as missing values.

4.1 COMPARING AUSTRALIA AND POLAND

This research follows on from previous studies that the authors have performed investigating pharmacist practice in these two countries.[17, 18] Poland and Australia were selected as comparators as there is minimal collaboration between countries that practice under a more traditional scope of practice, such as those in Eastern Europe, and those that provide a more progressive and modern form of practice, such as the USA, and Australia. A global perspective is important in order to facilitate the adoption of coherent policies and establishing best practices.[19] A comparison between Australia and Poland was thought to be useful in providing a new and unique perspective on pharmacist practice in NICUs.[18] It is important to note that due to the highly

specialized nature of the NICU, this study was intended to provide a preliminary understanding of the pharmacy practice background in each country.

4.2 PARTICIPANTS

According to published literature and the structure of the healthcare system in Poland, it is apparent that clinical pharmacy practice is less developed and as such all hospital pharmacists and directors of pharmacy at hospitals containing a NICU were invited to complete the survey.[14] All Australian pharmacists working in NICUs, as well as directors of pharmacy of hospitals that contained a NICU, were eligible to participate in the study, regardless of work status (i.e. full-time/part-time). Participants were contacted through the Paedpharm online pharmacists group and through publicly available registers in Poland and Australia i.e. Polish Register of Facilities delivering Medical Activities (Rejestr Podmiotów Wykonujących Działalność Leczniczą – RPWDL), and the Australian and New Zealand Neonatal Network (ANZNN) that list hospitals with neonatal intensive care units. Pharmacists were also asked to forward the survey among any interested colleagues and to any relevant networks to expand the sample.

A sample size calculation was performed for survey questions 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. The point estimate of effect was the anticipated response to specific survey questions, based on the results of previous research. [8, 7, 20] The target sample size needed was found to be 64 participants total.

4.3 DATA ANALYSIS

Quantitative data were analyzed via 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: perceptions of the preparedness of pharmacists to provide pharmaceutical care, opinions on the barriers to the provision of pharmaceutical services and changes that are required to improve pharmaceutical care). Statistical significance was accepted at a p value of <0.05.

Qualitative data (i.e., pharmacist responses to open-answer questions) were thematically analyzed. Manual inductive coding was used, i.e. significant statements in participants responses were identified and subsequently categorized into key themes around the study objectives.[21] To ensure correct interpretation and coding of data into emerging themes, three researchers (NK, IP, BB) independently analyzed 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.[22] 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 'AP' for Australian pharmacists and 'PP' for Polish pharmacists.

5. RESULTS

As this is a very narrow area of clinical pharmacy practice, there were limited numbers of possible participants in each country. It is unknown how many pharmacists subscribe to the Paedpharm online pharmacists register, and it is also unknown how many surveys were distributed among colleagues within each hospital. As such, the response rate was calculated with the denominator being the number of surveys sent out electronically by researchers. A total of 55 surveys were sent out to Australian participants, of which 29 responded (response rate = 52.7%) and 40 surveys were sent out to Polish participants, of which 20 responded (response rate = 50%) completed the survey (Table 1).

The majority of participants in each country were female (75.9% in Australia and 85% in Poland). Most Polish pharmacists (65%) identified that they were employed as general hospital pharmacists versus 48.3% of Australian participants who identified themselves as NICU pharmacists.

5.1 PERCEIVED LEVELS OF COMPETENCY TO PERFORM PHARMACEUTICAL CARE SERVICES

Participants were asked to provide their opinions on their perceived preparedness in providing pharmaceutical care services to the NICU. (Table 2) Overall, it is apparent that Australian pharmacists felt more competent in the provision of clinical and educational roles than Polish participants. In 14/15 clinical roles listed, more than 70% of Australian participants felt that pharmacists had a 'good' level of preparation to provide services to the NICU, including medication chart reviews (93.1%), performing pharmaceutical interventions (96.6%), and collaborating with medical and nursing staff (93.1%). In comparison, most Polish pharmacists identified a 'poor' level of preparedness to deliver 10/15 clinical services including participation in ward rounds (85%, $p < 0.001$), evaluating patients' laboratory test results (90%, $p < 0.001$), and recommending medications

and contributing to the pharmacotherapy decision making process (65%, p < 0.001). Interestingly, Polish pharmacists felt well prepared to provide one clinical role – monitoring total parenteral nutrition (90%). Overall, Polish pharmacists felt most confident in their roles relating to the provision of medicines. All (100%) of participants agreed that they had a 'good' level of preparation in the dispensing and extemporaneous compounding of medicines for this ward.

