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ORIGINAL ARTICLE

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Using a statewide survey methodology to prioritize pediatric cardiology core content

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Abstract

Objective: Although pediatrician-reported relevance of Canadian cardiology-specific objectives has been studied, similar data are not available for the 2016 American Board of Pediatrics (ABP) cardiology-specific objectives. This study asked Kentucky trainees, pediatricians, and pediatric cardiologists to identify "most important" content within these objectives.

Design, Methods, Outcome Measures: This cross-sectional study used an original, online survey instrument based on the 2016 ABP cardiology-specific objectives. We collected quantitative data (numerical indications of importance) and qualitative data (open-ended replies regarding missing content and difficulty in teaching and learning). Respondents indicated the top two choices of most important items within eight content areas. Descriptive statistics (frequencies and percentages) and chi-square analysis were calculated. Content within categories was organized using naturally occurring "clusters" and "gaps" in scores. Common themes among open-ended qualitative responses were identified using Pandit's version of Glaser and Strauss Grounded theory (constant comparison).

Results: Of the 136 respondents, 23 (17%) were residents, 15 (11%) fellows, 85 (62%) pediatricians, and 13 (10%) pediatric cardiologists. Of attendings, 80% reported faculty/gratis faculty status. Naturally occurring clusters in respondent-designated importance resulted in $\leq$3 "most selected" objectives per content area. Objectives in "most selected" content pertained to initial diagnosis (recognition of abnormality/disease) (n = 16), possible emergent/urgent intervention required (n = 14), building a differential (n = 8), and planning a workup (n = 4). Conversely, themes for "least selected" content included comanagement with subspecialist (n = 15), knowledge useful in patient-family communication (n = 9), knowledge that can be referenced (as needed) (n = 7), and longitudinal/follow-up concerns (n = 5).

Conclusions: This study demonstrated the utility of an online survey methodology to identify pediatric cardiology content perceived most important. Learners and faculty generally provided concordant responses regarding most important content within the cardiology-specific ABP objectives. Medical educators could apply this methodology to inform curriculum revision.

KEYWORDS
curriculum, medical education, residents, trainees

1 | INTRODUCTION

Cardiology introduces diverse and complex content to the training of pediatricians.[1–3] The American Board of Pediatrics (ABP) has compiled

Abbreviations: AAP, American Academy of Pediatrics; ABP, American Board of Pediatrics; EKG, electrocardiogram; UK, University of Kentucky; UL, University of Louisville.

a 77-page document to develop the general pediatrics certification exam which includes 52 cardiology-specific objectives.[4] Although pediatrician-reported relevance of Canadian cardiology-specific objectives has been studied, similar data are not available regarding perceived importance of the 2016 ABP objectives.[5] Because of the limited time available for cardiology education during pediatric residency training and broad range of topics included within these objectives, prioritizing these objectives by practical importance would be useful in curriculum reform.

The previous studies pertaining to resident education in cardiology have considered the best methods for teaching specific, investigator-driven objectives including electrocardiogram (EKG) interpretation, auscultation, and management of simulated patients.[6–10] Although these studies have demonstrated positive outcomes, self-reported needs of learners were not emphasized. Self-assessment data suggest that pediatric residents can develop goals related to personal limitations, with this ability improving throughout training.[11,12] In the model for self-regulated learning outlined by Lockspeiser et al.,[13] faculty and residents share responsibility for defining and monitoring goals.

This mixed-methods study asked pediatric trainees, general pediatricians, and pediatric cardiologists to select the "most important" cardiology content included in the ABP objectives, and then identified common themes among "most selected" and "least selected" content. This Kentucky-wide study begins to address this gap in pediatric education research. Understanding differences in perceived importance of specific content within these many objectives from the perspectives of learners and faculty can help medical educators make decisions about structuring residency curriculum in a best way.

2 | MATERIALS AND METHODS

This study used an original survey instrument in a cross-sectional research design. The content was based on the 2016 ABP content specifications for cardiovascular disorders, with objectives divided into 8 content areas. Both quantitative data (numerical indications of perceived importance of items) and qualitative data (open-ended replies regarding missing content and "What content is most difficult for learners?") were collected. The face validity (clarity, design, and scope) was established by expert review of University of Louisville (UL) School of Medicine faculty, and construct validity was established by using a simplified version of the 2016 ABP content specifications.

