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QUALITY IMPROVEMENT ARTICLE

Neonatal postgraduate training program for physician assistants: meeting a need in neonatal care

Elie G. Abu Jawdeh[1] · Frances Hardin-Fanning[2] · Tria B. Kinnard[1] · M. Douglas Cunningham[1]

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Abstract

There is a growing need for advanced practice providers in the NICU. Physician assistants (PAs) with postgraduate training in neonatology can help meet these demands. The premise of training PAs to work in the NICU is being adopted by multiple centers nationwide. Unfortunately, there are no standardized curricula for neonatal PA training that can be utilized to initiate residencies. Since our program is the longest running neonatal PA residency in the nation, we are in a unique position to share the accumulated experiences of our curriculum development. In this article, we describe our neonatal PA residency as it exists today with selected lessons learned. In addition, we present mixed qualitative and quantitative assessments of graduates. We believe that neonatal PA residency graduates become ideal candidates to fill the growing national need. We propose that our model program can be a stepping stone to enhance the role of PAs in neonatal care.

Introduction

Over the past decade graduate physician assistants (PAs) have become established advanced practice providers (APPs) for critically ill infants and children [1]. Historically, NICUs have been physician-led with the support of neonatal nurse practitioners (NNPs). However, the sustainability of this concept has become strained as the number of NNPs entering the neonatal intensive care workforce has declined [2–4]. Furthermore, the hours pediatric resident physicians spend in the NICU have been reduced in keeping with guidelines set forth by the Accreditation Committee for Graduate Medical Education (ACGME) [5]. These gaps in the NICU workforce necessitate innovative educational strategies to meet patient care needs in most hospitals today.

Physician assistants may help meet the needs for APPs in the NICU. Upon entering PA school, most students have already received a bachelor degree and typically have three years of healthcare experience [6]. PAs complete a master's degree program, which gives them a strong foundation in medical knowledge. Historically, most PAs enter primary care practices, however, an increasing number of PAs are seeking specialization [6]. The Accreditation Review Commission on Education for the Physician Assistant (ARC-PA) and the National Commission on Certification of Physician Assistants (NCCPA) govern PA training and certification, but actual clinical practice is governed by individual state laws, statutes, and regulations [7–9]. While varying from state to state, PA governance in most states allows for a broad scope of practice with limited direct physician supervision. Physician assistants are required to work within the scope of practice of a supervising physician, who is legally responsible for the services provided by the PA [8, 9]. Additionally, because neonatal-perinatal medicine is a hospital-based practice, it is also governed by hospital bylaws and credentialing processes.

The formation of neonatal specialty training for PAs has been a direct response to the evolving needs of neonatal critical care programs. Physician assistants with training in neonatal intensive care have become an option to support contemporary multidisciplinary NICU teams. In 2005, a

These authors contributed equally: Elie G. Abu Jawdeh, Frances Hardin-Fanning

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✉ Tria B. Kinnard
tbkinn0@email.uky.edu

✉ Elie G. Abu Jawdeh
elie.abujawdeh@uky.edu

[1] Division of Neonatology, Department of Pediatrics, University of Kentucky, Lexington, KY, USA
[2] College of Nursing, University of Kentucky, Lexington, KY, USA

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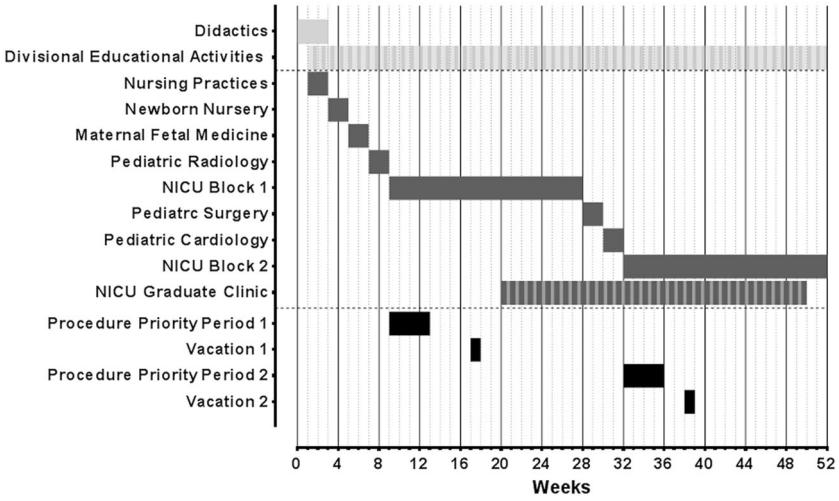

