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# Pharmaceutical Care in the Neonatal Intensive Care Unit: Perspectives of Polish Medical and Pharmacy Students

## Abstract

**Introduction:** The concepts of ward-based pharmaceutical care as well as collaborative practice are still relatively novel in Poland, particularly in specialty areas of practice such as the neonatal intensive care unit (NICU). The purpose of this study was to identify the opinions and perceptions of Polish medical and pharmacy university students toward the provision of pharmaceutical care services in the NICU as well as pharmacist integration into the ward-based multidisciplinary NICU treating team.

**Methods:** A cross-sectional, mixed-method survey was distributed among medical and pharmacy university students at a large Polish medical university.

**Results:** A total of 147 students completed the survey, comprising 74 pharmacy students and 73 medical students. Overall, there are statistically significant differences between the perspectives of medical and pharmacy students towards the provision of pharmaceutical care services in the NICU. For 11 out of 15 proposed clinical roles listed, a significantly lower proportion of medical students (M) agreed that pharmacists should perform these in the NICU, compared to pharmacy students (P). These roles included: participation in ward rounds (P = 82.4%, M = 38.4%,  $p < 0.001$ ), therapeutic drug monitoring (P = 98.6%, M = 78.1%,  $p < 0.001$ ) and monitoring total parenteral nutrition (P = 87.8%, M = 37%,  $p < 0.001$ ).

**Conclusions:** Further investigation is needed to develop educational strategies directed at clinical, patient-centered roles, particularly for specialty areas of practice such as the NICU, that have the potential to facilitate the provision of a more advanced and comprehensive level of pharmaceutical care.

**Keywords:** Student perspectives; Interprofessional education; NICU/neonates.

**Conflict of interest:** The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the article.

**Disclosure(s):** None to declare.

## Introduction

Hepler and Strand defined pharmaceutical care as the “responsible provision of drug therapy for the purpose of achieving definite outcomes that improve a patient’s quality of life”<sup>1</sup>. Since its introduction, this concept has been widely adopted worldwide and is now regarded as the foundation of modern pharmacy practice. Pharmaceutical care is promoted by organizations such as the World Health Organization (WHO) and the International Pharmaceutical Federation, which encourage pharmacists to be highly and purposefully involved in the medication management process<sup>2,3</sup>. The WHO, in particular, highlights that pharmacists should be able to access patient medical records, perform interventions to address drug-related problems, collaborate with medical and nursing staff, and monitor therapeutic outcomes in patients<sup>3</sup>. The uptake of patient-centered pharmaceutical care has been particularly strong in countries such as Australia, Canada, UK and USA<sup>4-8</sup>. However, within Europe, in particular Eastern European countries such as Poland, the implementation of pharmaceutical care is not yet fully realized<sup>9</sup>.

Pharmaceutical care was introduced into Polish pharmaceutical legislation as a type of service in 2008, 19 years after the concept was originally published by Hepler and Strand in 1989<sup>1,9,10</sup>. It is defined within the legislation as a documented process whereby pharmacists collaborate with the patient, doctor, and, wherever necessary, with other medical professionals to optimize pharmacotherapy for the purposes of achieving specific outcomes that improve a patient’s quality of life<sup>10</sup>. However, since its introduction very little has changed in terms of service provision<sup>9</sup>. Currently, pharmacy-based services in Poland are primarily limited to the dispensary. Pawłowska and Kocić reported that pharmacists mainly spent their time on dispensing medications and compounding medicinal products, as well as related administrative tasks<sup>11</sup>. Pharmacists have little to no direct contact with patients nor do they have a significant role in pharmacotherapeutic decision-making<sup>11</sup>. This is due to a multitude of reasons, but predominantly attributed to a lack of legislation outlining the roles and responsibilities of pharmacists, the lack of pharmacist-physician collaboration, as well as the inability for pharmacists to access confidential patient information within medical records<sup>9,12,13</sup>. Furthermore, there are no specific educational programs or professional bodies to co-ordinate and support the provision of pharmaceutical care in either the community or hospital setting<sup>12</sup>.

Ward-based, clinically driven pharmaceutical care services are relatively abstract concepts within hospital settings in Poland and are not widely implemented.<sup>14</sup> A national study in 2016 found that only 15.2% of hospital pharmacists performed pharmaceutical care services on hospital wards<sup>14</sup>. Rather, the role of the pharmacist is limited to the dispensing of medicines within a traditional distribution-based system, with no legal or professional obligations to implement any form of clinical practice<sup>15</sup>. Additionally, there is minimal collaboration and pharmacist interaction with the multidisciplinary team. The pharmacist is often excluded from pharmacotherapy-related decision-making and consultations are restricted to medication procurement issues or advice relating to drug interactions or adverse events<sup>14</sup>. With pharmaceutical care advancing in other countries around the world, there is debate in Poland surrounding the capacity of pharmacists to undertake a more clinically-oriented, collaborative role in hospital therapy<sup>13</sup>. These two concepts are of particular importance when considering specialties of care, such as the neonatal intensive care unit (NICU).

