

Neonatal Resuscitation Skills Among Pediatricians and Family Physicians: Is Residency Training Preparing for Postresidency Practice?

AMY M. WOOD, MD
M. DOUGLAS JONES JR, MD
JAMES H. WOOD, MD
ZHAOXING PAN, MD, PhD
THOMAS A. PARKER, MD

Abstract

Background Pediatricians and family physicians are responsible for providing newborn resuscitation, yet Accreditation Council for Graduate Medical Education requirements for training in this area during residency differ markedly for the two specialties. Our objectives were to determine (1) the extent to which neonatal resuscitation training differs for pediatric and family medicine residents; (2) the extent to which general pediatricians and family physicians engage in newborn resuscitation in their practice; and (3) whether use of resuscitation skills differs between urban/suburban and rural providers.

Methods We surveyed a national cohort of pediatricians and family physicians who obtained board certification between 2001 and 2005. Data were analyzed based on type of physician and setting of current practice.

Results Survey response rate was 22% (382 of 1736). Compared with family medicine physicians, pediatricians received more neonatal resuscitation training during residency. Most members of both groups had attended no deliveries in the year prior to the survey (75% [111 of

148] versus 74% [114 of 154]). In their current practice, the groups were equally likely to have provided a newborn bag and mask ventilation, chest compressions, and resuscitation medications. Pediatricians were more likely than family physicians to have attempted to either intubate a newborn (20% [28 of 148] versus 10% [16 of 153]; $P = .0495$) or insert umbilical catheters (15% [22 of 148] versus 5% [8 of 153]; $P = .005$). Regardless of specialty, rural physicians were much more likely to report that they attended deliveries (61% [41 of 67] versus 15% [36 of 234]; $P < .001$). Among rural pediatricians attending deliveries, 44% (7 of 16) reported feeling inadequately prepared for at least one delivery in the past year.

Conclusions Few primary care pediatricians and family physicians provide newborn resuscitation after residency. For those who do attend deliveries, current training may provide insufficient preparation. Flexible, individualized residency curricula could target intensive resuscitation training to individuals who plan to practice in rural areas and/or attend deliveries after graduation.

Amy M. Wood, MD, is Instructor of Pediatrics in the Division of Neonatology, Department of Pediatrics, University of Colorado School of Medicine, and Attending Neonatologist at Denver Health Medical Center; **M. Douglas Jones Jr, MD**, is Professor of Pediatrics, Senior Associate Dean for Clinical Affairs, and Attending Neonatologist in the Division of Neonatology, Department of Pediatrics, University of Colorado School of Medicine; **James H. Wood, MD**, is Senior Resident in the Department of Pediatric Surgery at the University of Colorado Denver School of Medicine; **Zhaoxing Pan, MD, PhD**, is Instructor in Pediatrics and Biostatistician in the Department of Biostatistics, Children's Hospital Colorado Research Institute; and **Thomas A. Parker, MD**, is Associate Professor of Pediatrics, Director of Fellowship Training in Neonatology, and Attending Neonatologist in the Division of Neonatology, Department of Pediatrics, University of Colorado Denver School of Medicine.

We are grateful for the help of Dr Arnold Levinson, PhD, MJ, for sharing his expertise in survey design.

Funding: The authors report no external funding source.

Corresponding author: Thomas A. Parker, MD, Division of Neonatology, Department of Pediatrics, University of Colorado Denver, Room 4304, Mail Stop 8402, 12121 East 17th Avenue, Aurora, CO 80045, 303.724.2861, parker.thomas@tchden.org

Received November 30, 2010; revision received April 22, 2011; accepted April 27, 2011.

DOI: <http://dx.doi.org/10.4300/JGME-D-10-00234.1>

Editor's Note: The online version of this article contains the survey instrument used in this study.