The survey was administered online using SurveyMonkey. Eligible participants were contacted by email with an invitation to participate including IRB and researcher contact information. As recommended by Dillman,[14] eligible participants were sent a second reminder after 2 weeks and a third reminder after an additional week to maximize response rate.

The population surveyed included all pediatric residents and pediatric subspecialty fellows at the UL School of Medicine and the University of Kentucky (UK) College of Medicine (n = 110); pediatric clinical faculty (noncardiology n = 187; and cardiology n = 13) at the UL School of Medicine; pediatric clinical faculty (noncardiology n = 92, and cardiology n = 7) at the UK College of Medicine; other pediatric cardiologists practicing in Kentucky (n = 10); and approximately 800 general pediatricians practicing in Kentucky who were the members of the Kentucky chapter of the American Academy of Pediatrics (AAP) (The AAP distributed the survey through their email contact list.).

Quantitative data were analyzed using SPSS Version 22.0 (IBM, Armonk, New York). We used descriptive statistics (frequency and percentages) to organize the objectives in each of the 8 cardiology content areas. Objectives were then reported as "most selected" and "least selected" within each category based on naturally occurring "clusters" and "gaps" in scores. We also evaluated differences in responses among the different types of pediatric groups using the Pearson's chi-square test. If significance was found among the pediatric groups, we tested for significant differences between each group. The significance level was set by convention at $P < .05$.

We applied Pandit's version of Glaser and Strauss Grounded theory (constant comparison)[15] to identify the common themes among items, working within each content category individually as the categories were markedly different. We also used Pandit's technique[15] to find themes in a final open-ended question, "What content is most difficult for learners?" The study was deemed exempt by the UL IRB.

3 | RESULTS

Of the 136 respondents, 60 (45%) attended or were completing residency at UL School of Medicine, 15 (11%) at UK College of Medicine, 59 (44%) at another institution, and 2 participants did not respond to this question. Of the respondents, 73 (59%) were female, with mean age of 42 years (SD = 13), and mean years in practice of 12 (SD = 13). Types of medical degrees completed were as follows: 120 (88%) MD, 11 (8%) DO, and 5 (4%) international medical graduates. Most respondents (56 [42%]) were primarily inpatient physicians, whereas 51 (38%) were primarily outpatient, and 25 (19%) reported equal inpatient and outpatient hours. Regarding academic affiliations, 23 (17%) respondents were pediatric residents, 15 (11%) pediatric fellows, 85 (62%) general pediatricians, and 13 (10%) pediatric cardiologists with 80% of attendings having faculty or gratis faculty status.

Within this cohort, several notable differences in perceived importance of content emerged as shown in Figure 1 ("most selected") and Figure 2 ("least selected"). For example, in the endocarditis content area, 82% selected "recognizing clinical findings of endocarditis" first or second most important versus only 7% prioritizing "understanding the natural history of endocarditis." Naturally occurring clusters in respondent-designated importance resulted in $\leq$3 "most selected" and $\leq$3 "least selected" objectives per content area.

When comparing "most selected" and "least selected" objectives among pediatric groups, few significant differences emerged. Regarding residents, for the objective "recognize the clinical findings associated with congestive heart failure in children of various ages" only 57% of residents rated this first or second most important compared to 91% of general pediatricians and 92% of pediatric cardiologists ($^*X^2 = 13.9$,