Pharmacotherapy is a highly relied upon intervention in the care of neonatal patients, and current literature emphasizes the importance of the pharmacist serving as a core member of the multi-disciplinary treating team<sup>16</sup>. Interventions by clinical pharmacists have been shown to help rationalize the use of medicines and decrease medication error rates in the NICU setting<sup>16-19</sup>. Thus, pharmacists are well-placed within the NICU multi-disciplinary team alongside doctors, nurses, dieticians and physiotherapists, in achieving quality neonatal patient outcomes<sup>20</sup>. However, a study exploring pharmacy services provided to NICUs in Australia and Poland highlighted significant practice gaps between countries with highly developed clinical pharmacy practices and those in which practice is less progressive<sup>21</sup>. Only 18.2% of Polish pharmacists surveyed reported that they collaborated with medical and nursing staff on the NICU, in comparison with 96.4% of Australian pharmacists<sup>21</sup>. Indeed, all of the Polish pharmacists surveyed did not consider themselves members of the NICU team<sup>21</sup>. Furthermore, a higher proportion of Australian pharmacists was found to perform clinical services than their Polish counterparts<sup>21</sup>. Current efforts by professional bodies such as the International Pharmaceutical Federation (FIP) and the European Association of Hospital Pharmacists (EAHP), are directed at the development of standardized guidelines promoting the adoption of consistent and coherent pharmaceutical care services between settings both nationally and internationally<sup>2,22</sup>. As such,

the significant practice gaps evidenced between these two industrialized countries are a concern. Thus, there is a need from the Polish perspective to identify and implement strategies to help narrow the practice gap.

The implementation of changes into tertiary schooling programs has been credited as one of the most effective methods of instigating change in healthcare systems<sup>3,23</sup>. Education of medical and pharmacy students has been highlighted as having a crucial role in preparing future practitioners to appropriately respond to and facilitate the implementation of pharmaceutical care<sup>24</sup>. Furthermore, the World Health Organization (WHO) highlights the necessity of inter-professional education for both under-graduate and post-graduate students in enabling more effective multi-disciplinary teamwork and collaboration as future health practitioners<sup>25,26</sup>. However, the current Polish tertiary healthcare schooling system is seen to focus on a uni-professional, rather than an inter-professional form of education and does not prepare health graduates for collaborative practice<sup>27-29</sup>. Cerbin-Koczorowska et.al. found disparities between student groups when exploring their attitudes toward establishing co-operative relationships<sup>26</sup>. Medical students at a Polish medical university did not consider collaboration with pharmacists as necessary during therapeutic decision-making, whereas pharmacy students were open to pharmacist-physician co-operation<sup>26</sup>. Furthermore, it is reported that pharmacy students' attitudes towards engagement in clinical services were similar to those seen in other international studies; that is, they were interested in developing the pharmacist's role in patient care, beyond traditional services such as dispensing and stock control<sup>26,30-33</sup>. However, no studies have explored student perceptions towards pharmaceutical care practices specifically in high-risk wards, or in specialties of practice such as the NICU.

Given the significant pharmacy practice gaps evidenced in the NICU between Poland and western countries, such as Australia, there is a need to canvass the perspectives of medical and pharmacy students to gain an understanding of the direction of future pharmacy practice in specialties of care. It is important to investigate two concepts – attitudes towards pharmacist involvement in clinical roles in the NICU, as well as towards the integration of the pharmacist into the NICU multi-disciplinary team. Given that pharmacists in Poland have the ability to obtain 12 post-graduate specializations in pharmacy practice, including clinical pharmacy, it is important to explore whether the student expectations of their future practice align with the current healthcare

system seen in Poland, or whether they are more in line with the advanced form of collaborative, ward-based pharmaceutical care practiced in other nations.

### **Aim of study**

The purpose of this study was to identify the opinions and perspectives of Polish medical and pharmacy university students toward the provision of pharmaceutical care services in the NICU.

The specific objectives included:

- identifying student opinions, as future health professionals, towards which pharmaceutical care roles are perceived as being important for the NICU
- whether students considered clinical pharmacists to be an important part of the inter-disciplinary therapeutic team
- identifying student perceptions towards the integration of the pharmacist onto the NICU ward

### **Methods**

A cross-sectional, paper-based survey was distributed among university students undertaking medical and pharmacy degrees at a Polish medical university between January and February 2017.

#### **Ethical considerations**

Ethics approval was sought and obtained from the respective human research ethics committees at the University of Technology (UTS), Australia (HREC REF NO. ETH16-1033) and the Medical University of Gdańsk (GUMed), Poland (HREC REF NO. NKBBN/424/2016). Ethics approval was obtained from GUMed in Poland, where the research was carried out in a local medical university. Although data was not collected in Australia, ethics approval was also obtained from UTS, as two of the researchers were based in Australia.

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

## Participants

The study population was made up of university students undertaking medical and pharmacy degrees in their final three years of study at a Polish medical university. Medical degrees at this university take 6 years of undergraduate study, and pharmacy degrees 5.5 years. This study sought to identify pharmacy and medical students' perceptions towards pharmacy services in the NICU, based on their theoretical knowledge of this patient population as well as of current hospital pharmacy practice in Poland. Medical students are introduced to pediatric pharmacology in the third year of their studies, whilst pharmacy students are introduced to pediatric physiology and pharmacology in their fourth year of study<sup>34,35</sup>. Whilst students in this study did not have practical experience with the NICU, they held an overall theoretical knowledge relating to pharmacology and pharmacotherapies used in the pediatric population, and are also familiar with the general pharmaceutical care system functioning in hospitals in Poland.

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<sup>14,36,37</sup>. The target sample size needed was found to be 38 participants total.

