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A National Survey of Pediatric Residents and Delivery Room Training Experience

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Abstract

Objective—To investigate current delivery room training experience in U.S. pediatric residency programs and the relationship between volume of delivery room training and confidence in neonatal resuscitation skills.

Study design—Links to a web-based survey were sent to pediatric residency programs and distributed to residents. The survey concerned delivery room attendance during training and comfort level in leading neonatal resuscitation for various scenarios. Comfort level was rated on a 1 to 9 scale. Mixed models accounted for residency programs as random effects.

Results—For PL-3's, the mean number of deliveries attended was 60 (standard deviation 43), ranging from 13 to 143 deliveries for individual residency programs. Residents' confidence level in leading neonatal resuscitation was higher when attending more deliveries, with 90.3% of those attending > 48 deliveries having average score 5 or greater vs. 51.5% of those attending < 21 deliveries. Higher attendance also correlated with confidence in endotracheal intubation and umbilical line placement.

Conclusions—Wide variability existed within and among residency programs in number of deliveries attended. Volume of experience correlated with confidence in leading neonatal resuscitation and related procedural skills.

Keywords

Resident education; Neonatal resuscitation; Duty hours

General pediatricians are often the primary caregiver when resuscitation of newborns in the delivery room is required. According to the American Board of Pediatrics and the Accreditation Council for Graduate Medical Education, pediatric residency programs must ensure their residents become proficient at both the resuscitation and care of newborns in the delivery room including competency in the performance of technical procedures such as endotracheal intubation.(1)

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We previously found that there was a decline in pediatric resident attendance at deliveries from the years 2000 to 2005 at an academic training hospital.(2) The success rates of pediatric trainees in neonatal intubation in another center also declined over a 10 year period.(3) That study found a reduction in the number of intubations performed by pediatric residents over time, which was associated with decreased proficiency.

Both studies were limited in that they were single-center investigations, and may not be representative of pediatrics residency programs in general. The purpose of our study was to explore the extent of training in newborn medicine, particularly delivery room training, across United States pediatrics residency programs. Our aims were to investigate the scope and variation in pediatric resident delivery room experience across programs and to assess the extent to which quantity of experience influences confidence in neonatal resuscitation. We hypothesized that more delivery room training experience would correlate with higher confidence in neonatal resuscitation skills.

Methods

This study was approved by the Stanford University Institutional Review Board. An invitation to participate in a survey study was sent to a contact person (program director, program coordinator, or chief resident) at 195 categorical general pediatrics residency programs in all 50 states and Washington, D.C. Program and contact information were obtained using the Fellowship and Residency Electronic Interactive Database (FREIDA) published by the American Medical Association [www.ama-assn.org/ama/pub/category/2997.html]. Each residency program received a link to a voluntary and anonymous web-based survey which was distributed to residents in each program. We used a commercial web-based survey program [www.surveymonkey.com]. Surveys were identifiable by program, but not by individual respondent. Informed consent was obtained on the first page of the survey. The invitation was sent at the beginning of May 2008 and a reminder was sent late May to early June 2008. The survey distributed to residents is shown in Figure 1 (available at www.jpeds.com).

In addition to survey response data, we used information from FREIDA to characterize residency programs based on the number of residents in the program and by type of hospital at which the program is based. Programs were divided into quartiles based on the distribution of respondents to those having 12–30 residents, 31–45 residents, 46–59 residents, and 60–126 residents. The types of hospitals were also noted per FREIDA groupings, and were characterized as (1) community hospital; (2) university based; and (3) community hospital, university-affiliated.

The median number of deliveries, mean, and standard deviation (SD) were calculated for individual programs, and for the cohort by resident year. Comparisons were made for PL-3's only in regard to geographic region (South, West, Midwest, Northeast, Southeast), program type, and program size. We considered that PL-3's in May / June would be completing their general pediatric training and should be well prepared to independently manage patients. In comparing means for multiple groups, ANOVA was used with the Tukey multiple comparison test. The mean number of deliveries was also compared according to whether the residency program had neonatal nurse practitioners, whether there was an affiliated neonatology fellowship program, and by future plans of the resident.

The survey gave 4 scenarios for which residents rated their confidence level in leading neonatal resuscitation, such as a 33 week gestational age cesarean delivery for pre-eclampsia (Figure 1). Confidence was rated on a scale of 1 (Not comfortable at all) to 9 (Very comfortable). An average score of 5 or higher was considered as the cutoff for comparison. The confidence levels associated with the performance of technical skills of neonatal intubation and umbilical line

placement were also rated in a similar fashion. Other questions included characteristics of the program such as the presence of neonatal nurse practitioners and fellows in the neonatal intensive care unit, and future plans of the respondent. Respondents were divided into tertiles based on the number of deliveries attended. A mixed model was created using PROC GLIMMIX in SAS to account for the random effect of individual training programs as well as the other factors found to be associated with confidence level scores. Year of training, program size, program type, and number of deliveries attended were considered fixed effects and the individual residency program was modeled as a random effect. Odds ratios (OR) with 95% confidence intervals (CI) were estimated for each variable. SAS 9.1 (Cary, NC) was used for statistical analysis.