Fig. 1 Representation of neonatal physician assistant residents schedule during the yearlong residency program. The residency starts with 3 week didactic period during which residents receive 30–40 lectures and simulation-based training. Other divisional educational activities such as grand rounds, lectures, case presentations, journal review, and mortality and morbidity reviews continue throughout the year (~64/year). The resident then starts with introductory inter-professional 2 week rotations (nursing practices, newborn nursery, maternal–fetal medicine, and pediatric radiology). Neonatal intensive care (NICU) rotations start in our level 4 NICU in two blocks (NICU Blocks 1 and 2). Two week pediatric surgery and cardiology rotations are offered mid-way through the year as residents are more comfortable caring for sick patients. NICU graduate clinic exposure starts half-way through the year and occurs 1–2 times per month. Procedure priority periods are offered twice a year to ensure adequate opportunities to perform procedures. A total of 2 weeks of vacation are offered

unique yearlong neonatal intensive care residency program was established for PAs at our institution [1]. Our hospital is a referral center with an 80-bed level 4 NICU. The program has been sustained continuously, and today leads to a certificate of completion as a physician assistant with advanced neonatal training. In recent years, several other centers nationwide have initiated neonatal PA training programs in order to meet the clinical demands in the NICU. In this article we chronicle the continued development of our training program for PA residents and document their success as neonatal intensive care advanced providers.

Curriculum

In the following section we describe our neonatal PA residency curriculum. Our current curriculum evolved with ongoing feedback to better meet the needs of contemporary neonatal intensive care. The residency currently accepts 2–3 residents per year. The residents are carefully selected after review of resume, application (including school transcripts), personal statement, letters of recommendations, and day-long in-person interviews with our faculty and staff. We present the sample yearlong schedule in Fig. 1.

Didactics

Our residents experience a period dedicated to neonatal education prior to caring for patients. An introductory lecture series provides a foundation of information for the PA residents (Appendix 1). The lecture series introduces residents to common neonatal morbidities and basic management strategies. Our residents receive 30–40 h of basic didactic education within the first three weeks of residency. Furthermore, didactic lectures and case discussions also continue throughout the year (~64/year) as part of divisional educational conferences that include grand rounds, journal reviews, case presentations, and mortality and morbidity reviews. In addition, PA residents participate in interdisciplinary departmental conferences with maternal–fetal medicine, pathology, and cardiology (Fig. 1).

Clinical rotations

Our PA residents spend 2 months in orientation (e.g., electronic medical records training, introduction to institutional policies and clinical practice guidelines, shadowing on patient care rounds), nursing practices rotation and selected pediatric subspecialties, including newborn nursery, maternal–fetal medicine and pediatric radiology (Appendix 1) before starting clinical service in the NICU (Fig. 1). Subsequently, NICU training begins with patient assignments. Residents cover patients with variable complexities ranging from critically ill newborns to convalescent preterm infants. Pediatric surgery, cardiology and NICU graduate clinic rotations are offered mid-way through the year (Appendix 1). Daily bedside rounds include regular interaction with neonatologists, fellows, nursing staff, respiratory therapists, dieticians, and social workers.

Clinical service includes in-house call on a rotating basis with pediatric house staff.

Procedures

Prior to caring for patients, PA residents participate in simulation-based training (SBT) for procedures, resuscitations, and NICU bedside emergencies. Simulation procedures include intubation, umbilical line placement, and chest tube placement. High fidelity neonatal simulators, standard mannequins, and animal models are utilized. Numerous studies have shown that SBT leads to greater levels of procedural competency with decreased errors and complications [10]. We have implemented a second SBT session in the last 6 months to assess procedural competence and ensure skill maintenance. It has become more difficult to obtain neonatal procedural experience due to the increasing number of learners, especially in academic centers [5]. In response, we developed a process giving priority for procedures to the PA residents. Residents have a procedure priority period (PPP) twice per year. Each PA resident is assigned for 2 months to an APP team (1 month in the first quarter and a second month halfway through residency) for their PPP (Fig. 1). Our APP teams consist of experienced NNPs and PAs who are willing to provide procedural priority to the PA residents. Residents always have priority for procedures on their own patients.