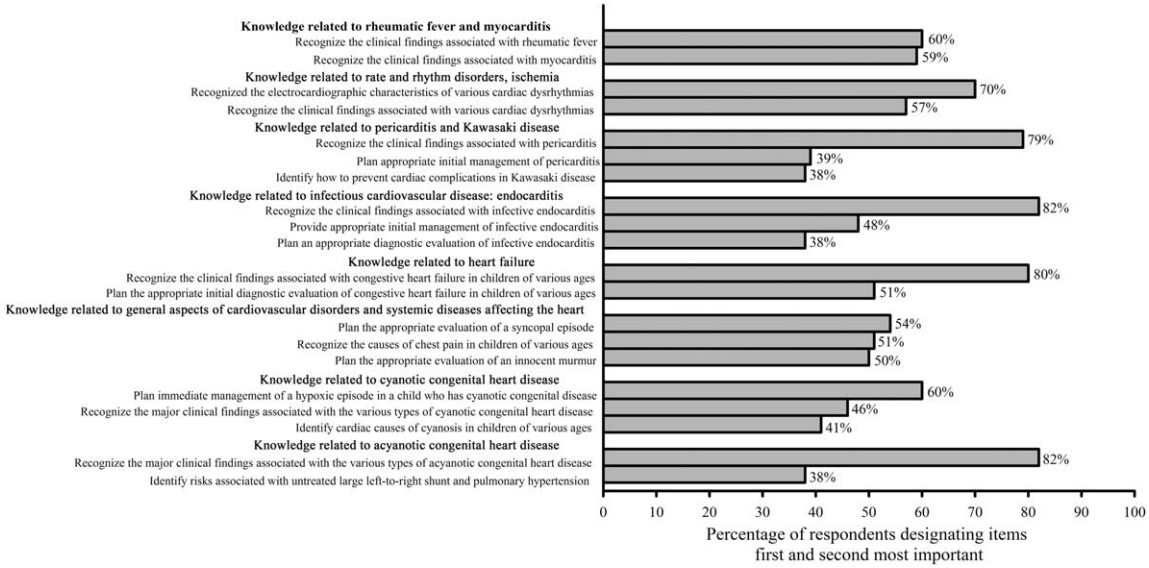

FIGURE 1 2016 ABP content objectives selected most frequently by Kentucky trainees, pediatricians, and pediatric cardiologists

$P = .007$). For the objective "recognize the clinical findings associated with infective endocarditis," fewer residents (52%) selected this compared to fellows (93%), general pediatricians (87%), pediatric cardiologists (100%), and other subspecialists (83%) with $^*X^2 = 19.4$, $P = .001$.

Fellows (61%) more often prioritized "provide appropriate initial management of infective endocarditis" than general pediatricians (42%), pediatric cardiologists (31%), or other subspecialists (40%) with $^*X^2 = 10.8$, $P = .028$. However, for the objective "recognize the electrocardiographic characteristics of various cardiac dysrhythmias," all fellows (100%) rated this highly compared to 65% of pediatricians and 57% of other subspecialists ($^*X^2 = 9.9$, $P = .041$) [*for all X^2 comparisons, df = 4].

As summarized in Tables 1 and 2, groupings of "most selected" and "least selected" items were also cohesive, with ≤4 themes per category. Objectives included in "most selected" content related to themes of initial diagnosis (recognition of abnormality/disease) (n = 16), possible emergent/urgent intervention required (n = 14), building a differential (n = 8), and planning a workup (n = 4). Objectives included in "least selected" content related to themes of comanagement with subspecialist (n = 15), knowledge useful in patient–family communication (n = 9),