Results

There were a total of 828 responses to the resident survey. The following responses were excluded: one fourth year medicine-pediatrics resident, seven respondents who declined to consent, and 81 respondents who did not respond to any questions beyond the residency year. Of the 739 eligible survey responses, two respondents noted that they had already completed neonatology fellowship prior to residency. These responses were included in the analyses on number of deliveries attended, but excluded from the analyses regarding confidence level with resuscitation scenarios and procedural skills.

The 739 responses were representative of 86 of the 195 programs invited to participate. Average program size was similar between responding and non-responding programs (42 vs. 41 residents, $p = 0.7$). There was also no significant difference in distribution of program type ($p = 0.61$). There was a difference in response by region ($p = 0.04$), with the largest group of responding programs located in the Southeast (28% vs. 16% of non-responding programs).

For PL-1s, the mean number of deliveries attended over one year was 25 (SD 26) with median 16, ranging from 0 to 240. For PL-2's the mean number of deliveries attended over two years was 49 (SD 42) with median 38, ranging from 2 to 294. For PL-3's, the mean number of deliveries attended over three years was 60 (SD 43) with median 48, ranging from 1 to 225. In general, the number of deliveries attended declined with each successive year. Among PL-2's, the mean number of deliveries in the PL-2 year alone was 23 (median 16). Among PL-3's, the mean number of deliveries in the PL-3 year alone was 16 (median 12). The Table lists the mean number of total cumulative deliveries attended for PL-3s over their entire residency training according to program characteristics and future plans of residents.

There was wide variability in number of deliveries by program and also within individual programs. For programs with at least 3 PL-3s responding to the survey, the mean number of total deliveries attended by residents ranged from 13 to 143 according to residency program.

In analysis of all resident responses, confidence level in leading delivery room resuscitation, endotracheal intubation, and umbilical line placement all correlated with the number of deliveries attended (all $p < 0.0001$) (Figure 2). In considering what proportion of PL-3s had "very comfortable" levels of confidence (8 or 9 on the 9 point scale) in leading neonatal resuscitation, 19.4% had confidence score of 32 or higher. [H1]For endotracheal intubation, 28.7% of PL-3s recorded scores of 8 or 9. For umbilical line placement, 29.2% recorded scores of 8 or 9.

Generalized mixed models were created to see which factors may be related to average confidence score of 5 or greater for leading neonatal resuscitation, endotracheal intubation, and umbilical line placement. Program size and program type were not significantly associated with confidence for all three skills. First year residents were less likely to be confident in leading neonatal resuscitation than third year residents (OR 0.3, 95% CI 0.2, 0.5). Residents attending

< 21 deliveries (OR 0.2, 95% CI 0.1, 0.4) or 21–48 deliveries (OR 0.4, 95% CI 0.2, 0.7) had less confidence than those attending > 48 deliveries.

For endotracheal intubation, both attendance at 21–48 deliveries (OR 0.57, 95% CI 0.34, 0.95) and attendance at < 21 deliveries (OR 0.49, 95% CI 0.28, 0.86) were independently associated with less confidence than attendance at > 48 deliveries. For umbilical line placement, attendance at < 21 deliveries was associated with less confidence than attendance at > 48 deliveries (OR 0.42, 95% CI 0.24, 0.74).

Discussion

The assessment and care of newborns is an integral part of pediatric practice. The ACGME requires pediatric residents to become proficient in newborn resuscitation.(1) However, there is no mandatory minimum experience requirement for newborn resuscitation during residency, and no requirement for tracking experience during training. In our current study surveying U.S. residency programs, we found enormous variability in delivery room exposure during training. Furthermore, we found that confidence level with procedures required for newborn resuscitation was significantly associated with increased number of deliveries attended during training. These findings suggest that an examination of participation in a minimum number of delivery room experiences during residency must be entertained as part of training requirements as a surrogate for competency until truly objective and validated markers of performance are developed.