When considering administrative roles, a significantly higher proportion of Australian pharmacists agreed that they were competent in the provision of two administrative services: conducting quality assurance measures (Aus = 72.4%, Pol = 30%, p = 0.001) and creating medication policies and guidelines for the NICU (Aus = 86.2%, Pol = 30%, p < 0.001) compared to Polish participants. Furthermore, a significantly higher proportion of Australian pharmacists in comparison to Polish pharmacists also felt adequately prepared in counseling parents of patients (Aus = 89.7%, Pol = 5%, p < 0.001) being a source of medication information for medical and nursing staff on the NICU (Aus = 89.7%, Pol = 45%, p = 0.001), and also in providing training on topics related to neonatal pharmacotherapy (Aus = 79.3%, Pol = 5%, p < 0.001).

5.2 CURRENT BARRIERS

Significant differences were identified when considering pharmacist perceptions towards barriers to pharmacist practice in the NICU (Table 3). More than 80% of Polish participants agreed to 10/16 barriers items. In comparison, Australian participants had a low perception of barriers, with most responses remaining lower than 45%. The barriers most commonly referred to by Polish pharmacists related to a lack of legislation regulating pharmacist practice on the NICU (Aus = 34.5%, Pol = 90%, p < 0.001), lack of an apparent need for a pharmacist to be present on this ward (Aus = 17.2%, Pol = 85%, p < 0.001) and the ignorance of medical and nursing staff towards pharmacist competencies and skills (Aus = 34.5%, Pol = 85%, p < 0.001). Participants in their qualitative responses also expressed these issues, where they referred to the lack of guidelines or policies, from both a local and national level, to guide their practice. They emphasized that there is no legislation that specifies what pharmaceutical care services should be provided directly on the ward.

> '*Lack of procedures*.' **PP11**

> '*It is not legally regulated, it does not exist in hospital practice*.' **PP15**

Furthermore, they noted that there was reluctance on the part of doctors to accept pharmacists as partners in the medication management process.

> *'…in our country, however, the division of roles between staff is roles is traditional/classic*.' **PP2**

> '*Pharmacists are not treated as equal co-workers*.' **PP12**

> '*Doctors do not know and do not understand the potential of a pharmacist, and as such they are not willing to co-operate… there is a lack of consent from the doctors. In Poland, clinical pharmacists are rare*.' **PP15**

Alternatively, Australian pharmacists highlighted that the greatest barriers apparent in their healthcare system included a shortage of pharmacy staff (Aus = 72.4%, Pol = 100%, p = 0.010), lack of pharmacist time to deliver the necessary services to the NICU (Aus = 65.5%, Pol = 80%, p = 0.270) and a lack of pharmacists with the skills and knowledge necessary to be able to practice in the NICU (Aus = 62.1%, Pol = 90%, p = 0.030).

> '*On the days there is pharmacy cover in NICU there is good pharmaceutical practice but there is often a staff deficit not allowing full coverage of the ward*.' **AP24**

> *Not enough time to dedicate to unit as role is shared with other ward responsibilities, outpatient clinics and dispensary duties*.' **AP15**

> '*Bed to pharmacist ratio could be better to allow more detailed input into each patient's care*.' **AP18**

Interestingly, these barriers were also highly perceived by Polish participants, in particular pharmacist shortages in the hospital. Due to limited funding, staffing deficiencies were identified key reasons for the lack of clinical pharmacy practice in the NICU. As a result, pharmacists are overloaded with dispensary-based duties and are unable to provide clinical activities on the ward.