## Survey

A self-administered, anonymous, paper-based questionnaire was distributed by one researcher (NK) to students during two lecture sessions as well as during an academic presentation session. Due to the exploratory nature of this research, the research instrument adopted a mixed-methods approach, whereby both quantitative and qualitative data was collected. This method was utilized in order to enable a greater understanding of student perspectives on current and future practice. The questionnaire was made up of 12 questions and the majority of questions were fixed 'agree/disagree' answers, supplemented by 2 open-ended questions:

- Describe whether the current pharmaceutical care system in Poland is fulfilling the pharmacotherapeutic needs of NICU patients
- Describe the benefits or disadvantages to having a pharmacist practicing on the NICU

The close-ended questions in the survey were split into four distinct sections that gathered data relating to: participant characteristics (e.g. degree, year of study), attitudes towards pharmaceutical care in the NICU, opinions on the integration of the pharmacist into the therapeutic team and onto the NICU as well as students' preferences regarding which roles should be performed by pharmacists in the NICU (within four key categories: administrative, clinical, education, provision). The survey questions were adapted from a previously validated survey instrument used in a study by El Hajj et.al. where pharmacy student attitudes towards pharmaceutical care in Qatar were explored<sup>33</sup>. The survey item used was based on the validated Pharmaceutical Care Attitudes Survey (PCAS) tool. Slight modifications were made to these survey questions to ensure relevance to the NICU setting. Our researcher-modified survey was not further tested for reliability or validity.

The surveys were administered in Polish, and the results translated into English via a three-tiered process. All survey results were initially translated to English by one researcher (NK). These translations were then revised and confirmed by two researchers independently (BB, IP) to determine whether the language was correct.

All questions were pre-coded for data entry. The survey was pre-tested for content, design and readability on a small group of Polish pharmacists and was modified where deemed necessary. Within this study, no further validation of the questionnaire was undertaken beyond checking of face validity and pilot testing among the researchers.

All surveys whose close-ended questions were 100% completed by participants were included for analysis.

#### Data analysis

Quantitative data were analyzed using descriptive statistics in the Statistical Package for the Social Sciences (SPSS) Version 22. The Chi-square test was applied to examine the association between independent variables (e.g., degree type - pharmacy and medicine) and dependent variables (e.g., proportion of agree/disagree responses to questions relating to: expectations of pharmacist roles that should be performed in the NICU, and inter-professional integration into the therapeutic NICU team). Statistical significance was accepted at a  $p$  value of  $<0.05$ .

Qualitative data (i.e., the students responses to 2 open-answer questions in the survey) were thematically analyzed via manual inductive coding<sup>38,39</sup>. For reliability, three researchers (NK, BB, IP) independently analyzed the transcripts. A pragmatic approach was used in the analysis of data, in line with that used in other survey studies<sup>40-42</sup> and involved: 1) carefully re-reading responses to identify important statements and any patterns; 2) categorizing responses into key themes structured around the research objectives; and 3) iterative comparison and review to elicit non-overlapping themes and sub-themes. Codes were used to identify significant statements in the text<sup>43</sup>. Similar codes were organized into categories, from which themes were derived. A total of 25 codes were initially derived from the data to generate 6 broad categories, which were then combined to 3 themes<sup>40</sup>. Any points of disagreement were discussed and resolved by consensus among the researchers (theme verification)<sup>40,41,44-46</sup>.

Three researchers (NK, BB, IP) independently evaluated the data to ensure the appropriate interpretation of data into descriptive themes in line with the existing questions and study objectives.

The qualitative responses of participants are represented by the code 'M' for medical students and 'P' for pharmacy students.

## Results

Overall, 100 surveys were sent out to each group of medical students and pharmacy students. A total of 147 students completed the survey comprising 73 medical students (response rate = 73%) and 74 pharmacy students (response rate = 74%). All of the returned surveys were included in the analysis as they were all fully completed by participants. The majority of students were in their final two years of study, i.e. 5<sup>th</sup> or 6<sup>th</sup> year for medical students, 4<sup>th</sup> or 5<sup>th</sup> year for pharmacy students (Table 1).

### Opinions on the essential roles of a NICU pharmacist

Overall, a high proportion of both medical (M) and pharmacy (P) student groups agreed to wanting pharmacist involvement in the NICU. When presented with pharmacist roles that should be performed in the NICU, respondents recorded similar responses to responsibilities listed within the administrative, educational and medication provision categories (Table 2). All medical

students (100%) and 98.6% of pharmacy students agreed that extemporaneous compounding was expected to be performed by pharmacists in the NICU. Significantly more medical than pharmacy students (95.9% vs. 85.1%) agreed that pharmacists should provide pharmacotherapy-related training and education to health professionals on the NICU ( $p=0.027$ ). However, a higher proportion of pharmacy students compared to medical students agreed that counseling of families/carers of patients should be performed by pharmacists ( $M = 69.9\%$  vs.  $P = 90.5\%$ ,  $p < 0.002$ ).

Statistically significant differences were identified across the majority of clinical roles (11/15) when comparing medical and pharmacy student responses, with all pharmacy students expressing high rates of agreement (13/15 clinical roles  $>80\%$ ) (Figure 1). Clinical roles included: participation in ward rounds ( $M = 38.4\%$ ,  $P = 82.4\%$ ,  $p < 0.001$ ), total parenteral nutrition (TPN) monitoring ( $M = 37.0\%$ ,  $P = 87.8\%$ ,  $p < 0.001$ ), therapeutic drug monitoring (TDM) ( $M = 78.1\%$ ,  $P = 98.6\%$ ,  $p < 0.001$ ), calculating and recommending doses ( $M = 76.7\%$ ,  $P = 100\%$ ,  $p < 0.001$ ), and monitoring the efficacy of pharmacotherapy in patients ( $M = 69.9\%$ ,  $P = 100\%$ ,  $p < 0.001$ ). When considering pharmacist involvement in the evaluation of laboratory results, only a small proportion of medical or pharmacy students agreed that this was expected to be performed, at 16.4% and 37.8% respectively.