In a previous study, we found that at a single institution, resident delivery room experience had declined significantly over a 5 year period.(2) This may have been the result of various factors including changes in residency curriculum, work duty hours, and changes in the workforce incorporating increased use of pediatric hospitalists and neonatal nurse practitioners. (4–9) In the surgical literature, resident duty hours have been associated with decreased case exposure in some programs, but not in others.(10–14) These studies have been performed at individual training programs. Similarly, individual pediatric residency programs may have adapted differently in recent years to accommodate various requirements.

Attendance at more deliveries was associated with higher confidence levels in leading neonatal resuscitation, umbilical line placement, and endotracheal intubation. We did not have the ability to determine if that confidence level translated into actual competence and skill. However, this only highlights the lack of current means to assess competency for trainees.

Should there be a minimum experience requirement to ensure proficiency at resuscitation and management of newborns in the delivery room? Although intensive care and hospital based rotations have traditionally been the bulk of the time spent during pediatrics residency, there has been a trend to shift to more outpatient experiences. This may be appropriate for the majority of pediatricians who practice primarily in an urban / suburban outpatient setting, but places those whose scope of practice includes neonatal resuscitation at a potential disadvantage. Because delivery room training is difficult to schedule, it may be particularly at risk for being overlooked with competing priorities for resident education. Technical and procedural skills are particularly difficult to learn outside of a “real life” setting. Studies in the anesthesia literature have shown that there may be a minimum number of exposures necessary to ensure adequate training of skills such as intubation, vascular access, and epidural placement.(15–16) Considering the random timing of deliveries and those requiring extensive resuscitation, simulation-based learning could play an important role in helping residents gain exposure to a wide range of clinical scenarios and in creating a venue for truly objective assessment of skills.(17)

Our study is limited by selection bias in both the residency programs which chose to distribute the survey link to their residents, as well as the residents who chose to respond. There was regional variation in response with programs in the Southeast more likely to participate. However it is unlikely that the topic of delivery room attendance would have a strong influence on those who chose or chose not to respond. As in any survey asking for about past experience, our study may be subject to recall bias. We simplified this recollection process by not asking for the total number of deliveries over a year period, but rather asking for estimates over daily and weekly time periods. Although the estimates of absolute number of deliveries attended may be subject to error due to these biases, the wide variation in responses from within and across programs is still notable.

Newborn resuscitation is an essential skill for pediatricians. In our study, the confidence of residents in newborn resuscitation skills correlated strongly with the quantity of their delivery room experiences. Considering the variability of experiences found in our study, it may be beneficial to have a formalized assessment of the quantity and quality of delivery room training across residency programs.

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Abbreviations

ACGME	Accreditation Council for Graduate Medical Education
FREIDA	Fellowship and Residency Electronic Interactive Database
SD	Standard deviation
OR	Odds ratio
CI	Confidence interval

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1.

FOR QUESTIONS ABOUT THE STUDY, CONTACT: Dr. Henry Lee, 650-580-2963.

DESCRIPTION: You are invited to participate in a research study on resident experience for newborn care in pediatrics. You will be asked to complete a survey regarding your experience so far during residency. You will not be asked for any identifiable information. By having clicked on the link in your email, residency program information is part of the information collected. *** These answers are otherwise completely anonymous and cannot be traced to your email address. ***

RISKS AND BENEFITS: The risks associated with this study are none. The individual benefits which may reasonably be expected to result from this study are none. We cannot and do not guarantee or promise that you will receive any benefits from this study. Your decision whether or not to participate in this study will not affect your employment.

TIME INVOLVEMENT: Your participation in this experiment should take no longer than 10 minutes.

PAYMENTS: You will receive no payment for your participation.

SUBJECT'S RIGHTS: If you have read this form and have decided to participate in this project, please understand your participation is voluntary and you have the right to withdraw your consent or discontinue participation at any time without penalty or loss of benefits to which you are otherwise entitled. You have the right to refuse to answer particular questions. Your individual privacy will be maintained in all published and written data resulting from the study.

CONTACT INFORMATION:

* If you have any questions, concerns or complaints about this research study, its procedures, risks and benefits, or alternative courses of treatment, you should ask the Protocol Director, Dr. Henry Lee. You may contact him now or later at 650-580-2963. You should also contact him/her at any time if you feel you have been hurt by being a part of this study.

*Independent Contact: If you are not satisfied with how this study is being conducted, or if you have any concerns, complaints, or general questions about the research or your rights as a participant, please contact the Stanford Institutional Review Board (IRB) to speak to someone independent of the research team at (650)-723-5244 or toll free at 1-866-680-2906. You can also write to the Stanford IRB, Stanford University, Stanford, CA 94305-5401.

By clicking the link below you agree to the above consent. You may first print a copy for your records.

1. Do you consent to participation in this study?

☐ Yes

☐ No

2. No Consent Page

You have not given consent. You may now quit the survey.