> '*At the hospital, there are only a few pharmacists employed, about a dozen or so, to cover about 1200 beds, it is physically unfeasible*.' **PP18**

Participants also felt that their formal training (pharmacy degree) did not adequately prepare them for clinical practice, and therefore lacked confidence in making recommendations to the NICU team.

> *'lack of pharmacist experience in this area….*' **PP15**

> *'… neither the university studies nor the post-graduate specialization courses prepare pharmacists for such a role. We do not have enough knowledge to be able to advise doctors*.' **PP18**

5.3 CHANGES NEEDED TO IMPROVE SERVICES

A significantly higher proportion of Polish pharmacists agreed that changes were needed to improve pharmacist practice in the NICU (Aus = 53.6%, Pol = 90%, p = 0.007) (Table 4). Indeed, all (100%) of Polish participants agreed to all 11 of the proposed changes listed. In their qualitative responses, Polish pharmacists highlighted that changes were necessary to improve patient safety and the quality of care. Furthermore, they acknowledged that the current healthcare system did not apply pharmacists and their skills to their maximum potential.

> '*Changes to the role of the pharmacist in the NICU would increase the safety of pharmacotherapy, which would have a positive influence on pharmacoeconomy and improve a patients level of comfort*.' **PP1**

> '*The knowledge of pharmacists is not fully utilized and therefore underestimated*.' **PP12**

> *'The pharmacist would introduce an alternative point of view and bring knowledge that would increase the safety of treatment (e.g. with interactions, too high doses), and improve economics, leading to better medicines management*.' **PP16**

In comparison, Australian pharmacists most commonly felt that changes needed to be directed at increasing the staffing of the pharmacy department to allow more pharmacists to be introduced to the NICU (91.3%), providing education and training opportunities for pharmacists in the fields of neonatology and clinical pharmacy (86.4%), and increasing pharmacists own motivation towards practice on this ward (86.4%).

> **'***I would like to see greater involvement of pharmacists in activities that directly improve clinical outcomes for patients. This includes a variety of clinical and non-clinical activities, including research*.' **AP4**

> **'***All NICUs should have their own dedicated NICU clinical pharmacists*.' **AP5**

6. DISCUSSION

The findings of this study highlight that there are significant differences in the perceptions of Polish and Australian pharmacists towards practice in the NICU. To our knowledge, this is the first study to

compare pharmacist opinions towards pharmaceutical care services provided to NICUs in two countries. It is important to note, that this research is exploratory in nature and was intended to provide context and understanding behind the differences in practice seen in NICUs in Australia and Poland. Future research is aimed at further qualitative studies that will explore not only pharmacist perceptions towards practice, but also other healthcare professionals in this setting i.e. doctors and nurses, to ensure a fuller insight into practice.

One concept arising from the data that warrants discussion is the finding that pharmacists in Poland and Australia held significantly different perceptions of their own competencies towards delivering pharmaceutical care to the NICU. Polish pharmacists felt the most confident in delivering traditional pharmacist activities, including dispensing and extemporaneous compounding. This is not unexpected, as according to other published literature, pharmacist practice in this country is often limited to dispensary-based activities.[7] However, their perceived competence in providing clinical and educational-based roles was lower. In comparison, Australian participants were particularly confident in the clinical and educational areas of practice, signifying more experience and familiarity with these services. This is also reflected in other literature, highlighting the integrated role of the Australian pharmacist in pharmacotherapy-related decision-making in hospital wards.[23, 24] It is apparent that Polish pharmacists are unaccustomed to the concept of the pharmacist as a provider of direct patient care, and identify more with the distributive model of practice. Alternatively, Australian pharmacists associate more with the pharmaceutical care practice model, whereby pharmacists assume responsibility for patient care and are members of the inter-disciplinary treating team.[25]