PA resident evaluation

PA residents meet with the program director quarterly to review their progress. The review process utilizes both a multisource feedback (MSF) and individualized learning plans (ILP). MSF, also known as "360 degree evaluation", has been studied rigorously in physician training and provides a better assessment of an individual's performance than single evaluators [11]. Our MSF system includes a standardized survey by faculty, fellows, pediatric residents, nurses and APPs for patient care, knowledge, practice-based learning and improvement, system-based practice, communication, and professionalism.

The ILPs are short term goals set every three weeks to coincide with the faculty on-service schedule [12]. At the beginning of a three week service block with an attending physician the PA resident is required to establish two specific measurable clinical goals. At the end of the service block the PA resident meets with the attending physician to discuss her or his progress and satisfaction in achieving their goals. It has been our observation that ILPs help PA residents take ownership of their learning process and develop self-directed lifelong learning habits consistent with other reports [13].

Residents are required to complete all written examinations, which are conducted at the end of every rotation and twice during the NICU rotations, with a grade of at least 80%. We use a bank of examination questions developed by our APPs and neonatology faculty. Faculty review examination results with PA residents and provide targeted remediation in specific areas of concern.

Quality improvement

The final component to our curriculum is an introduction to quality improvement (QI) initiatives. The NCCPA recognizes the value of QI activities for PA licensure [14]. Our residents attend an introductory course in QI to gain basic procedural knowledge related to QI methods. Working as a team, PA residents select and plan a QI project to achieve a common clinical goal. The work is supervised by a faculty member with expertize in QI methods.

Methods

We have conducted a qualitative assessment of our program comprised of interviews of graduates and their supervising neonatologists/directors in order to evaluate their satisfaction with the training and to document their overall assessment of the quality of the experience. This assessment was approved by the Institutional Review Board. Qualitative interviews were conducted by a researcher (FHF) with no affiliation to the PA program, in order to avoid bias and insure anonymity. Prior to the interviews, the researcher (FHF) extensively reviewed residency learning objectives and competency expectations for all rotations (i.e., NICU, nursing, newborn nursery, maternal–fetal medicine, pediatric cardiology, pediatric radiology, pediatric surgery, and NICU graduate clinic). Program graduates and their employers (i.e., neonatologist/medical director) were contacted by the PA residency director to schedule a telephone interview. Acceptance of the telephone interview constituted implied consent. The researcher was provided a schedule of interviews that included the names of the interviewees. A random numbers table was generated (Stat Trek Generator, 2017) and each interviewee was assigned a random number to ensure anonymity and confidentiality. Telephone interviews were audiotaped and all references to the interviewee were based on the random number with no other identifiers used during the interviews. Each interview lasted ~15–20 min.

A semi-structured interview format was used to elicit perceptions of practice expectations and graduate competency. (A copy of the interview may be obtained by contacting the corresponding author.) Additional questions by the investigator were added to clarify or explore emerging

themes. Field notes were recorded to capture additional themes. Member checks were conducted at the end of the interviews. Interviews were transcribed verbatim by an independent transcriptionist not affiliated with the PA Residency program. Transcribed data were analyzed by the nurse researcher using nVivo (QRS International, Melbourne, Australia, 2017) software to aggregate themes of employers' expectations of PA graduates and the graduates' perceptions of their practice [15]. Interviews and field notes were conducted until saturation was achieved [16].

We have also sought to regularly evaluate the program by following our graduates with anonymous online surveys. Data obtained from the surveys were used for curriculum development and modifications over the past years. Through 2017 we have graduated 22 PA residents (largest neonatal PA training program to date). Quantitative data from our PA graduate anonymous survey are presented. The survey used dichotomous and Likert scales and included 20 items that covered feedback related to curriculum structure, perceptions of procedural competency, and overall satisfaction and readiness for the job market upon graduation. The survey was sent using an online tool (SurveyMonkey Inc., San Mateo, CA, USA).

Results

Saturation was achieved after interviewing six PA residency graduates (five female, one male) and five neonatologists/medical directors (one female, four male) for this qualitative assessment. All PA interviewees were currently working in hospitals providing care for high-risk neonates.

Upon accepting a position as a PA at each of the hospitals, graduates were expected to be competent in chest tube placement, endotracheal intubation, umbilical line placement, and lumbar puncture. Graduates expressed high levels of competency and confidence after program completion. Two graduates had competency concerns for one procedure, chest tube placement, due to limited opportunities to perform placement during their clinical experiences.

Several of the graduates shared significantly positive feedback related to their competency levels from members of the interdisciplinary team (Table 1). Neonatologists/medical directors also expressed high degrees of competency and confidence in the graduates (Table 1).