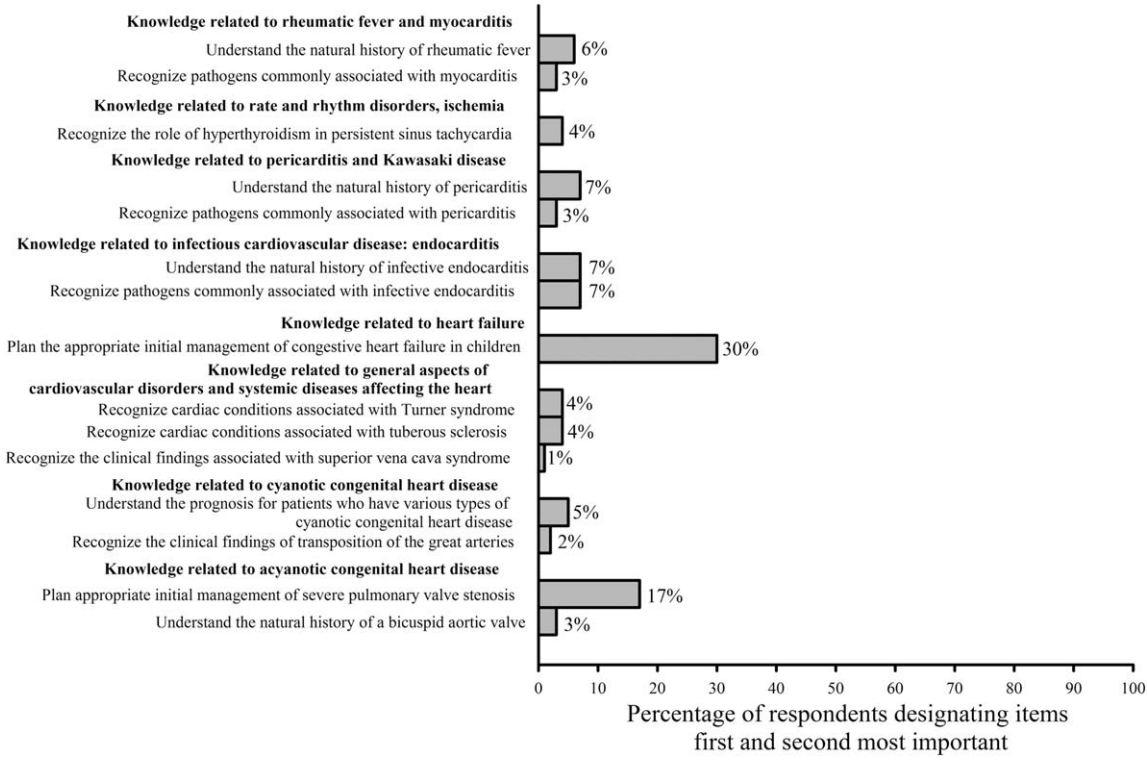

FIGURE 2 2016 ABP content objectives selected least frequently by Kentucky trainees, pediatricians, and pediatric cardiologists

TABLE 1 Content selected most often, shown by descriptive characteristics

Content	Descriptive characteristic initial diagnosis (recognition of abnormality/disease)	Possible emergent/ urgent intervention required	Building a differential	Planning a workup
Plan the appropriate evaluation of a syncopal episode	x		x	x
Recognize the causes of chest pain in children of various ages	x	x	x	
Plan the appropriate evaluation of an innocent murmur	x		x	x
Recognize the clinical findings associated with congestive heart failure in children of various ages	x	x		
Plan the appropriate initial diagnostic evaluation of congestive heart failure in children of various ages	x	x	x	x
Plan immediate management of a hypoxic episode in a child who has cyanotic congenital disease	x	x		
Recognize the major clinical findings associated with the various types of cyanotic congenital heart disease	x		x	
Identify cardiac causes of cyanosis in children of various ages	x	x	x	
Recognize the major clinical findings associated with the various types of acyanotic congenital heart diseases	x		x	
Identify risks associated with untreated large left-to-right shunt and pulmonary hypertension		x		
Recognize the clinical findings associated with infective endocarditis	x			
Provide appropriate initial management of infective endocarditis		x		
Plan an appropriate diagnostic evaluation of infective endocarditis	x			x
Recognize the clinical findings associated with rheumatic fever	x	x		
Recognize the clinical findings associated with myocarditis	x	x		
Recognize the clinical findings associated with pericarditis	x	x		
Plan appropriate initial management of pericarditis		x		
Identify how to prevent cardiac complications in Kawasaki disease		x		
Recognize the electrocardiographic characteristics of various cardiac dysrhythmias	x	x		
Recognize the clinical findings associated with various cardiac dysrhythmias	x	x	x	

knowledge that can be referenced (as needed) (n = 7), and longitudinal/ follow-up concerns (n = 5).

There were several open-ended questions in this survey that yielded rich qualitative data. Most of these data, because of their complexity, will be addressed in a separate article. One question, however, "which content is most difficult for learners" is so closely related to curriculum revision that we present those outcomes here (Figure 3). Of 136 respondents, 122 (89.7%) replied to this question. All replies were clearly articulated with no ambiguity in the language. Replies fell into 9 themes: recognition of signs or symptoms (n = 22), evaluation of murmurs/auscultation (n = 19), knowing when to order testing or refer/resource utilization (n = 16), EKGs and arrhythmias (n = 14), differentiation between conditions (cardiac vs other, or among types of congenital heart disease) (n = 13), understanding anatomy and physiology (n = 12), identification of rare from benign conditions with common presentations (n = 11), depends on individual learning style (n = 10), and management issues (n = 5).