Background

Approximately 10% of newborns require medical intervention within the first minutes of life.¹ Both pediatricians and family physicians provide this care to newborns, especially in rural settings; however, published data are inadequate to assess the correlation between neonatal resuscitation training during residency and later use of newborn resuscitation skills.^{2,3}

The 2007 Accreditation Council for Graduate Medical Education (ACGME) requirements for pediatric residency education specify 3 to 4 months of experience in the neonatal intensive care unit,⁴ including experience in neonatal resuscitation. Family medicine residency programs are required to provide general experience in the care of neonates, with no specific instructions regarding acquisition

of delivery room resuscitation skills.⁵ No studies have examined how residency experience in neonatal resuscitation matches later practice in pediatrics or family medicine.

To refine residency education in newborn resuscitation, more data are required on which physicians attend deliveries, what skills they require, and how well residency experiences are meeting their needs. We surveyed pediatricians and family physicians: (1) to determine the extent to which neonatal resuscitation training differs for pediatric and family medicine residents; (2) to determine the extent to which general pediatricians and family physicians engage in newborn resuscitation in their current practices; (3) to determine whether use of resuscitation skills differs between urban/suburban and rural providers; and (4) to correlate residency opportunities with perceptions of comfort with resuscitation among physicians with current delivery room responsibilities.

Methods

Survey Design

We designed a 26-question survey according to a Tailored Design Method⁶ and with a consultant experienced in survey methodology. The survey focused on the development and use of neonatal resuscitation skills during and after residency training. Prior to mailing, the survey was pilot tested locally with faculty and fellows, resulting in minor changes.

Study Population

We sent surveys to pediatricians and family physicians in rural and urban regions that (1) had trained after the 1997 ACGME changes to pediatric residency requirements and (2) had been out of training for a minimum of 2 years, to allow for the establishment of practice patterns. To meet these inclusion criteria, we limited the study population to first-time board certifiers between 2001 and 2005. Respondents who graduated from residency before 1997 or trained in a foreign program were excluded.

Physician Sampling

With a level of significance set at 5%, we determined that we would need at least 18 respondents per group.⁷ Based on a projected response rate of 30%, we anticipated that we would need to survey 60 pediatricians and 60 family physicians. Using the 2006 American Medical Association (AMA) physician distribution data,⁸ we estimated that approximately 20% of physicians from both groups practice in rural areas. We anticipated that sending a total of 2000 surveys, 1000 to each specialty group, would adequately power our study.

We obtained addresses via the American Board of Pediatrics and the American Board of Family Medicine, and paper surveys were mailed in 2008. This study received exemption from the Colorado Multiple Institute Review Board.

What was known

Newborn resuscitation is an important skill for pediatricians and family medicine physicians attending deliveries.

What is new

Residency experience differs markedly, with more focus on neonatal resuscitation skills in pediatrics. Rural physicians were more likely to report needing resuscitation skills.

Limitations

Findings are based on self-reports of practice and perceived preparedness.

Bottom line

Residents planning to locate in rural practice may benefit from added training in pediatric resuscitation.