Additionally, graduates identified physician commitment to the neonatal PA program, the academic setting in which the program is housed, their clinical rotations that required 24-h call responsibility, and the multidisciplinary clinical rotations as the facilitators of their learning experience (Table 2). Graduates felt that a dedicated clerkship director at each clinical site could enhance the learning experience; which we have since included. Graduates and medical directors also recommended the addition of simulation scenarios for infrequent procedures, and valid competency assessment tools. In addition, participants recommended requiring students to be involved in clinical research.

Graduates were queried about their current opportunities for teaching, quality improvement, and research (Table 3). While most graduates were involved in some level of all three aspects, medical directors felt more exposure to these experiences during residency would be beneficial.

In the quantitative assessment, a total of 19 out of 21 PA graduates responded to our surveys between 2011 and 2017; a response rate of 90.4%. The majority of PA graduates perceived that they were competent in basic procedures commonly performed in the NICU such as endotracheal intubations and umbilical line placement as presented in Table 3. Overall, all of respondents perceived that faculty members were readily available and majority (95%) provided adequate instruction and guidance. As represented in Table 5, respondents perceived that the

Table 1 Physician assistants and faculty perceived competency observations from members of multidisciplinary team

Perceived competency reported by PA graduates
"My co-workers [say] that I know what I'm doing and they feel very confident when I'm the provider on call…they feel confident in my decisions."
"…all the nurses and respiratory therapists have mentioned that they are very confident in me."
"They [nurses and nurse practitioners] were actually impressed with how independent I was when I came out of residency. "
Perceived competency reported by neonatologists and medical directors
"…the number one strength would be the clinical acumen they develop during residency. I think their clinical skills are very, very good."
"…this is not just my observation but also from talking with other faculty, we see the curve from the time they start to the time they finish about how confident they are in taking care of babies."
"They [PAs] would be the… first line person to deal with any new emergency."
"They are very well-skilled at procedures…I'm comfortable with them doing them independently."
"[They do] an excellent job, demonstrated core competencies which has been very good….a willingness and eagerness to learn… compassionate and empathetic in conversations with families… excellent communication skills."
"They have a really good understanding of disease process and I'm going to contrast that with some of our neonatal nurse practitioners who, after spending many years at the bedside from the nursing tradition, sometimes having a difficult time making that transition from bedside nurse and the patient-centered approach which is absolutely terrific. However, they have a more difficult time grasping the disease process and I think the neonatal PAs from this program come in much better prepared to think about disease processes and make medical decisions based on pathophysiology."

Table 2 Perceived facilitators and barriers to neonatal physician assistant competency

Facilitators	"…within this program, they are very, very good at teaching the PA residents."
Physician commitment to program	"They are used to our level of learning and they expect us to progress so that is always great." "Definitely if a PA student has an idea and wants to work on something, we encourage that…the NICU is always looking for meaningful QI projects." "They make sure they do not waste our time and that we are learning as much as we possibly can." "They gave me the best experience to do something I love and I will be forever grateful…I'm really blessed…because they changed my life forever." "…they do an excellent job at looking for [program] weaknesses and are trying to improve constantly." "You're involved with the practitioner team and the resident team…they're very cognizant of knowing that you need to do procedures…they do a great job of grabbing you to do that procedure…"
Academic medical center	"There are people there who are always teaching you…people that are used to teaching people." "A small bedside talk can give you a lot of information about the right direction you need to go." "…reasonable expectations but also accountability for those expectations. That's always good…" "…the hands-on learning is what sets UK apart…we're in the unit almost the entire time…they have us basically critical-thinking the entire year….it's very structured and well-organized…" "…the best part of the residency is the variety [of acuity and complexity]…it would be difficult to graduate and be…a clinician if you didn't get exposed to that variety."
24-h call responsibility	"We're on call for about 24 h…a tremendous amount of autonomy… the attending physician comes in for the micro-preemies…more of a teamwork kind of relationship." "Being in the unit on-call as much as we were really put us ahead of the game and really helped us in the end." "I think the 24 h shift that you work where you go from taking over just your baby to taking over the babies in the entire unit helps expand that variety so you don't just see the same thing every day "I think those 24 h shifts are really amazing and important to your learning."
Multidisciplinary rotations	"The residency experience is just phenomenal, they do a slower introduction where they put the residents in the normal newborn nursery and radiology and they do certain other rotations in the beginning just because it is so intimidating starting in the NICU…" "I think it helps them to be able to work with other services…like pediatric surgery or radiology." "We manage the whole spectrum, all aspects, of a level 4 infant so it gave great experience…" "I got really comfortable working with all the different disciplines in the hospital."
Barriers	"Off-service rotations could be improved upon."
No designated liaison/advisor for each clinical site	"I think [following the babies post-operatively] would be more important than having us just watch surgeries or checking in on kids that have different disorders that you're never going to provide care for." "…I don't think they do a great job collaborating [during off-service rotations] to make it beneficial for the resident…kind of stuck in a pool of students not really learning much of anything…"