4 | DISCUSSION

This study demonstrated the utility of an online survey methodology to identify the content perceived most important within pediatric cardiology from the perspectives of trainees and faculty. Respondents designated content areas of higher priority from the numerous cardiology-specific objectives developed for certification in general pediatrics. Additionally, respondents provided insight into the most difficult cardiology concepts for those training in general pediatrics.

Although the ABP content objectives are intended primarily as source material for the ABP certification examination in general

TABLE 2 Content selected least often, shown by descriptive characteristics

Content	Descriptive characteristic			
	Comanagement with subspecialist	Knowledge useful in patient/family communication	Knowledge that can be referenced (as needed)[a]	Longitudinal/ follow-up concerns
Recognize cardiac conditions associated with tuberous sclerosis	x	x	x	
Recognize cardiac conditions associated with Turner syndrome	x	x	x	
Recognize the clinical findings associated with superior vena cava syndrome	x	x	x	
Plan the appropriate initial management of congestive heart failure in children of various ages	x			
Understand the prognosis for patients who have various types of cyanotic congenital heart disease	x	x		x
Recognize the clinical findings of transposition of the great arteries	x			
Plan appropriate initial management of severe pulmonary valve stenosis	x			
Understand the natural history of a bicuspid aortic valve	x	x		x
Recognize pathogens commonly associated with infective endocarditis	x	x	x	
Understand the natural history of infective endocarditis	x	x		x
Understand the natural history of rheumatic fever	x	x		x
Recognize pathogens commonly associated with myocarditis	x		x	
Understand the natural history of pericarditis	x	x		x
Recognize pathogens commonly associated with pericarditis	x		x	
Recognize the role of hyperthyroidism in persistent sinus tachycardia	x		x	

[a]The details of this core content may be taught and learned initially, but referenced in usual clinical practice.

pediatrics, this study suggests the practical relevance of cardiology-specific content included in this outline. This corresponds to the findings from a Canadian study validating the utility of national cardiology-specific objectives.[5] In general, learners and faculty largely agreed upon the "most important" content. In fact, when all 35 objectives included in both the "most selected" and the "least selected" content were considered, significant differences in responses among the pediatric groups were noted for only 4 objectives.

The most frequent theme unifying the "most selected" content was initial diagnosis (recognition of abnormality/disease) which seems reasonable as learners must identify an issue before any other steps can be taken. Not surprisingly, the next most frequent theme arising from the "most selected" content was possible emergent/urgent intervention required. Consistent with our findings, investigators chose recognition and immediate management of "critical" EKGs as important assessment measures in a study evaluating emergency medicine residents.[16] The other 2 themes apparent less prominently within the "most selected" content involved more baseline knowledge and synthesis from the learner: building a differential and planning a workup.

Within the "least selected" content, the most common theme was comanagement with subspecialist, which may reflect the proportion of respondents affiliated with an academic center or recent real-world practice patterns for specific content. A recent survey of pediatricians noted frequent cardiac comorbidities and subspecialist comanagement for their patients.[17] When patients are comanaged, it is also possible that pediatricians feel that the content contained within the other themes including knowledge useful in patient–family communication, knowledge that can be referenced (as needed), and longitudinal/follow-up concerns would be provided to the family at the cardiologist visit.

The open-ended question "which content is most difficult for learners" produced clear results that faculty could use to better allocate instructional time. We drew 2 conclusions from data related to this question. First, respondents' replies fell into a practical hierarchy of pediatric cardiology content; that is, the most basic content,