Data Analysis

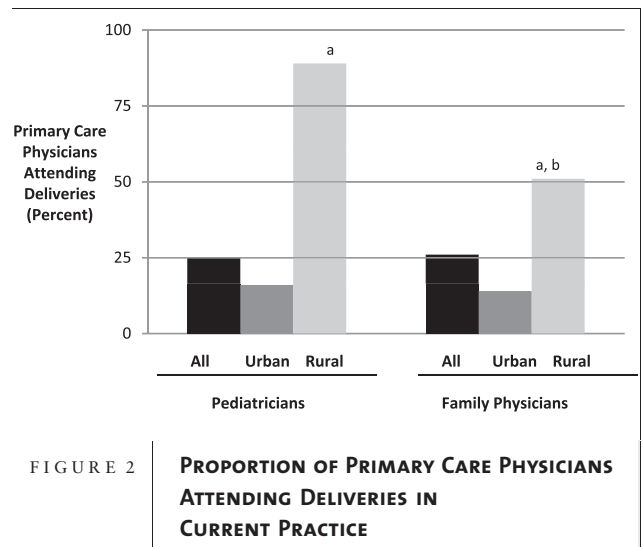
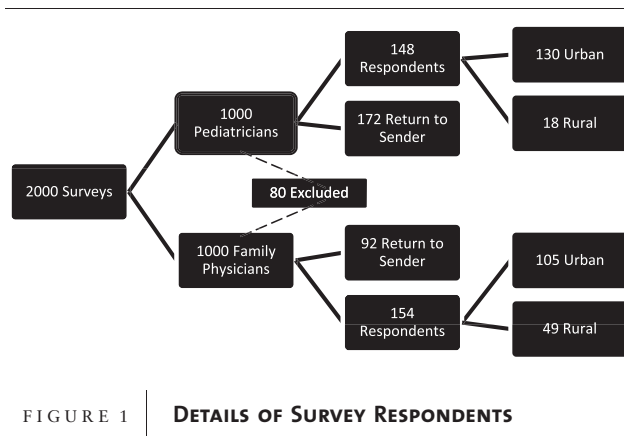
We entered responses into a Statistical Analysis Software (SAS Inc, Cary, NC) database and categorized them according to type of residency training and practice location. We conducted χ^2 tests to evaluate categorical data and Spearman correlation coefficients to assess the extent of association between ordinal variables. Physicians who were not attending any deliveries in their current practice were excluded from the “comfort in current practice” analyses. We used cross-tabulations between the residency training and the current practice sections to uncover patterns that might indicate insufficient training or predictors of comfort for each group.

Results

Of the 2000 mailed surveys, we received 382 completed surveys (22% response rate; 382 of 1736). Eighty surveys were excluded from analysis; reasons included training outside the United States, attending residency outside of the 2001–2005 time frame, being subspecialists, and having incomplete answers. Of the 302 surveys that met our inclusion criteria, 148 were from pediatricians and 154 were from family physicians. Data were analyzed according to a self-designation of rural (22%) or urban/suburban (78%). The 4 subsets included: 18 rural pediatricians, 130 urban pediatricians, 49 rural family physicians, and 105 urban family physicians (FIGURE 1). One urban pediatrician and one rural family physician failed to complete every question, resulting in a sample size of 147 pediatricians and 153 family physicians for some of the data analysis.

Delivery Room Experience During Residency

Pediatricians reported attending more deliveries, both term and preterm, during their residency training than family physicians ($P < .001$). Most members of both



^a $P < .01$ versus urban practitioners; ^b $P < .01$ versus rural pediatricians.

groups reported attending more than 30 term deliveries (pediatricians: 85% [126 of 148]; family physicians: 62% [65 of 154]; $P > .001$), but more pediatricians than family physicians reported attending more than 10 preterm deliveries (89% [131 of 148], 22% [33 of 153]; $P < .001$). The difference was similar among physicians currently attending deliveries: 89% [33 of 37] of pediatricians reported attending 10 or more preterm deliveries compared with 30% [12 of 40] of family physicians ($P < .001$).

Family physicians were more likely than pediatricians to report completion of residency training without successfully intubating a neonate (family physicians: 48% [73 of 153] versus pediatricians: 1% [1 of 148]; $P < .001$) and without successfully inserting umbilical catheters (family physicians: 60% [92 of 153] versus pediatricians: 4% [6 of 148]; $P < .001$). Pediatricians were more likely than family physicians to report feeling comfortable with all 6 neonatal resuscitation skills (bag-mask ventilation, term and preterm intubations, chest compressions, provision of resuscitation medications, and insertion of umbilical catheters) upon graduation from residency ($P < .001$ for all 6).

Need for Delivery Room Skills After Residency

Distinctions in residency training experiences did not match postresidency practice patterns. Similar proportions of pediatricians and family physicians reported attending no deliveries in the year prior to the survey (75% [110 of 147] and 74% [114 of 154], respectively; FIGURE 2), and similar proportions attended more than 20 deliveries (7% [11 of 147] and 11% [17 of 154], respectively). Pediatricians and family physicians were equally likely to provide newborn bag and mask ventilation, chest compressions, or resuscitation medications. Pediatricians were more likely to have intubated a term ($P = .049$) or preterm ($P < .001$) baby, and to have inserted umbilical catheters ($P = .007$).