#### Integration into the inter-disciplinary therapeutic NICU team

Although the majority of all students agreed overall, significantly more pharmacy students than their medical student counterparts agreed that pharmacists should be consulted as part of the therapeutic NICU team when making medication-related decisions for NICU patients ( $M = 71.2\%$  vs.  $P = 91.9\%$ ,  $p < 0.001$ ). Participants were also questioned whether pharmacists should be directly employed on the NICU; all (100%) pharmacy students agreed that pharmacists should either have a routine or permanent position on the ward, whereas 16.4% of medical students agreed that pharmacists should not have any ward-based positions on the NICU (Table 3). Furthermore, all (100%) pharmacy students agreed that pharmacists should hold direct (face-to-face) consultations with medical staff, whilst 19.7% of medical students agreed that doctor-pharmacist contact should be through telephone or email.

## Themes

Of the 147 students who completed the close-ended questions of the survey, a total of 92 students comprising 39 medical students (response rate = 53.4%) and 53 pharmacy students (response rate = 71.6%) filled in the open-ended questions.

Three key themes were identified within the responses of medical and pharmacy students:

1. Pharmacist's support of the prescribing process
2. Clinical pharmacy practice is not well-developed in Poland

The third theme comprised 4 sub-themes:

3. Issues around adding a clinical pharmacist to the therapeutic team
  - 3.1 Cost implications
  - 3.2 Pharmacists preparation for clinical practice in the NICU
  - 3.3 Acknowledgement of the pharmacist as part of the multi-disciplinary team
  - 3.4 Lack of inter-disciplinary support for the clinical pharmacist

### *Theme 1: pharmacist's support of the prescribing process*

The majority of both pharmacy and medical students were supportive of the role of the pharmacist in providing assistance during pharmacotherapy-related decision-making on the NICU. In particular, both groups valued the 'consultant' role of the pharmacist, and identified the pharmacist as a medication expert, contributing to a more efficient and safe prescribing process.

*'Up-to-date knowledge of medicines is passed onto doctors to keep them informed and advice is provided about drug interactions and pharmacotherapy for patients.'* **M42**

*'A pharmacist is a valuable source of information/advice on equivalent medications, possible undesirable effects, poly-therapy and interactions with other medications in specific NICU patient cases.'* **M66**

*'The pharmacist has a thorough knowledge on the subject of medicines, thereby improving the quality of patient care. Their presence on the ward allows for quick consultations.'* **P45**

*'The pharmacist has knowledge of medicines, pharmacology and drug technology. This knowledge is necessary to improve the quality of pharmacotherapy, and this knowledge should be more utilized in the NICU.'* **P43**

However, differences were observed when considering student opinions on the advantages associated with the pharmacist's role on the NICU. Medical students were found to view pharmacists more as a support system, or a safety net, for the medical team during the pharmacotherapy-decision making process. They valued the direct role on the ward mostly for the purposes of having access to drug information with emphasis on assisting doctors with prescribing, and cited that in this way, pharmacists contributed to a reduction in medication errors, drug interactions and side-effects. As such, medical students more often associated pharmacist involvement with the process of managing pharmacotherapy i.e. in selecting medications, preventing drug interactions and monitoring side-effects.

*'A pharmacist permanently present in the intensive care unit can assist the doctor in the treatment of newborns. This can reduce the risk of error in drug selection and allow the doctor to focus on his/her practice.'* **M2**

*'A pharmacist working directly in intensive care could provide doctors with pharmacotherapy related consultations for a rare, uncommon illness where it is not known which drugs to use. With routine treatment, the doctor follows the guidelines and the pharmacist's consultation seems to be unnecessary.'* **M5**

*'Most procedures have pharmacotherapy guidelines so a pharmacist's daily work on the ward does not make much sense. On the other hand, the ability to use their knowledge in the treatment of cases not responding to recommendations using routine treatment would certainly help and would assist the work of doctors in charge of the patients concerned.'* **M15**

In contrast, pharmacy students considered the role of the pharmacist more holistically, and were focused on the continuum of care and the pharmacist's involvement in monitoring a patient's

therapy throughout their admission, reflecting a more patient-centered approach. In particular, pharmacy students referred to pharmaceutical care services as an opportunity to better utilize the knowledge and expertise of the pharmacists to resolve patient care problems, to optimize pharmacotherapy, provide better quality of care and to benefit the team. Pharmacy students emphasized that the pharmacist's role would improve the appropriateness of therapy, efficacy of treatment and promote the individualization of therapy. Furthermore, they highlighted that due to the high-risk nature of the vulnerable neonatal population, these roles would also contribute to increasing medication safety.

*'Safe use of drugs, which is especially important in neonatal therapy.'* **P42**

*'The advantage of a pharmacist working directly in the NICU is the ability to control a patient's course of pharmacotherapy in a continuous manner. Greater safety of pharmacotherapy for patients.'*

**P72**

*'Control of the pharmacotherapy regimen reduces the risk of adverse drug reactions caused by inappropriate drug administration and its storage, interactions or incompatibilities.'* **P73**

*'A pharmacist working in a team with a doctor, increases the individualization of pharmacotherapy, focusing on the patient.'* **P25**

Theme 2: clinical pharmacy practice is not well-developed in Poland

The majority of students (both medical and pharmacy) felt that there was no real pharmaceutical care provided in the Polish health system. They also identified a lack of overall support from the hospital and broader health system to support the clinical pharmacist's role on the ward. Medical students more often referred to the ward-based, clinical model of practice as being 'abstract' or foreign to the Polish healthcare system. These participants viewed this as a reality of working in the system, and did not take issue with it, as they also more often suggested that a full-time pharmacist presence was likely not needed in the NICU.