didactics, procedures and clinical aspects were appropriate. Respondents perceived that they were more competitive in the job market and indeed all graduates were successfully employed upon graduation (Table 5). Eight respondents suggested additional specialty service rotations, some of which have since been included in our curriculum. All respondents would recommend this program to other PAs wishing to specialize in neonatology.

Discussion

A decade long unique experience in PA postgraduate training in neonatal intensive care has been described. The curriculum evolved from a limited scope of hands-on training to a comprehensive educational program. The curriculum focuses on apprenticeship with a goal to transform PA residents to skilled practitioners. Knowledge is initially transmitted through didactics, followed by hands-on training to acquire clinical and procedural skills. Our faculty members focus on nurturing residents toward competence and self-confidence through individualized plans and frequent feedback to cultivate critical thinking and clinical reasoning. Qualitative methods were primarily utilized to assess the perceptions of the faculty and PA graduates of their competence and experiences as it relates to the growth of their careers. We demonstrated through this program review that PA

Table 3 Career enrichment opportunities

Teaching	"I teach some of the residents and new physician assistants." "The attending physician wanted me…to teach the team about what to look for, what labs to do…" "…important for the PA to have good teaching skills…NICUs are training grounds for nursing students, medical students, residents and others…" "…They are expected to assist with supervising and teaching medical residents and interns." "I help out with nursing education for new hires…" "All the lectures that I received during residency were crucial to me being able to educate others."
Quality improvement/research	"I am a member of our nutrition committee. I work with the team on nutritional quality improvement projects in the NICU." "We took a QI class in the beginning of the residency and were able to participate in a project on kangaroo care…" "I'm involved in the antibiotic committee, the neonatal abstinence committee, and then a general quality improvement committee…my experience helped me be more involved in that aspect…" "…one research project we did related to the guidelines that come out for blood transfusions…I was involved with the data collection "…was able to help with data collection for a research project with one of the fellows in the NICU…on neonate anemia…right now writing the paper [for publication]. I co-initiated the project."

residency graduates are effective in caring for patients in a NICU.

We believe key elements in the success of our graduates are the structure/set up of the residency and the unifying support of our faculty. Physician assistant residents recall the initial intensive didactics portion of the program as a valuable "head-start" to their NICU rotations. The PA residents continue to participate in divisional educational activities throughout the year. We recognize the intense nature of our training program as our PA residents spend the majority of their clinical time in our busy level 4 NICU; however, both the survey and semi-structured interviews indicated that the current structure of the program has contributed to their success. To avoid being overwhelmed by the complexity of the NICU, we found that starting the residents in subspecialty [multidisciplinary] rotations and bedside nursing exposure served as an effective means of introducing the team approach in neonatal care. The identified barriers related to the subspecialty rotations (Table 2) such as lack of focus on PA education have been addressed by appointing faculty clerkship directors responsible for providing adequate opportunity for learning. Although in recent years many medical programs have diminished overnight on-call hours [5], in-house call was perceived as positive by our residents (Table 2). They expressed that they gained a sense of autonomy and expanded clinical experiences from being first call for the whole team. Our residents complete their overnight call on rounds the next morning and have the opportunity to receive feedback on their patient care management overnight.

There is growing concern regarding medical trainees gaining enough procedural competencies during their residency [17, 18]. In the NICU the need for procedures (e.g., intubations/chest tube placement) have decreased in the advent of "gentle" ventilation. In the meantime, the number of learners has increased; i.e., now it is challenging to provide adequate opportunities for procedures [5]. In response to this challenge and to ensure competence, we implemented SBT and PPP model, maintaining adequate opportunity for our residents to perform procedures. The vast majority of PA graduates perceived that they were completely competent at the basic NICU procedures (Table 4). The majority of our graduates were less confident in their ability to perform less common procedures such as chest tube and peripheral arterial line placement. While we acknowledge that defining and assessing competency can be subjective, hard to measure and institutionally dependent, our program provides graduates with learning strategies to enhance their skills in the clinical setting [5, 19].