3. Select Year

1. What year of pediatrics residency are you currently in?

☐ PL-1

☐ PL-2

☐ PL-3

4. 3rd year

*** 1. By the time you complete your 3rd year, how many weeks will you have spent THIS ACADEMIC YEAR attending deliveries?**

*** 2. How many deliveries did you attend on a typical day during one of those weeks?**

* 3. How many weeks during your second year of residency were spent on rotations involving delivery attendance?

* 4. How many deliveries did you attend on a typical day during one of those weeks?

* 5. How many weeks during your first year of residency were spent on rotations involving delivery attendance?

* 6. How many deliveries did you attend on a typical day during one of those weeks?

5. 2nd year

* 1. By the time you complete your 2nd year, how many weeks will you have spent THIS ACADEMIC YEAR attending deliveries?

2. How many deliveries did you attend on a typical day during one of those weeks?

* 3. How many weeks during your first year of residency were spent on rotations involving delivery attendance?

* 4. How many deliveries did you attend on a typical day during one of those weeks?

6. 1st year

* 1. By the time you complete your 1st year, how many weeks will you have spent THIS ACADEMIC YEAR attending deliveries?

* 2. How many deliveries did you attend on a typical day during one of those weeks?

7. Default Section

* 1. How comfortable are you in the delivery room setting in leading a resuscitation of the following newborns?

	1 - Not comfortable at all	2	3 - Slightly comfortable	4	5 - Somewhat comfortable	6	7 - Pretty comfortable	8	9 - Very comfortable
35 week GA vaginal delivery	☐	☐	☐	☐	☐	☐	☐	☐	☐
33 week GA cesarean for pre-eclampsia	☐	☐	☐	☐	☐	☐	☐	☐	☐
40 week GA meconium stained amniotic fluid	☐	☐	☐	☐	☐	☐	☐	☐	☐
26 week GA cesarean for IUGR	☐	☐	☐	☐	☐	☐	☐	☐	☐

8. Neonatal Intubation

* 1. How confident are you in performing the following procedures?

	1 - Not comfortable at all	2	3 - Slightly comfortable	4	5 - Somewhat comfortable	6	7 - Pretty comfortable	8	9 - Very comfortable
Neonatal Intubation	☐	☐	☐	☐	☐	☐	☐	☐	☐
Placing Umbilical Lines	☐	☐	☐	☐	☐	☐	☐	☐	☐

9. Who teaches neonatal resuscitation

* 1. At your institution, who is primarily responsible for providing neonatal resuscitation teaching and skills?

- ☐ Senior Residents
☐ Chief Residents
☐ Neonatal Nurse Practitioners
☐ Pediatric Attendings / Hospitalists
☐ NICU Fellows
☐ NICU Attendings

10. Questions

* 1. Do neonatal nurse practitioners work in any of the NICUs that you rotate through?

- ☐ Yes
☐ No

* 2. Does your program have a NICU fellowship?

- ☐ Yes
☐ No

11. After Residency

* 1. What do you plan on doing after you finish your residency?

- ☐ Neonatology fellowship
☐ Other subspecialty
☐ Primarily hospitalist
☐ Primarily clinic with some attendance at deliveries
☐ Primarily clinic with no attendance at deliveries
☐ Non-clinical position
☐ Not yet known

12. Thanks

Thanks for your participation!

1. Please feel free to provide any comments pertaining to this survey.

Figure 1.
Survey of pediatric residents.

Figure 2.
Confidence in neonatal resuscitation and procedural skills.

Table 1

Mean number of deliveries attended by third year pediatric residents during training.

	n	Mean	Standard deviation	P
U.S. Region				
South	16	57	44	0.32
West	20	58	32	
Midwest	65	59	44	
Northeast	50	60	36	
Southeast	68	62	51	
Program type				
Community hospital	10	96 [*]	35	0.01
University based	65	53	35	
Community hospital, university-affiliated	121	61	46	
Program size (number of residents)				
12–30	78	59	36	0.0008
31–45	45	58	39	
46–59	53	75 [^]	58	
60–126	43	45 [^]	32	
Neonatal nurse practitioners in NICU				
Yes	202	60	44	0.61
No	14	66	36	
Neonatal fellowship program at hospital				
Yes	140	57	42	0.14
No	76	66	47	
Future plans of resident				
Neonatology fellowship	25	67	54	0.33
Other subspecialty	86	66	46	
Primarily hospitalist	33	50	42	
Primarily clinic with some attendance at deliveries	20	56	35	
Primarily clinic with no attendance at deliveries	43	51	31	
Not yet known	8	57	44	

* Significantly different from other two program types

[^] Significantly different from each other