*'The vision of a pharmacist being available on the NICU ward and also on all others seems to be a bit abstract for the Polish situation but it would of course be very valuable for the patient and the medical staff.'* **M5**

*'I believe that consultations with a pharmacist would be very helpful, but I do not think it is necessary for a pharmacist to be permanently located on the ward because doubts about pharmacotherapy occur sporadically.'* **M50**

On the other hand, pharmacy students highlighted that the lack of pharmaceutical care was problematic, inferring that it reflected suboptimal practice.

*'I think the current model of pharmaceutical care practice conducted within the NICU does not meet the medication management needs of neonatal patients. Pharmacists do not play a role in pharmaceutical care provided on hospital wards. The pharmacist should have a permanent position on the NICU ward.'* **P72**

*'At present, pharmacists in Poland do not actively participate in pharmacotherapy, they do not have direct contact with the patient.'* **P21**

*'The current pharmaceutical care model within the NICU does not meet the needs of patients due to the small input of pharmacists in the life of the unit, limited to drug delivery and preparation of prescription drugs.'* **P26**

*'The current model does not meet the needs, because the level of care and monitoring is not adequate. Pharmacists are missing in hospitals.'* **P47**

Theme 3: issues around adding a clinical pharmacist to the therapeutic team

Both groups of participants believed that introducing a NICU-based pharmacist to the therapeutic team would be met with several barriers:

### Sub-theme 3.1: Cost Implications

Financial issues were commonly identified by both medical and pharmacy students, and mostly related to the pressures of cost containment, with participants commonly reporting that the creation of a pharmacist's position on the ward would have a significant impact upon allocated ward budgets. Pharmacy students tended to refer to the economic considerations in terms of net cost-savings and net benefits, whereas medical students used negative terms such as 'burden' on hospital funds.

*'The pharmacist is an additional burden on the ward budget.'* **M50**

*'Employment of a pharmacist on the NICU ward = generation of costs (even though the pharmacist contributes to a decrease in pharmacotherapeutic costs).'* **P33**

*'There is a lack of parties willing to finance the position.'* **P48**

*'The regulations of the current care system do not involve or pay for pharmaceutical care within the NICU.'* **P33**

### Sub-theme 3.2: Pharmacist's Preparation For Clinical Practice In The NICU

Pharmacists were perceived by both medical and pharmacy students to be underprepared for clinical practice in the NICU. This was most commonly associated with a perceived insufficient level of clinical knowledge relating to the types of pharmacotherapy used in neonates, as well as a lack of practical, ward-based experience. However, differences between the perspectives of pharmacy and medical students were identified. Medical students perceived that pharmacists were unable to apply their knowledge to patient care in the NICU, and therefore felt that the pharmacist would not be able to support higher functions in decision-making.

*'The theoretical knowledge of the pharmacist may not agree with the practical experience of the physician.'* **M10**

*'The pharmacist does not fully understand the patient's clinical problem and should not be involved in therapy.'* **M29**

*'The level of education and competencies of a pharmacist are not sufficient to enable them to make decisions about the treatment of patients, in accordance with their current training system.'* **M49**

On the other hand, pharmacy students, referred to the fact that the current education system did not adequately train pharmacists for specialized clinical practice in the NICU. However, given enough educational opportunities, these participants felt that pharmacists would be able to contribute significantly to medication management in the neonatal population.

*'The current level of education does not consider neonatal pharmacotherapy – the pharmacist does not have up-to-date knowledge on this topic.'* **P11**

*'Pharmacists could be trained in this particular category and have a lot of knowledge about these particular therapies and this patient population.'* **P51**

### Sub-theme 3.3: Acknowledgement Of Pharmacist As Part Of The Multi-Disciplinary Therapeutic Team

Only pharmacy students acknowledged that involving the pharmacist in clinical roles on the NICU would give recognition to their expertise and increase their job satisfaction. They also emphasized a need for pharmacists to be acknowledged as a member of the therapeutic team in the NICU. Pharmacy students reported that through the creation of a direct, ward-based clinical pharmacy position on the NICU, pharmacists would be able to contribute to medication safety, patient care and to the medical team itself.

*'A pharmacist is a specialist in pharmacotherapy, and in collaboration with a doctor who appropriately diagnoses a disease, can optimize treatment and exclude certain side-effects and interactions.'*

**P32**

*'All staff would have the opportunity to benefit from the knowledge/advice of the pharmacist.'* **P67**

*'The doctor is responsible for the diagnosis and the pharmacist for the selection of drugs, doses and identifying interactions.'* **P71**

However, in addition, pharmacists also emphasized that the greater engagement of the pharmacist into the NICU environment would be associated with increased responsibility, workload and stress.