Furthermore, Polish pharmacists perceived practice barriers at a higher rate than Australian participants, and were also more inclined to want changes to pharmacist roles to be made. In particular, Polish participants commonly highlighted throughout the survey, the apparent lack of support from doctors and nurses for the pharmacists role in the NICU. The absence of interdisciplinary collaboration with the hospital pharmacist has been previously discussed by Piecuch et.al. who highlighted that the hierarchical structure of the healthcare system in Poland is not encouraging of collaborative practice. Rather, the doctor is seen to dominate treatment and pharmacists are not involved in the pharmacotherapy process, aside from dispensing and preparing medicines. In comparison, Australian participants expressed that they felt valued by the medical and nursing staff and instead voiced concerns with the staffing of the NICU and in ensuring that the full-range of services are provided. As such the focus of pharmacist concerns are different for each

country. This also further highlights the need for insights from other stakeholders/members of the NICU team.

Whilst these differences in perceptions may be attributed to contrasting healthcare systems, legislation, practice culture and educational systems, these findings are important to consider as they provide an insight into the reality of pharmacist practice in NICUs in Poland and Australia. The barriers identified and the perceptions of pharmacist competence highlight the gap in practice observed between Poland and Australia. These differences in perceptions raise the question – what impact are these different levels of service having on the outcomes of such a vulnerable patient group? The World Health Organization (WHO) and International Pharmaceutical Federation (FIP) both call for practice equality and the standardization of practice on a global scale.[26, 27] Efforts by the FIP have brought about the Basel Statements, which have sought to standardize hospital pharmacy practice on an international scale from a general perspective.[28] However, there is a need for the development of such standards for sub-specialties in pharmacy, where patients, such as those in the NICU, require unique considerations from a pharmacotherapy perspective. The Society of Hospital Pharmacists Australia (SHPA) has recognized this need and introduced specialty support groups, ranging from cardiology, infectious diseases and emergency medicine to rural and remote practice, to encourage the exchange of information and the ability for pharmacists to develop their specialty practice.[29] These practice groups have the potential to then define criteria outlining essential pharmacist roles for their respective sub-specialties.

These findings have implications for the development of standardized pharmacist practice policies for the NICU and bridging the practice gap between countries. Neonatal patients are a unique population that have specific pharmacotherapy needs and requirements that differ from other patient groups. As such, pharmacist practice provided to this ward should be aimed at a consistent, high-quality and homogenous level of care to allow equal opportunity for these high-risk and vulnerable patients to achieve the best possible outcomes. Future research should be directed at investigating the barriers contributing to practice differences, and identifying facilitators that would assist in bridging the gap in NICU pharmacist practice within and between countries.

6.1 LIMITATIONS

Whilst this study is the first to report on pharmacist perceptions towards their preparation for practice in Australian and Polish NICUs, the findings are subject to some limitations. The major limitation is that the assessment of practice preparedness and competence is highly prone to self-report bias. Due to the traditional pharmacy practice structure in Poland, there was a difference in the number of pharmacists who considered their role as a NICU pharmacist in comparison to Australian participants. Pharmacists subjectively self-assessed their capabilities in providing roles in the four listed domains. Therefore the findings may be overestimated due to the potential for social desirability bias. Furthermore, there is potential for the good/average/poor categories to have been interpreted differently by individual participants. Likewise, it is possible that participants had varying interpretations when considering the pharmacist practice roles, i.e. TPN monitoring. Therefore, results should be interpreted with caution.

Due to the low response rate and the small number of participants, the survey data may not be representative of all pharmacists in Poland and Australia and may not be generalizable across settings in each country.

The sample size was not reached, however this can be attributed to the narrow scope and highly specialized nature of practice and the subsequent limited possible number of participants that could be included in this study. As such, further research is needed to verify these findings.

