

# Use of Electronic Health Record Systems by Office-Based Pediatricians

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abstract

**BACKGROUND AND OBJECTIVES:** The American Recovery and Reinvestment Act of 2009 accelerated the implementation of electronic health records (EHRs) in pediatric offices. We sought to determine the prevalence and functionalities of EHRs, as well as pediatricians' perceptions of EHRs.

**METHODS:** An 8-page self-administered questionnaire was sent randomly to 1621 nonretired US members of the American Academy of Pediatrics from July to December 2012. Responses were compared with a similar survey in 2009.

**RESULTS:** The percent of pediatricians, who are using EHRs, increased significantly from 58% in the 2009 survey to 79% in 2012. Only 31% used an EHR considered to have basic functionality, and only 14% used a fully functional EHR. Providers with equal or greater than 20% public insurance patients (threshold for meaningful use eligibility) were more likely to have an EHR. Solo/2-physician practices were least likely to have adopted an EHR. Younger physicians were more likely to consider an EHR important to quality care and perceived the presence of an EHR as more important in recruiting.

**CONCLUSIONS:** The number of office-based pediatricians who are using an EHR has steadily risen to almost 80%. EHR cost and reduction in productivity remain serious concerns. Despite the widespread adoption of EHRs by pediatricians, only few use a basic or fully functional EHR and even fewer have added pediatric functionality. There is a role for the EHR certification process to advance functionalities used by pediatricians and to increase efficiency, data exchange capability, and general EHR functionality.



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Dr Lehmann analyzed the data and drafted the initial manuscript; Ms O'Connor led the data collection, carried out the initial analyses, and reviewed and revised the manuscript; Ms Shorte participated in the drafting of the manuscript and reviewed and revised the manuscript; Dr Johnson was involved in the design of the survey tool, and he reviewed and revised the manuscript; and all authors approved the final manuscript as submitted.

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**WHAT'S KNOWN ON THIS SUBJECT:** In 2009, only 58% of pediatricians were using electronic health records (EHRs), most of which were lacking pediatric functionality. The American Recovery and Reinvestment Act (ARRA) of 2009 accelerated the implementation of EHRs in pediatric offices.

**WHAT THIS STUDY ADDS:** The effects of ARRA have remained largely unmeasured in pediatrics. This study provides information on the prevalence and functionalities of EHRs, as well as physicians' perceptions.

The American Academy of Pediatrics (AAP) considers the use of electronic health records (EHRs) a mark of professionalism and a means to improve quality, efficiency, and safety of pediatric care. A 2009 study of EHR adoption in pediatric ambulatory settings demonstrated that needed functions (weight-based dosing, anthropometric analysis, immunization forecasting) were missing in ambulatory EHRs.<sup>1</sup> The lack of pediatric specific content<sup>2</sup> and functionality as delineated in the Model Pediatric EHR Format by the Agency for Healthcare Quality and Research<sup>3</sup> remains a barrier to implementation and use of EHRs.

In 2012, a follow-up survey was conducted to determine if adoption of and pediatricians' perceptions toward EHRs changed and to ascertain EHR functionality in pediatric office settings. Since 2009, the United States has seen an increase in EHR adoption, partly because of incentives offered by the American Recovery and Reinvestment Act.<sup>4</sup> The Health Information Technology for Economic and Clinical Health (HITECH) Act offered \$18 billion in payments to practitioners who meet criteria for "meaningful use"<sup>5</sup> of "certified electronic health record technology."<sup>6</sup> The percentage of office-based physicians who used an EHR increased from 34.8% in 2007 to 71.8% in 2012.<sup>7</sup>

Pediatricians' path to meaningful use (MU) differs from other specialties. Pediatricians report MU efforts through their respective states instead of a central federal repository. Further, 20% of patient encounters must be Medicaid encounters, which is financially infeasible for many pediatricians.<sup>4</sup> In 2009, only 58% of pediatricians were using EHRs, confirming that pediatricians lagged in EHR adoption.<sup>8</sup>

## METHODS

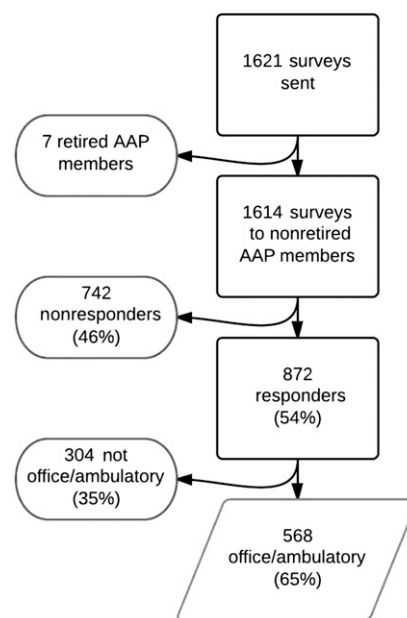
The AAP Periodic Survey (PS) of Fellows gathers data for the purpose

of informing policy, developing new initiatives, and evaluating existing projects. The survey also collects demographic information and practice characteristics on US nonretired members.<sup>9</sup>