*'Increased responsibility and level of stress.'* **P37**

*'Only advantages, but they come with great responsibility.'* **P52**

*'Stress, complicated medical cases.'* **P63**

#### Sub-theme 3.4: Lack Of Inter-Disciplinary Support For The Clinical Pharmacist

Pharmacy students identified that the main barrier to pharmacist practice on the NICU would be resistance from the medical team to collaborate, particularly senior doctors. Respondents also perceived that the provision of clinical pharmacy services directly on the ward would be met with distrust:

*'There is a lack of desire from doctors to collaborate with pharmacists.'* **P42**

*'Polish doctors will not change their approach to pharmaceutical care.'* **P44**

*'The pharmacist has very limited powers and is often not seen as a partner by doctors.'* **P45**

*'It is believed that the place of the pharmacist is only in the dispensary. There is no possibility of active participation in pharmacotherapy.'* **P51**

*'For a pharmacist in this position, they could be faced with too little trust from the doctors as well as too much responsibility.'* **P65**

## Discussion

The purpose of this study was to explore the opinions and attitudes of Polish medical and pharmacy students towards the provision of pharmaceutical care services to the NICU. To our knowledge, this is the first study of its kind to investigate student perceptions towards a specialty area of pharmaceutical care.

Our research demonstrates that both Polish medical and pharmacy students recognize that the hospital pharmacists traditional supply function is becoming outdated, particularly in high-intensity and high-risk wards such as the NICU, which demand a multi-disciplinary group of healthcare providers. This finding is encouraging given the structure of the current health system in Poland. Both medical and pharmacy students acknowledged that no form of pharmaceutical care was currently being provided to the NICU, or within the hospital setting in the Polish healthcare system. However, the results highlight that the majority of both groups of students did envision pharmacists holding positions directly on NICU wards to some degree, and were also receptive towards collaborative professional relationships between doctors and pharmacists.

However, distinct differences were also identified between the attitudes of the two groups of students towards the provision of pharmaceutical care services in the NICU. Medical students expressed less positive responses towards direct pharmacist involvement in ward-based activities, including clinical roles, and highlighted that medical and nursing staff could perform these services. These findings are similar to those obtained in a Croatian study by Seselja-Perisin et.al. investigating medical and pharmacy student attitudes towards pharmacist-physician collaboration<sup>47</sup>. In their study, Seselja-Perisin et.al. highlighted distinct differences in perceptions between 'shared authority' and 'interprofessional education', with pharmacy students expressing the most positive attitudes in comparison to medical students who showed the lowest attitudes towards collaboration<sup>47</sup>. Seselja-Perisin et.al. cite that these findings may impact upon interprofessional collaboration in students future careers as health care professionals<sup>47</sup>. It is apparent that when it comes to the NICU, medical students feel that pharmacotherapy-related decisions are the responsibility of the medical staff, with pharmacists acting as a support for the administrative

processes rather than as an influencing factor in patient care. These results are similar to those obtained from the study conducted in Poland by Swieczkowski et.al., who assessed medical and student perceptions towards pharmaceutical care in the community setting<sup>48</sup>. Swieczkowski et.al. highlighted that the majority of medical students felt that doctors are solely responsible for selection of pharmacotherapy, TDM and patient education, whereas teamwork with pharmacists was expected in the reporting of adverse drug reactions and drug interactions<sup>48</sup>. Medical students viewed pharmacists more as an adjunct to the medical team, and perceived their value to lie in their capacity as a source of medication information. This indicates that medical students do not understand the fundamental concept of pharmaceutical care (PC) and also have a limited understanding of the potential scope of pharmacist practice in a ward-based environment. PC is defined as “*a philosophy of practice in which the patient is the primary beneficiary of the pharmacist’s actions. PC focuses the attitudes, behaviors, commitments, concerns, ethics, functions, knowledge, responsibilities and skills of the pharmacist on the provision of drug therapy with the goal of achieving definite therapeutic outcomes toward patient health and quality of life*”<sup>1,3</sup>. These results mirror those obtained by Swieczkowski et.al. who reported that the majority of Polish medical students in their study could not identify a correct definition of pharmaceutical care<sup>48</sup>.

In contrast, pharmacy students expressed favorable attitudes towards integrating the pharmacist into the therapeutic team. The majority indicated that pharmacists should be consulted on pharmacotherapy-related decisions on the NICU and should also have a direct role on the ward in a clinical capacity. These findings are consistent with those collected by Pawłowska et.al. in their study relating to pharmacist practice in hospitals in Poland, whereby 33% of hospital pharmacists indicated that they would like to be included as a member of the therapeutic team<sup>14</sup>. When comparing practicing pharmacists opinions to those of pharmacy students, our study found that 91.9% of pharmacy students felt that as future pharmacists they should be involved in pharmacotherapy-related decisions. Similar sentiments were found among Kuwaiti pharmacy students, who expressed positive attitudes towards the provision of pharmaceutical care<sup>31</sup>. This indicates that pharmacy students are more comfortable with the concept of pharmacists having an active role in prescribing and monitoring pharmacotherapy on the NICU and being a contributor to the multidisciplinary treating team than medical students. Pharmacy students

consistently reported the positive impact of pharmacist involvement in the NICU, and recognized the importance of pharmaceutical care being extended throughout a patient's admission to the NICU. However, it was observed that despite their interest to perform more clinical roles, pharmacy students felt unprepared to carry out ward-based services in their future practice.