Need for Delivery Room Skills Based on Practice Setting

Rural physicians were significantly more likely to have attended at least one delivery in the year prior to the survey (rural: 61% [41 of 67] versus urban/suburban: 15% [25 of 234]; $P < .001$). Although 30% (20 of 67) of rural physicians had attended more than 20 deliveries in the previous year, just 3% (8 of 234) of their urban/suburban counterparts had done so ($P < .001$). Rural physicians were more likely than urban/suburban physicians to be responsible for a newborn delivered by uncomplicated repeat (51% [34 of 67] versus 11% [26 of 232]; $P < .001$) or emergency cesarean section (54% [36 of 67] versus 9% [22 of 232]; $P < .001$), or for a 28-week preterm infant delivered emergently (49% [33 of 67] versus 8% [18 of 232]; $P < .001$). Rural physicians were more likely to engage in all 6 of the neonatal resuscitation procedures evaluated ($P < .001$ for all; TABLE 1).

Comfort With Delivery Room Skills Among Physicians Who Attend Deliveries

We examined the correlation between reported comfort with resuscitation skills and experiences both during residency and during the year immediately preceding the survey in the 77 respondents who reported currently attending deliveries. The number of successful term intubations and umbilical catheter insertions during residency correlated with current comfort for intubations and umbilical line insertion (Spearman correlation coefficients 0.5 and 0.48, respectively). The frequency of attempted neonatal endotracheal intubations in the previous year correlated with current comfort with intubation of both term and preterm infants (Spearman correlation coefficients 0.51 and 0.46, respectively). For umbilical catheter insertion, the

TABLE 1 RESUSCITATION EXPERIENCE IN THE PAST YEAR

	Pediatricians, No. (%) (n = 147)		Family Physicians, No. (%) (n = 153)	
	Urban (n = 129)	Rural (n = 18)	Urban (n = 105)	Rural (n = 48)
Bag and mask ventilation	30 (23)	16 (89) ^a	11 (10)	25 (52) ^a
Term intubation	19 (15)	13 (72) ^a	7 (7)	15 (31) ^a
Preterm intubation	9 (7)	9 (50) ^a	1 (1)	1 (2) ^a
Chest compressions	16 (12)	12 (67) ^a	8 (8)	13 (27) ^a
Resuscitation medications	11 (9)	9 (50) ^a	6 (6)	9 (19) ^a
Umbilical catheter insertion	14 (11)	11 (61) ^a	2 (2)	6 (13) ^a

^a $P < .01$, rural versus urban, within physician subtype.

frequency of attempts in the past year also correlated with current comfort (Spearman correlation coefficient 0.61). Data for comfort with resuscitation skills among the 4 subgroups are shown in TABLE 2. Among rural practitioners who had attended any deliveries in the last year, 7 of 16 pediatricians (44%) and 10 of 25 family physicians (40%) felt inadequately prepared for at least one delivery.

Discussion

Our survey asked recent graduates of pediatric and family medicine residency programs about their experiences with neonatal resuscitation both during and since completion of residency. Our primary findings were that: (1) pediatricians recall attending more deliveries, particularly preterm deliveries, during residency and are more likely than family physicians to have successfully intubated a newborn and inserted umbilical catheters at the completion of residency training; (2) approximately 75% of general pediatricians and family physicians had not attended a single delivery in the year prior to the survey; (3) rural practitioners in both specialties are much more likely than urban/suburban practitioners to attend deliveries and provide neonatal resuscitation.

Nearly all pediatric respondents (94%; 139 of 148) indicated that they had attended at least 20 term deliveries, and most recalled comfort with their newborn resuscitation skills at the completion of residency. Family medicine respondents (72%; 101 of 154) indicated that they had also attended at least 20 term deliveries. The survey did not allow us to distinguish between attendance at deliveries and active participation in resuscitations, but a substantial proportion of both groups completed their residencies without successfully intubating a newborn or inserting umbilical catheters, and family physicians were more likely to complete their residencies without successfully intubating a baby or inserting umbilical catheters.