Table 4 Perceived procedural competency of physician assistant graduates

	I	SC	CC	N/A
Endotracheal intubation	0 (0)	2 (11)	17 (89)	0 (0)
Umbilical line placement	0 (0)	0 (0)	19 (100)	0 (0)
Lumbar puncture	0 (0)	0 (0)	19 (100)	0 (0)
Intraventricular reservoir tap	0 (0)	3(16)	15 (79)	1 (5)
Thoracentesis	0 (0)	9 (47)	3 (16)	7 (37)
Chest tube placement	0 (0)	15 (79)	2 (10.5)	2 (10.5)
Peripheral arterial line placement	6 (32)	8 (42)	3 (16)	1 (5)

I incompetent, *SC* somewhat competent, *CC* completely competent, *N/A* not applicable

Number (%)

Neonatal PA residents have experienced immediate acceptance in the job market upon completing their residency. Of particular interest to us has been the current acceptance of our graduates in 12 states across the USA. The majority of our graduates perceived that the residency made them more competitive for employment (Table 5). While the roles and utilization of PAs and NNPs in the

Table 5 Neonatal physician assistant graduate survey responses relating to residency curriculum and employment impact

	Yes, *n* (%)
Do you feel that completing the residency made you more competitive in the job market?	18 (94.4)
Do you feel that there were more job opportunities available to you due to completing the residency?	18 (94.4)
Do you feel that you were able to obtain a higher salary due to completing the residency?	12 (61.1)
Were you able to find employment in a NICU after completion of the residency?	19 (100)
Are you currently working in a NICU?	17 (88.9)
Do you feel that the expectations and requirements for the residency were adequately explained to you prior to beginning your training?	18 (94.4)
Do you feel that the didactic components of the program were adequate?	15 (77.8)
Do you feel that the subspecialty rotations were beneficial?	18 (94.4)
Do you feel that the clinical components of the program (NICU service months, on-call shifts, etc.) were adequate?	18 (94.4)
Do you feel that you received ample opportunity to perform procedures during the residency?	18 (94.4)

NICU are nearly identical [1], both PAs and NNPs bring unique qualities and perspectives to the NICU team. PAs are trained in the "medical" model with a focus on the scientific process, whereas NNPs are trained in the "nursing" model, which focuses on the human aspect of illness [20]. In our unit, PAs and NNPs work interchangeably. However, a notable difference between NNPs and PAs upon graduation is the total hours of actual NICU experience in training. NNPs usually have at least 2 years of NICU bedside nursing experience prior to starting their NNP training [21]. Physician assistants usually have limited NICU experience before beginning their neonatal intensive care training. This postgraduate neonatal training model compensates for this difference by providing comprehensive learning experience including ~3000 h of bedside teaching, simulation exercises and hands-on patient care.

We acknowledge that as a limitation this manuscript presents the experience only of a single center. Moreover, we also recognize as a limitation that the survey was not previously validated and the descriptive/quantitative data we have shared are from retrospective surveys of our PA graduates. However, the qualitative assessment data were prospectively collected by an independent investigator from semi-structured interviews of both PA graduates and neonatologists showing similar results.

In summary, given that our program is the longest running neonatal PA residency in the nation, we are in a unique position to share the accumulated experiences of our curriculum. In 2005 when this neonatal PA training program started, the idea of PAs sharing responsibilities in the NICU was novel. Currently, the prescience of the founders of our program has been substantiated by the success of our graduates. Our mixed-methods evaluation of our program supports PAs in the NICU setting, both from a graduate and employer viewpoint. The premise of training PAs to work in the NICU is being adopted by several other centers across the USA. We firmly believe that neonatal PA residency graduates have become ideal candidates to fill the growing national need for advanced practice providers in the NICU. We propose that our model program can be a stepping stone to expand and enhance the role of PAs in neonatal intensive care.

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Author contributions EGAJ designed and conceptualized the study, conducted data collection, and interpretation of the quantitative sections. He participated in draft revisions, and approved the final draft. FH-F participated in development of the study plan, conducted all qualitative interviews, analyzed the qualitative data, wrote the qualitative sections, participated in draft revisions, and approved the final draft. TK and MDC designed and conceptualized the study and participated in draft revisions, and approved the final draft.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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