The differences in opinions seen between pharmacy and medical students may be attributed to several reasons. First, there are socio-cultural elements that need to be considered, relating to the perceived hierarchy of healthcare providers in the hospital. Traditionally, doctors in Poland have been regarded as authoritative figures in the hospital, responsible for all aspects of decision-making relating to the patient<sup>49</sup>. In comparison, nurses and pharmacists are considered to work in a supportive capacity, assisting in the delivery of services<sup>49</sup>. Currently, pharmacists do not provide ward-based services in hospitals, and fulfill their function from within the dispensary. As such, these ingrained perceptions may influence the current opinions of students. This traditional form of pharmacy practice and multi-disciplinary collaboration has also influenced the way the pharmacy and medical studies are delivered at universities in Poland. The current tertiary education system focuses on uni-professional education of students rather than an inter-professional form of education. At present, each health-related discipline i.e. medicine, nursing, pharmacy and physiotherapy is taught separately from the others as a distinct, individual course, with minimal to no multi-disciplinary collaboration. In addition to this, pharmacy curricula in Poland 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. There are no subjects that prepare students for more integrated roles on ward environments, and there is no learning involving simulations relating to patient care, or teamwork. This is also observed within the medical curriculum, where there is no emphasis placed on teaching medical students about the roles and potential contributions of the pharmacist as a member of the multi-disciplinary treating team. As such, the current schooling system does not fully expose students to pharmaceutical care and students are not fully prepared for a collaborative form of practice. The findings of this study reinforce this point given that small proportion of students from both disciplines felt the evaluation of laboratory results was a role for pharmacists, but a large proportion thought pharmacists should be involved with TDM and TPN monitoring which both primarily involve laboratory interpretation. As such, this reinforces that the students' replies are

primarily based on theoretical knowledge and they may not actually understand the potential roles on which they are being asked to comment.

Overall, the results draw attention to three major issues – the absence of multidisciplinary collaboration, poor understanding of the pharmacist's role and their potential in the NICU and a lack of structural support and preparation for pharmacists in undertaking clinical practice. As such, these findings indicate a significant need for the development of educational strategies that address these gaps in knowledge to better prepare graduates for their future careers in healthcare teams. Interprofessional education (IPE) has been cited as an effective tool in improving collaboration and increasing the understanding of each profession's capabilities and their responsibilities on the ward<sup>50</sup>. The WHO acknowledges that, "*health professionals who are taught together in a interprofessional educational setting and learn to collaborate as a team during their student years, are more likely to work effectively together in their professional lives in a clinical setting*"<sup>51</sup>. This approach is particularly important to the NICU, as the quality of neonatal care and the safety of patients is dependent on team-based care<sup>50</sup>. Barbosa highlights that "*a collaborative, multidisciplinary team approach that emphasizes shared responsibility, practices effective communication, and respects and recognizes that no one functions independently in the NICU is recommended to promote the best possible outcome for infants and families*"<sup>52</sup>. NICU-specific IPE strategies have been reported as including simulated case studies, for example involving respiratory distress syndrome or sepsis, requiring nursing, medical, pharmacy and respiratory therapy students to role play working through the case as they would in practice i.e., reviewing the plan of care, determine priorities, and discuss any needed changes<sup>50</sup>. Other interactive activities has been described as practice simulations, or immersive experiences, involving videotaped procedures, which encourage collaboration and communication among students<sup>50</sup>. The subsequent reported benefits for students of NICU-specific IPE include: improved general interactions and communication between future health professionals, improved understanding of overlapping professional functions, an understanding of each professions roles in healthcare delivery and the value of these roles in relation to patient management as well as a better understanding of illnesses and therapeutic interventions in this area of practice<sup>53,54</sup>.

As such, the implementation of IPE into Polish medical and pharmacy programs could assist in introducing clinical aspects of the role to pharmacy students as well as help to challenge the

traditional stereotypes of a pharmacist, as perceived by medical students. A study by Swieczkowski et.al. which canvassed the opinions of a group of Polish pharmacy and medical students, highlighted that 89.9% of students agreed that during medical training there should be more emphasis on developing a collaborative relationship between doctors and pharmacists<sup>48</sup>. Both the WHO and FIP have agreed that: “*IPE leads to a collaborative practice-ready workforce, and collaborative practice leads to a strengthened healthcare system, resulting in improved patient health outcomes*”<sup>55</sup>. Therefore, future research is needed to develop educational strategies that further integrate both interprofessional education as well as more clinically-driven courses into the pharmacy and medical curriculum, specifically for specialty areas of practice.

### Limitations

This survey was distributed among students at only one medical university, and as such, the sampling frame and sample size are limited. Furthermore, the study used convenience sampling and the manual distribution of surveys during lectures may have also limited the number of participants. Overall, the small sample size and limited survey data may not be representative of all pharmacy and medical health professionals or students in Poland and might not be generalizable across university settings nationally. Furthermore, the responses obtained from students are based on their theoretical knowledge of pharmaceutical care given that they have had limited contact with this type of practice to date. In regard to the study design, surveys are unable to elicit in-depth qualitative data in the way that interviews or focus groups can, and therefore the researchers were unable to fully explore participants' underlying reasons for these responses. Therefore, the results should be interpreted with caution. However, this study can inform future qualitative research to capture a more comprehensive story of student perceptions towards advancing pharmacy services in hospitals.