Survey PS#83 (2012) addressed the functions of EHRs used by pediatricians, attitudes toward EHRs, and barriers to EHR adoption similar to a survey conducted in 2009 (PS#74).<sup>1</sup> PS#83 was an 8-page self-administered questionnaire sent to 1621 randomly selected nonretired US AAP members from July to December 2012. Seven mailed contacts (cover letter, survey questionnaire, and business reply envelope) were made to nonrespondents. The initial mailing included a flyer describing the PS and a \$2 bill as a token of appreciation. Nonrespondents were emailed twice with a link to complete the survey electronically. Survey response was 54% (872 respondents, including pediatric residents; Fig 1).

Respondents were asked the following: "Does your main practice use an electronic medical record (EMR) or electronic health record (EHR) system (not limited to billing records)?" Formal criteria as defined in the National Ambulatory Medical Care Survey<sup>10</sup> and by DesRoches et al<sup>11</sup> differentiated between 3 categories: (1) Any EHR use, (2) use of basic EHRs (demographics, problem lists, prescription orders, laboratory and imaging result viewing, clinical notes, and medication lists), or (3) use of fully functional EHRs (basic plus drug interactions warnings, e-Prescribing, ordering and electronic transmission of laboratory and radiology tests, age-specific laboratory ranges, electronic images returned, medical history, and guideline reminders).

Analysis was limited to 568 pediatricians who completed residency training and provided patient care in an office or clinic-based ambulatory care setting. The



**FIGURE 1**

This figure reveals how 568 analyzed surveys resulted from 1621 surveys mailed in 2012. A response rate of 54% resulted in 872 respondents, of whom 568 were office- or ambulatory care-based (65%) and were included in our final analysis.

study was exempt from human subject review by the AAP institutional review board.

## RESULTS

### Demographics

Physician and practice characteristics in 2012 and 2009 were similar (Table 1). However, in 2012, respondents were more likely to be general pediatricians (78% vs 73%), to practice in a suburban area (49% vs 39%), and to be slightly older (30% vs 26% in the 50–59 years age group).

### EHR Availability

In 2012, 79% of pediatricians used an EHR, an increase from 58% in 2009 ( $P < .001$ ). Pediatricians younger than the mean age of 49 years were more likely to use an EHR (86% vs 73%,  $P < .001$ ). Among those not using an EHR system, 50% reported plans for implementing an EHR within 12 months (35% in 2009 [ $P < .01$ ]).

Providers with  $\geq 40\%$  public insurance patients were more likely to have an EHR (85% vs 69%,  $P <$

**TABLE 1** Demographic Characteristics of Responding Office-based Pediatricians

	2012, N = 568, n (%)	2009, N = 646, n (%)	P
Gender	N = 560	N = 644	.057
Men	226 (40.4)	295 (45.8)	—
Women	334 (59.6)	349 (54.2)	—
Age, y	N = 559	N = 640	.045
30–39	117 (20.9)	172 (26.9)	—
40–49	173 (30.9)	195 (30.5)	—
50–59	167 (29.9)	168 (26.3)	—
60–69	90 (16.1)	100 (15.6)	—
70–77	12 (2.1)	5 (0.8)	—
Race/ethnicity	N = 539	N = 621	.599
White, non-Hispanic	406 (73.3)	482 (77.6)	—
Asian/Pacific Islander	77 (14.3)	84 (13.5)	—
All others <sup>a</sup>	55 (10.4)	55 (8.9)	—
Practice activity type	N = 558	N = 639	.032
General pediatrician	436 (78.1)	465 (72.8)	—
Subspecialist	122 (21.9)	174 (27.2)	—
Practice type <sup>b</sup>	N = 517	N = 585	.114
1–2 pediatricians	93 (18.0)	115 (19.7)	—
3–5 pediatricians	107 (20.7)	101 (17.3)	—
≥6 pediatricians	110 (21.3)	104 (17.8)	—
Multispecialty group/HMO	106 (20.5)	119 (20.3)	—
Hospital/clinic	101 (19.5)	146 (25.0)	—
Practice setting	N = 559	N = 631	.004
Urban, inner city	83 (14.8)	131 (20.8)	—
Urban, not inner city	142 (25.4)	174 (27.6)	—
Suburban	272 (48.7)	246 (39.0)	—
Rural	62 (11.1)	80 (12.7)	—
Practice location	N = 568	N = 646	.076
Northeast	132 (23.2)	153 (23.7)	—
Midwest	122 (21.5)	138 (21.4)	—
South	176 (31.0)	234 (36.2)	—
West	138 (24.3)	121 (18.7)	—
Payment mix	N = 446	N = 518	—
<40% Medicaid/SCHIP	243 (54.5)	269 (51.9)	—
≥40% Medicaid/SCHIP	203 (45.5)	249 (48.1)	.428
<20% Medicaid/SCHIP	143 (32.1)	165 (31.9)	—
≥20% Medicaid/SCHIP	303 (67.9)	353 (68.1)	.945
Employment status	N = 559	—	—
Full or part owner	240 (42.9)	—	—
Employee	309 (55.3)	—	—
Independent contractor	10 (1.8)	—	—
Full/part-time work	N = 559	N = 641	.315
Full-time	416 (74.4)	493 (76.9)	—
Part-time	143 (25.6)	148 (23.1)	—

SCHIP, State Children's Health Insurance Program.