In contrast to their residency experiences, only 26% (77 of 301) of respondents had attended even a single delivery in the previous year of their current practice, regardless of specialty. Pediatricians were much more likely than family physicians to have intubated a baby or inserted umbilical catheters, suggesting that they were responsible for more complex resuscitations. Regardless of specialty, rural primary care physicians were more likely to have responsibility for newborn resuscitation and to have engaged in the full spectrum of resuscitation skills in the past year.

Our findings support proposals to increase individualization of residency training as recently advocated by the Residency Review and Redesign in Pediatrics (R³P) project⁹ and the Preparing the Personal Physician for Practice (P⁴) project.¹⁰ Although most respondents had not used their neonatal resuscitation skills in the previous year, it is concerning that of those rural pediatricians who had attended any deliveries in the last year, nearly half (44%) felt inadequately prepared for at least one delivery (data not shown). “One size fits all” training overemphasizes the acquisition of newborn resuscitation skills for most primary care providers who will never use them, and it likely constitutes inadequate preparation for those who will. Other areas of pediatrics may be similarly overemphasized or underemphasized during training relative to later need. Defining these areas and determining which are foundational and which should be individualized would require more comprehensive study and discussion. An optimal approach to career-specific learning might include flexibility to allow access to individualized training both near the end of residency and after completion of formal training.

Our study was not designed to allow us to determine a threshold of resuscitation experience needed to achieve comfort. We found that provider comfort correlated moderately with the number of opportunities to practice resuscitation both during and after residency training.

TABLE 2 RESPONDENTS WHO ARE VERY OR SOMEWHAT COMFORTABLE WITH CURRENT RESUSCITATION SKILLS, AMONG THOSE WHO ATTEND DELIVERIES

	Pediatricians, No. (%) (n = 37)		Family Physicians, No. (%) (n = 40)	
	Urban (n = 21)	Rural (n = 16)	Urban (n = 15)	Rural (n = 25)
Bag and mask ventilation	20 (95)	16 (100)	15 (100)	24 (96)
Term intubation	17 (81)	13 (81)	6 (40) ^a	18 (72)
Preterm intubation	11 (52)	9 (56)	2 (13) ^a	5 (20) ^a
Chest compressions	19 (90)	14 (88)	13 (87)	22 (88)
Resuscitation medications	14 (67)	12 (75)	4 (27) ^a	16 (64) ^b
Umbilical catheter insertion	10 (48)	10 (63)	1 (7) ^a	11 (44) ^b

^a $P < .05$, pediatrician versus family physician, within practice location.

^b $P < .05$, rural versus urban, within physician subtype.

Although comfort cannot be interpreted as a reliable surrogate for competence,¹¹ our study suggests that guidelines for establishing competency might include a minimum number of successful patient encounters. Our findings are consistent with those recently reported by Lee et al,¹² who found that pediatric residents reported greater procedural comfort with increased delivery room attendance.

Our study is the only survey to target both general pediatricians and family physicians and to focus specifically on newborn resuscitation. A national survey of pediatricians who graduated from medical school in 1994 found that 45% were attending deliveries.¹³ An earlier study found that 31% to 40% of general pediatricians practicing in Texas in 1994 provided intensive care for newborns, and that 51% to 81% performed intubations on their patients.³ Although neither study specifically asked about newborn resuscitation responsibilities, comparisons with our results are consistent with the hypothesis that primary care physicians are now less likely to attend deliveries and provide intensive newborn care after residency than previously.

A principal limitation of our study is the low response rate of 22%. In general, physicians are less likely than other groups to respond to surveys, and physician response rates seem to be declining.^{14–16} The primary concern with the low response rate is the possibility of nonresponse error. In an attempt to detect nonrespondent bias, we compared responses from the last 20% of our respondents with the first 80% and found no differences. In addition, our respondents were similar in demographic makeup to 2006 AMA distribution data describing the urban versus rural practitioner distribution. We believe our sample likely to be nonbiased and representative of our target population. A second limitation is our reliance on respondent recall to establish residents' residency experience. Although we doubt differential recall among respondents in our different groups

biased our results, time between residency completion and our survey may have diminished the accuracy of recall.