### Conclusion

Overall, Polish pharmacy and medical students have positive attitudes towards the concept of pharmaceutical care in the NICU. However, significant differences were identified regarding expectations around clinical roles, and pharmacist integration into multi-disciplinary medication consultations. Future efforts should be aimed at developing and integrating inter-professional

education into medical and pharmacy programs to encourage effective inter-disciplinary collaboration in future practice. Furthermore, there is a perceived need from pharmacy students to be better supported in their future roles as clinical pharmacists. As such, further investigation is also needed to develop educational strategies directed at clinical, patient-centered roles, particularly for specialty areas of practice such as the NICU, that have the potential to facilitate the provision of a more advanced and comprehensive level of pharmaceutical care. Whilst this study is the first to report on pharmacy and medical students perceptions towards pharmacist practice in Polish NICUs, the findings are subject to some limitations, which are primarily related to the study being conducted at a single Polish university, limiting the sample size and generalizability of the results.

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**TABLE 1 – DEMOGRAPHIC INFORMATION FOR PARTICIPATING MEDICAL AND PHARMACY STUDENTS**

	<b>PHARMACY (n = 74) (%)</b>	<b>MEDICINE (n = 73) (%)</b>
<b>GENDER</b>		
Female	61 (82.4)	52 (71.2)
Male	13 (17.6)	21 (28.8)
<b>YEAR OF STUDY</b>		
3	4 (5.4)	0
4	27 (36.5)	0
5	43 (58.1)	66 (90.4)
6	N/A	7 (9.6)

**TABLE 2 – PROPORTION OF STUDENTS AGREEING THAT SPECIFIC ROLES SHOULD BE PERFORMED BY PHARMACISTS IN THE NICU (NEONATAL INTENSIVE CARE UNIT)**

<b>ADMINISTRATIVE ROLES</b>			
	<b>Pharmacy Students (%) N = 74</b>	<b>Medical Students (%) N = 73</b>	<b>P-value (Comparison of proportions between pharmacy and medical students)</b>
Development/implementation of a drug formulary service	69 (93.2%)	63 (86.3%)	0.164
Attendance at non-clinical meetings i.e. Drug and Therapeutics Committee	70 (94.6)	67 (91.8)	0.498
Conducting quality assurance measures i.e. drug usage evaluations, workload documentation, auditing	73 (98.6)	71 (97.3)	0.552
Management of the drug budget	52 (70.3)	41 (56.2)	0.076
Evaluation, selection and purchasing of pharmaceuticals for the unit	58 (78.4)	56 (76.7)	0.809
Development of drug policies/protocols/guidelines for the NICU	72 (97.3)	71 (97.3)	0.989

<b>EDUCATION/COMMUNICATION/RESEARCH</b>			
	<b>Pharmacy Students (%) N = 74</b>	<b>Medical Students (%) N = 73</b>	<b>P-value (Comparison of proportions between pharmacy and medical students)</b>
Providing training/in-services for other health professionals on NICU related topics and drug related problems	63 (85.1)	70 (95.9)	0.026
Contributing to and/or attending NICU related conferences	72 (97.3)	64 (87.7)	0.027
Involved in clinical trials	73 (98.6)	72 (98.6)	0.992
Involved in research related to neonatal pharmacotherapy	72 (97.3)	71 (97.3)	0.989
Source of drug information - responding to information requests from health professionals on the ward	69 (93.2)	72 (98.6)	0.099
Counseling parents/carers of neonatal patients	67 (90.5)	51 (69.9)	0.002

<b>PROVISION OF MEDICINES</b>			
	<b>Pharmacy Students (%) N = 74</b>	<b>Medical Students (%) N = 73</b>	<b>P-value (Comparison of proportions between pharmacy and medical students)</b>
Dispensing prescriptions	64 (86.5)	58 (79.5)	0.256
Extemporaneous compounding of formulations for the NICU	73 (98.6)	73 (100)	0.319
Stocking the ward with essential medicines/house-keeping activities i.e. checking expiry dates, fridge temperatures etc.	66 (89.2)	66 (90.4)	0.807

NICU = Neonatal Intensive Care Unit

**TABLE 3 – PROPORTION OF STUDENT OPINIONS AGREEING ON PHARMACIST INVOLVEMENT IN THE NICU (NEONATAL INTENSIVE CARE UNIT)**

<b>OPINIONS</b>	<b>PHARMACY N = 74</b>	<b>MEDICINE N = 73</b>	<b>P-value (Comparison of proportions between pharmacy and medical students)</b>
<b>Should the pharmacist be consulted as part of the treating team when making medication-related decisions for NICU patients?</b>	68 (91.9%)	52 (71.2%)	0.001
<b>Is there a need for a pharmacist to be stationed permanently or routinely visiting the NICU?</b>			
<b>Yes routinely (PART TIME, VISITING POSITION ON THE WARD)</b>	27 (36.5%)	43 (58.9%)	-
<b>Yes permanently (FULL TIME POSITION ON THE WARD)</b>	47 (63.5%)	18 (24.7%)	-
<b>No</b>	0	12 (16.4%)	-
<b>In your future practice, would you like to see collaboration between the doctor and the pharmacist?</b>	72 (97.3%)	70 (95.9%)	0.638
<b>In what way?</b>			
<b>Direct consultation with visiting pharmacist</b>	24 (33.3%) N = 72	36 (50.7%) N = 71	-
<b>Direct consultation with permanent pharmacist</b>	48 (66.7%)	21 (29.6%)	-
<b>Email/telephone contact</b>	0	14 (19.7%)	-

**FIGURE 1 – EXPECTATIONS OF PHARMACY AND MEDICAL STUDENTS TOWARDS CLINICAL ROLES THAT SHOULD BE PERFORMED BY PHARMACISTS ON THE NEONATAL INTENSIVE CARE UNIT**

## Expectations of pharmacy and medical students towards clinical roles that should be performed by pharmacists on the neonatal intensive care unit