7. CONCLUSION

Overall, it is apparent that Polish pharmacists are more confident in providing traditional pharmacy services to the NICU. In comparison Australian pharmacists expressed they were competent in providing more advanced roles, including clinical and educational services. Statistically significant differences were also perceived when considering the barriers currently limiting practice in the NICU, with Polish pharmacists facing reluctance from doctors and nurses. Future efforts should focus on developing pharmacist practice guidelines and practice standards for the sub-specialty of neonatology to promote the standardization of practice.

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TABLE 1 – Participant Characteristics

	AUSTRALIA (%)	POLAND (%)
NUMBER OF RESPONDENTS	29	20
GENDER OF RESPONDENTS		
Female	22 (75.9)	17 (85)
QUALIFICATIONS		
Bachelors Degree	8 (27.6)	0
Masters Degree	12 (41.4)	19 (95)
PhD Degree	1 (3.4)	0
Qualifications held by participants other than those specified in the survey	8 (27.6)	1 (5)
- Post-Graduate Certificate/Diploma	8	0
- Clinical Pharmacy Specialization	0	1
SPECIALISED QUALIFICATIONS		
Yes	2 (6.9)	0
Postgraduate Certificate – (Neonatal And Paediatric Specific)		
No	27 (93.1)	20 (100)
POSITION IN THE HOSPITAL		
Neonatal Pharmacist	14 (48.3)	0
Director Of Pharmacy	5 (17.2)	5 (25)
Pharmacist Working In Main Hospital Pharmacy	3 (10.3)	13 (65)
Other	7 (24.1)	2 (10)
Hospital Pharmacy Co-ordinator		1 (50)
Deputy Director	1 (14.3)	
Clinical Pharmacist	2 (28.6)	1 (50)
Medicines Information Pharmacist	2 (28.6)	
Specialist Women, Youth And Children Pharmacist	1 (14.3)	
Aseptic CIVAS Pharmacist	1 (14.3)	
EXPERIENCE		
< 1 Year	6 (20.7)	2 (10)
Between 1-5 Years	13 (44.8)	11 (55)
Between 6-10 Years	3 (10.3)	1 (5)
> 10 Years	7 (24.1)	6 (30)
NUMBER OF BEDS IN NICU (RANGE)	8 - 110	5 – 28

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TABLE 2 – Pharmacist Perceived Competencies towards Pharmacist Roles in the NICU

ADMINISTRATIVE ROLES							
	AUSTRALIA (%) N = 29			**POLAND (%) N = 20**			**P-value (Comparison of proportions between Australian and Polish participants)**
	GOOD	AVERAGE	POOR	GOOD	AVERAGE	POOR	
Development/implementation of a drug formulary service	22 (75.9)	7 (24.1)	0	15 (75)	5 (25)	0	0.945
Attendance at non-clinical meetings i.e. Drug and Therapeutics Committee	21 (72.4)	6 (20.7)	2 (6.9)	10 (50)	8 (40)	2 (10)	0.269
Conducting quality assurance measures i.e. drug usage evaluations, workload documentation, auditing	21 (72.4)	7 (24.1)	1 (3.4)	6 (30)	5 (25)	9 (45)	0.001
Management of the drug budget	14 (48.3)	9 (31)	6 (20.7)	9 (45)	8 (40)	3 (15)	0.775
Evaluation, selection and purchasing of pharmaceuticals for the unit	19 (65.5)	8 (27.6)	2 (6.9)	17 (85)	1 (5)	2 (10)	0.133
Development of drug policies/protocols/guidelines for the NICU	25 (86.2)	4 (13.8)	0	6 (30)	4 (20)	10 (50)	<0.001