Conclusions

This study provides insight into the relevance of training in neonatal resuscitation for providers of primary care to children. Residency training for primary care physicians offers a limited time to learn a large and constantly increasing body of knowledge. Focused training in neonatal resuscitation during residency would be better determined by anticipated practice needs and location than by specialty.

References

- 1 American Heart Association; American Academy of Pediatrics. 2005 American Heart Association (AHA) guidelines for cardiopulmonary resuscitation (CPR) and emergency cardiovascular care (ECC) of pediatric and neonatal patients: neonatal resuscitation guidelines. *Pediatrics*. 2006;117:e1029–e1038. <http://pediatrics.aappublications.org/cgi/content/full/117/5/e1029>. Accessed October 12, 2010.
- 2 Melzer SM, Grossman DC, Hart LG, Rosenblatt RA. Hospital services for rural children in Washington state. *Pediatrics*. 1997;99(2):196–203.
- 3 Feigin RD, Drutz JE, O'Brian Smith E, Collins CR. Practice variation by population: training significance. *Pediatrics*. 1996;98:186–190.
- 4 Accreditation Council for Graduate Medical Education. ACGME program requirements for graduate medical education in pediatrics. http://www.acgme.org/acWebsite/downloads/RRC_progReq/320_pediatrics_07012007.pdf. Accessed October 15, 2010.
- 5 Accreditation Council for Graduate Medical Education. ACGME program requirements for graduate medical education in family medicine. http://www.acgme.org/acWebsite/downloads/RRC_progReq/120pro7012007.pdf. Accessed October 15, 2010.
- 6 Dillman D. *Mail and Internet Surveys: The Tailored Design Method*. Hoboken, NJ: John Wiley & Sons, Inc; 2007.
- 7 Cohen J. A power primer. *Psychol Bull*. 1992;112(1):155–159.
- 8 Smart DR. *Physician Characteristics and Distribution in the US, 2006*. New York, NY: American Medical Association Press; 2008:268.
- 9 Jones MD Jr, McGuinness GA. The future of pediatric residency education: prescription for more flexibility. *J Pediatr*. 2009;154(2):157–158.
- 10 David AK. Preparing the personal physician for practice (P4): residency training in family medicine for the future. *J Am Board Fam Med*. 2007;20(4):332–341.
- 11 Falck AJ, Escobedo MB, Baillargeon JG, Villard LG, Grunkel JH. Proficiency of pediatric residents in performing neonatal endotracheal intubation. *Pediatrics*. 2003;112(6, pt 1):1242–1247.

- 12 Lee HC, Chitkara R, Halamek LP, Hintz SR. A national survey of pediatric residents and delivery room training experience. *J Pediatr*. 2010;157(1):158–161.
- 13 Walton DM, Edwards MC. Nationwide survey of pediatric residency training in newborn medicine: preparation for primary care. *Pediatrics*. 2002;110(6):1081–1087.
- 14 Asch DA, Jedziewski MK, Christakis NA. Response rates to mail surveys published in medical journals. *J Clin Epidemiol*. 1997;50(10): 1129–1136.
- 15 Cummings SM, Savitz LA, Konrad TR. Reported response rates to mailed physician questionnaires. *Health Serv Res*. 2001;35(6):1347–1355.
- 16 Grava-Gubins I, Scott S. Effects of various methodologic strategies: survey response rates among Canadian physicians and physicians-in-training. *Can Fam Physician*. 2008;54(10):1424–1430.
- 17 Moore D, Tarnai J. Evaluating nonresponse error in mail surveys. In: Groves RM, Dillman DA, Eltinge JL, Little RJA, eds. *Survey Nonresponse*. New York, NY: John Wiley & Sons, Inc; 2002.