

Determinants of Physician, Sonographer, and Laboratory Productivity: Analysis of the Third Survey from the American Society of Echocardiography Committee on Pediatric Echocardiography Laboratory Productivity

Brian D. Soriano, MD, FASE, Craig E. Fleishman, MD, FASE, FACC, Andrea M. Van Hoever, BA, Bonnie Wright, RDCS, FASE, Beth Printz, MD, PhD, Theresa A. Tacy, MD, Vivekanand Allada, MD, Wyman W. Lai, MD, MPH, FASE, Sujatha Buddhé, MBBS, and Shubhika Srivastava, MBBS, FASE, *Seattle, Washington; Orlando, Florida; Durham, North Carolina; Lawrenceville, Georgia; San Diego, Palo Alto and Orange, California; Pittsburgh, Pennsylvania; and New York, New York*

Background: The American Society of Echocardiography Committee on Pediatric Echocardiography Laboratory Productivity was formed in 2011 to study institutional factors that could influence the clinical productivity of physicians and sonographers in academic pediatric echocardiography laboratories. In the previous two surveys, staff clinical productivity remained stable while total echocardiography volumes increased. This third survey was designed to assess how clinical productivity is associated with laboratory infrastructure elements such as training, administrative tasks, quality improvement, research, and use of focused cardiac ultrasound (FCU).

Methods: Survey questions were sent by e-mail to North American laboratories. The aims were to assess (1) educational and training obligations, (2) academic productivity and research, (3) laboratory medical director satisfaction, (4) quality improvement, (5) laboratory leadership roles, and (6) impact and use of FCU. Survey responses were compared with clinical productivity metrics defined in the first two surveys.

Results: There were 38 responses. Academic productivity was higher at institutions with more dedicated imaging personnel, personnel with dedicated protected academic time, and advanced imaging fellows. Academic productivity did not correlate with clinical productivity and was not significantly affected by the presence of dedicated research sonographers. The satisfaction level of laboratory medical directors was related to dedicated administrative time and an administrative stipend. The majority of administrative roles were tasked to the laboratory medical director with support of the technical director. FCU was listed as a hospital privilege at four institutions (13%). Twenty-two (58%) were training FCU providers in one or more subspecialties. FCU was not associated with clinical or academic productivity.

Conclusion: This third survey gathered supplemental data to complement the clinical productivity data collected from the first two surveys. Together, the results of these surveys further describe the range of factors that can affect North American academic pediatric echocardiography laboratories. (*J Am Soc Echocardiogr* 2018; ■:■-■.)

Keywords: Pediatric echocardiography laboratory, Academic productivity, Fellow training, Workforce

The American Society of Echocardiography Committee on Pediatric Echocardiography Laboratory Productivity (C-PELP) was formed in 2010. The aim of this group was to study institutional factors that could influence the clinical productivity of physicians and sonogra-

phers in academic pediatric echocardiography laboratories. On the basis of two prior surveys with questionnaires sent in 2011 and 2014, staff productivity remained unchanged, suggesting that hiring practices probably matched laboratory volume increases.^{1,2}

From the Seattle Children's Hospital, Seattle, Washington (B.D.S., S.B.); the Arnold Palmer Hospital for Children, Orlando, Florida (C.E.F.); the American Society of Echocardiography, Durham, North Carolina (A.M.V.); Gwinnett Medical Center, Lawrenceville, Georgia (B.W.); the University of California, San Diego, San Diego (B.P.); Lucile Packard Children's Hospital, Palo Alto (T.A.T.); CHOC Children's Hospital, Orange (W.W.L.), California; Children's Hospital of Pittsburgh of UPMC, University of Pittsburgh, Pittsburgh, Pennsylvania (V.A.); and the Icahn School of Medicine, Mount Sinai Medical Center, New York, New York (S.S.).

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Reprint requests: Brian D. Soriano, MD, FASE, Seattle Children's Hospital, 4800 Sand Point Way NE, M/S RC.8.820, Seattle, WA 98105 (E-mail: brian.soriano@seattlechildrens.org).

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Abbreviations

C-PELP = Committee on Pediatric Echocardiography Laboratory Productivity

FCU = Focused cardiac ultrasound

FTE = Full-time equivalent

QI = Quality improvement

TEE = Transesophageal echocardiography

TTE = Transthoracic echocardiography

As health care needs and economic forces evolve, there is ongoing need to evaluate factors in an academic echocardiography laboratory that may affect efficiency and productivity. In 2015, C-PELP created an interim survey to determine whether additional factors that rely on dedicated personnel time affect clinical productivity. The third C-PELP survey was designed to assess the current practices and impact on clinical and academic productivity by administrative organization of the pedi-

atric echocardiography laboratory, education, training, quality improvement (QI), and research infrastructure. It was hypothesized that time and resources allocated to all of the above would affect academic and clinical productivity.