CLINICAL ROLES							
	AUSTRALIA (%) N = 29			**POLAND (%) N = 20**			**P-value (Comparison of proportions between Australian and Polish participants)**
	GOOD	AVERAGE	POOR	GOOD	AVERAGE	POOR	
Patient medication chart review	27 (93.1)	1 (3.4)	1 (3.4)	7 (35)	2 (10)	11 (55)	<0.001
Participation in medical ward rounds	21 (72.4)	5 (17.2)	3 (10.3)	2 (10)	1 (5)	17 (85)	<0.001
Monitoring the efficacy of pharmacotherapy in patients	26 (89.7)	2 (6.9)	1 (3.4)	1 (5)	5 (25)	14 (70)	<0.001
Documenting/monitoring Adverse Drug Events/Reactions	24 (82.8)	4 (13.8)	1 (3.4)	5 (25)	12 (60)	3 (15)	<0.001
Documenting Medication Errors	25 (86.2)	3 (10.3)	1 (3.4)	4 (20)	6 (30)	10 (50)	<0.001
Evaluating patients clinical laboratory tests	22 (75.9)	6 (20.7)	1 (3.4)	1 (5)	1 (5)	18 (90)	<0.001
Therapeutic Drug Monitoring (TDM)	24 (82.8)	4 (13.8)	1 (3.4)	3 (15)	5 (25)	12 (60)	<0.001

Immunizations	17 (58.6)	6 (20.7)	6 (20.7)	0	3 (15)	17 (85)	<0.001
Monitoring Total Parenteral Nutrition (TPN)	21 (72.4)	7 (24.1)	1 (3.4)	18 (90)	2 (10)	0	0.296
Participation in clinical meetings	23 (79.3)	5 (17.2)	1 (3.4)	1 (5)	7 (35)	12 (60)	<0.001
Calculating and recommending doses and dosing schedules for specific patients	26 (89.7)	2 (6.9)	1 (3.4)	5 (25)	8 (40)	7 (35)	<0.001
Assisting doctors in prescribing off-label/unlicensed medicines	27 (93.1)	2 (6.9)	0	5 (25)	6 (30)	9 (45)	<0.001
Identifying and performing interventions for individual patients to prevent or resolve drug therapy problems i.e. interactions, incompatibilities, allergies etc.	28 (96.6)	0	1 (3.4)	4 (20)	8 (40)	8 (40)	<0.001
Recommending drugs and contributing to the pharmacotherapy decision making process for specific patients	24 (82.8)	4 (13.8)	1 (3.4)	1 (5)	6 (30)	13 (65)	<0.001
Collaborating and discussing specific patients with doctors and nurses	27 (93.1)	1 (3.4)	1 (3.4)	2 (10)	8 (40)	10 (50)	<0.001

EDUCATION/COMMUNICATION/RESEARCH							
	AUSTRALIA (%) N = 29			**POLAND (%) N = 20**			**P-value (Comparison of proportions between Australian and Polish participants)**
	GOOD	AVERAGE	POOR	GOOD	AVERAGE	POOR	
Providing training/in-services for other health professionals on NICU related topics and drug related problems	23 (79.3)	6 (20.7)	0	1 (5)	4 (20)	15 (75)	<0.001
Contributing to and/or attending NICU related conferences	17 (58.6)	9 (31)	3 (10.3)	6 (30)	6 (30)	8 (40)	0.035
Involved in clinical trials	18 (62.1)	7 (24.1)	4 (13.8)	13 (65)	2 (10)	5 (25)	0.348
Involved in research related to neonatal pharmacotherapy	14 (48.3)	8 (27.6)	7 (24.1)	5 (25)	3 (15)	12 (60)	0.040
Source of drug information - responding to information requests from health professionals on the ward	26 (89.7)	3 (10.3)	0	9 (45)	5 (25)	6 (30)	0.001
Counseling parents/carers of neonatal patients	26 (89.7)	1 (3.4)	2 (6.9)	1 (5)	3 (15)	16 (80)	<0.001

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PROVISION OF MEDICINES							
	AUSTRALIA (%) N = 29			**POLAND (%) N = 20**			**P-value (Comparison of proportions between Australian and Polish participants)**
	GOOD	AVERAGE	POOR	GOOD	AVERAGE	POOR	
Dispensing prescriptions	25 (86.2)	4 (13.8)	0	20 (100)	0	0	0.083
Extemporaneous compounding of formulations for the NICU	23 (79.3)	4 (13.8)	2 (6.9)	20 (100)	0	0	0.095
Stocking the ward with essential medicines/house-keeping activities i.e. checking expiry dates, fridge temperatures etc.	21 (72.4)	6 (20.7)	2 (6.9)	18 (90)	2 (10)	0	0.263