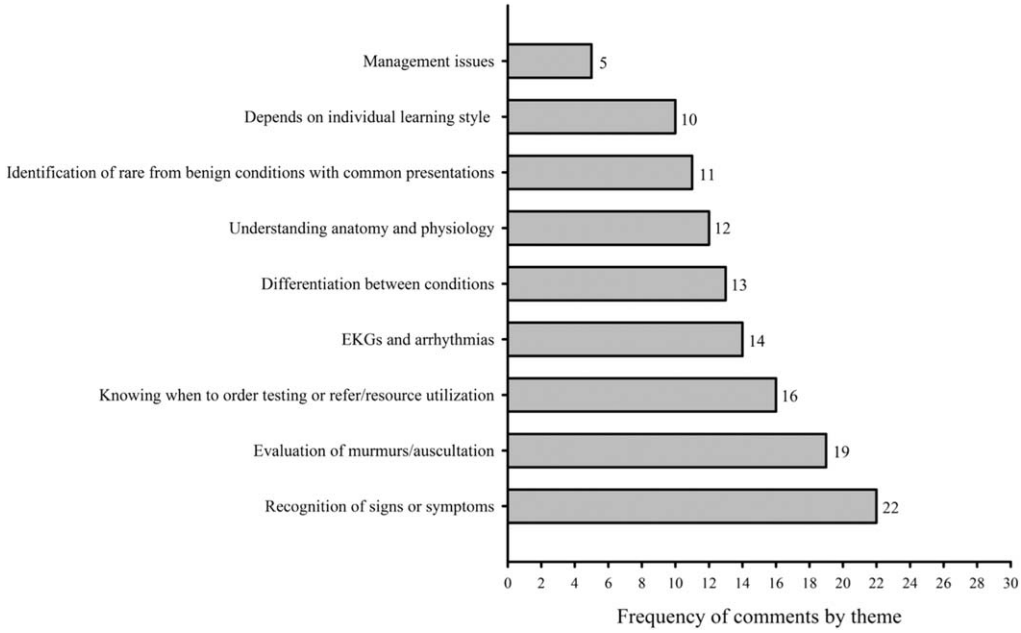

FIGURE 3 The identification of which content is most difficult for learners

recognition of signs or symptoms, followed by evaluation of murmurs and auscultation (cardiac-focused physical exam) was most often seen as presenting difficulty to learners, whereas arguably the most complex content (case management) was mentioned the least. This seemingly paradoxical outcome likely echoes prior emphasis of respondents on basic skills and the need to establish an initial diagnosis, whereas also suggesting that faculty and trainees are concerned basic content may not be mastered in medical school. These findings may reflect faculty insight into actual knowledge and skill deficiencies of many pediatric trainees (and noncardiology faculty as well) as supported by recent studies demonstrating poor cardiac physical exam skills in incoming residents and some noncardiology faculty.[18,19] It is also possible that once learners have mastered the basics, they are better prepared to grasp the nuances of case management.

The second conclusion is that the instructional groundwork for many of these fundamental content areas could be established in a classroom and/or simulation setting rather than relying on the somewhat arbitrary case mix during a resident's cardiology rotation. A learner who has mastered the essentials is more likely to benefit from assisting with a complex or unusual case.[20] However, as classroom and simulation training take time away from clinical responsibilities, these methods require evidence demonstrating effectiveness. Two recent small, single-center studies incorporating simulation into pediatric cardiology resident education have demonstrated improvement in cardiology knowledge.[9,10] Our study suggests that the primary educational interventions (bedside or simulation) should focus on helping learners build a framework for identifying and providing initial, emergent management to children who may require cardiology care.

Limitations of this study include a statewide sample that may not be generalizable to a national cohort. Similarly, most respondents were affiliated with an academic institution, which could affect respondent-designated importance. The survey design forces respondents to select 2 top choices within content areas. This may have arbitrarily assigned importance to some content, or information may have been omitted which was not captured by open-ended responses.

5 | CONCLUSIONS

This study demonstrated the utility of an online survey methodology to identify pediatric cardiology content perceived most important. Learners and faculty provided concordant responses regarding the most important content within the cardiology-specific ABP objectives and the most difficult content for learners. Understanding the perceived importance of specific content helps medical educators within pediatric cardiology make decisions about structuring residency curriculum in a best way. In addition, medical educators could potentially apply this methodology to other specialty-specific curriculum revisions.

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None to declare.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest with the contents of this article.

AUTHOR CONTRIBUTIONS

Research project design: Neal
Data acquisition: Neal, Lehto, Miller, Ziegler, Davis
Data analysis: Neal, Lehto, Miller, Ziegler, Davis
Manuscript drafting: Neal, Lehto, Miller, Ziegler, Davis
Revisions: Neal, Lehto, Miller, Ziegler, Davis
Approved final version: Neal, Lehto, Miller, Ziegler, Davis

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