The objectives of the third C-PELP survey were to assess (1) education and training implementation for both cardiology fellows and sonographers; (2) research and academic productivity, defined as number of abstracts and number of papers per physician full-time equivalent (FTE); (3) laboratory leadership infrastructure and organization; (4) QI; and (5) performance of point-of-care ultrasound or focused cardiac ultrasound (FCU).

METHODS

In 2015 the third C-PELP survey was sent by e-mail to 92 North American pediatric echocardiography laboratories, identified from the American Society of Echocardiography database of echocardiography laboratory medical directors, which also included centers that participated in the first two surveys. Recipients were asked to respond to the survey using the Research Electronic Data Capture service (<http://www.project-redcap.org>). Seventy-one questions were designed to meet the objectives noted above (Appendix 1):

1. Education and training obligations
 - a. For fellows: number of programs with categorical and advanced fellowships, number of imaging months in fellowship, type of imaging modalities incorporated into training.
 - b. For sonographers: allocation of financial and time resources for continuing education, sources of educational funding devoted to sonographers or sonographer students.
2. Research and academic productivity: amount of imaging-focused research performed by fellows and sonographers, degree of sonographer involvement, resources, barriers to research, number of abstracts generated, number of publications in peer-reviewed journals.
3. Echocardiography laboratory medical director: years in role, level of satisfaction, degree of administrative protected time.
4. Laboratory tasks and leadership roles: a matrix of survey questions sought to determine who was assigned to administrative, clinical, research, and educational tasks and how much relative work was performed amongst individuals. Leadership categories that were created for the survey included medical director, technical director, sonographer lead, and hospital administrator. A five-point scale was used to evaluate roles and responsibilities for select tasks. This included

- a. sonographer-related tasks (who was responsible for sonographer schedules, hiring, disciplinary action, periodic staff assessment); and
 - b. echocardiography laboratory equipment tasks (cart settings and presets, maintenance, information systems, capital purchases).
5. QI: amount of time spent on QI efforts, error detection methods and reporting, whether time is protected, implementation of pediatric appropriate use criteria.
 6. Point-of-care ultrasound (FCU): prevalence, credentialing, development.

Metrics and Outcomes

Assessments of academic productivity in the survey were targeted toward the 2014 calendar year. For metrics that factored in the numbers of fellows in each program, the 2014 academic year was used. Longitudinal data from the current survey were compared with data from the prior 2014 C-PELP survey.² Clinical productivity metrics defined by the first two surveys included (1) number of echocardiograms per physician FTE per day, (2) number of echocardiograms per sonographer per year, and (3) number of echocardiograms per machine per year.

Statistical Methods

Continuous variables are expressed as mean \pm SD and nonparametric variables as median (range). Categorical variables are expressed as frequency (percentage). Groups were compared using *t* tests or Mann-Whitney *U* tests on the basis of distribution for continuous variables and the Fisher exact test for categorical variables. Multiple correlations and analysis of variance were performed to assess relationships, trends, and determinants of the primary outcomes. Multivariate linear regression analysis was performed to assess independent association. All statistical analyses were performed using SPSS version 19.0 (SPSS, Chicago, IL), and a *P* value $< .05$ was considered to indicate statistical significance.

RESULTS

Among 92 survey requests sent to echocardiography laboratories, there were 38 responses (41%) compared with a response rate of 73% (54 of 73) and 65% (64 of 99) for the first two surveys, respectively. In similar proportions to the prior survey, 31 (82%) had categorical pediatric cardiology fellowship programs, and 12 (32%) had advanced imaging fellows. Six centers (16%) performed <150 surgical procedures per year, while more than half (20 centers), performed ≥ 350 procedures. For the Intersocietal Accreditation Commission, 95%, 73%, and 84% of laboratories were accredited in transthoracic, transesophageal, and fetal modalities, respectively. There were no statistically significant differences between the composition of the 38 centers and the centers in the previous survey when comparing surgical volumes, echocardiography volumes, or the amount of physician or sonographer FTEs required to cover day-to-day activities.

Centers were defined as either closed laboratories or open laboratories. For open laboratories, any provider can order an echocardiographic examination without cardiologist preapproval. In closed laboratories, orders were typically approved by a consulting cardiologist. There was no association on research productivity and whether the laboratory was open or closed.

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