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TABLE 3 – Barriers to Pharmacist Practice in the NICU

Barriers	AUSTRALIA N = 29 (%)	POLAND N = 20 (%)	P-value (Comparison of proportions between Australian and Polish participants)
Lack of policy/legislation for pharmacists to be regulated to perform services in the NICU	10 (34.5%)	18 (90%)	<0.001
Lack of pharmacist time to perform duties	19 (65.5%)	16 (80%)	0.270
Lack of pharmacy staff i.e. not enough pharmacy technicians to cover dispensing	21 (72.4%)	20 (100%)	0.010
There is no need for pharmacist to be on NICU	5 (17.2%)	17 (85%)	<0.001
Doctors/nurses are unaware of what services pharmacists can provide in the NICU	10 (34.5%)	17 (85%)	<0.001
Doctor/nurse reluctance or resistance to pharmacist role in the NICU	6 (20.7%)	15 (75%)	0.001
Lack of financial compensation/remuneration for pharmacists to perform activities on the NICU	10 (34.5%)	17 (85%)	<0.001
Pharmacist is physically removed from the NICU	6 (20.7%)	6 (30%)	0.456
A lack of clinical pharmacy training/knowledge opportunities related to neonatal practice	14 (48.3%)	16 (80%)	0.025
Pharmacists are not interested in performing clinical pharmacy services in the NICU	2 (6.9%)	4 (21.1%) N = 19	0.147
Unwilling to change current practice	9 (31%)	4 (20%)	0.390
Lack of communication with pharmacists	5 (17.2%)	10 (52.6%) N = 19	0.010
Lack of support from administration/hospital	13 (44.8%)	18 (90%)	0.001
Lack of confidence in own ability	9 (31)	11 (55)	0.093
Lack of pharmacists with the necessary skills and training	18 (62.1%)	18 (90%)	0.030
Lack of recognition of the contribution of the pharmacist to NICU care	12 (41.4%)	4 (20%)	0.117

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TABLE 4 – Changes needed to current practice

Is there a need to change pharmacist roles in the NICU?	**AUSTRALIA N = 28**	**POLAND N = 20**	**P-value (Comparison of proportions between Australian and Polish participants)**
YES	15 (53.6)	18 (90)	0.007
TYPES OF CHANGES NEEDED	**AUSTRALIA N = 22 (%)**	**POLAND N = 20 (%)**	**P-value (Comparison of proportions between Australian and Polish participants)**
Increased support from the hospital administration i.e. from hospital directors in creating and funding clinical pharmacist positions.	17 (77.3%)	20 (100%)	0.023
Increased levels of staffing in the pharmacy	21 (91.3%) N = 23	20 (100%)	0.177
Increased levels of communication with pharmacists	14 (63.6%)	20 (100%)	0.003
Increasing the level of support from doctors and nurses for the role of the pharmacist in the NICU	14 (63.6%)	20 (100%)	0.003
Increasing educational opportunities for pharmacists related specifically to neonatal/paediatric pharmacotherapy	19 (86.4%)	20 (100%)	0.087
Providing more training for pharmacists on clinical pharmacy services	19 (86.4%)	20 (100%)	0.087
Increasing nurse/doctor awareness of the roles and services that pharmacists can provide in the NICU	15 (68.2%)	20 (100%)	0.006
Increasing pharmacist salaries	9 (40.9%)	20 (100%)	<0.001
Creating specific NICU clinical pharmacist positions in the hospital i.e. organizational changes	17 (77.3%)	20 (100%)	0.023
Legislative changes regulating clinical pharmacy practice in the NICU	9 (40.9%)	20 (100%)	<0.001
Pharmacists own motivation and interest towards improving upon the current level of practice	19 (86.4%)	20 (100%)	0.087