<sup>a</sup>Includes Hispanic, African American, and American Indian.<sup>b</sup>Excludes the categories "nonprofit community health center" and "other."

.001), which still held true if the public insurance threshold was set to ≥20% (82% vs 63%,  $P < .01$ ).

Medical schools/hospitals/clinics had the highest adoption rate (90%), and solo/2-physician practices had the lowest rate (56%;  $P < .001$ ). Rural practices had the highest rate of adoption (87%) and suburban practices the lowest (72%;  $P < .01$ ).

In ambulatory care settings, 30.7% of pediatricians used a basic EHR;

14.3% of pediatricians used a fully functional EHR system, and 55% had neither a basic nor a fully functional EHR (Fig 2). From 2009, the percentage of pediatricians who had neither basic nor fully functional EHRs (equivalent to none or any EHR) dropped significantly from 75.2% to 55%.<sup>1,10</sup>

Among those with "fully functional" EHRs, 8% compared with 3% in 2009 ( $P < .001$ ) reported 5 additional

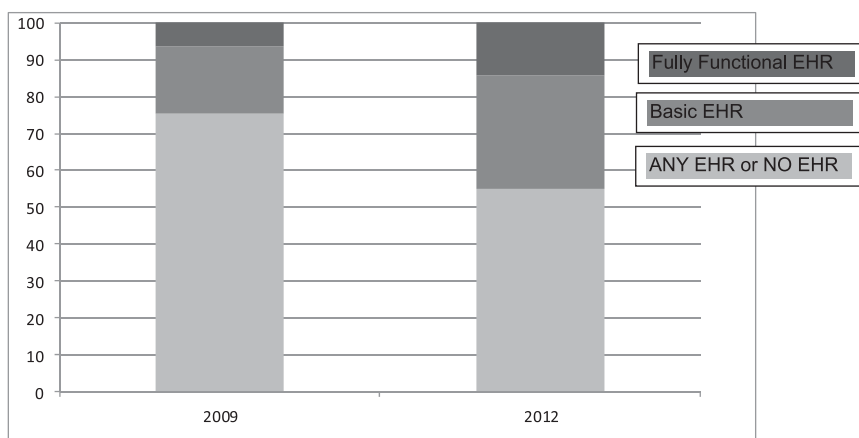
"pediatric-supportive" features (weight-based dosing, tracking recommended well-child visits and immunizations, calculating catch-up immunizations, and plotting growth charts and computing BMI).

Table 2 reveals the distribution of basic and fully functional EHRs in 2012 and 2009. Female pediatricians closed the gap EHR use by implementing preferably fully functional EHRs. General pediatricians increased their lead in all EHR use over specialists. The biggest gains in EHR use occurred in group practices of ≥3 pediatricians.

### EHR Functionalities

EHR functionalities most commonly available were patient demographics (87.2%), laboratory results viewing (85.3%), problem list (84.6%), prescription orders (84.6%), clinical notes (85.5%), and growth charts (80.2%). The EHR functionalities least likely to be available included underdosing alerts (33.6%),<sup>12</sup> voice recognition (31.7%), age-specific normal values (30.5%), guideline-based interventions for chronic diseases (34.3%), and staff telephone triage protocols (29%).

Table 3 reveals a multiple logistic regression analysis of characteristics related to use of basic or fully functional EHR systems and fully functional EHR (only). After controlling for pediatrician practice and personal characteristics, the odds of adopting a basic EHR were far greater among pediatricians in multispecialty group practices or health maintenance organizations (HMOs), hospital/clinic practices, and large pediatric group practices. Male pediatricians were nearly twice as likely as female pediatricians to have basic EHRs. The odds of having a fully functional EHR were ~7 times greater among pediatricians in multispecialty group practice/HMO and in hospital/clinic practice than in solo/2-physician practices.



**FIGURE 2**  
Type of EHR, 2009 and 2012.

### EHR Functionality Over Time

Pediatricians reported an increase in available EHR functionalities. The

biggest increases were in recording of race/ethnicity, e-Prescribing, electronic transmission, medical

**TABLE 2** Basic and Fully Functional EHR Use by Pediatrician Characteristics by Survey Year (Number and Percent of Pediatricians Reporting)

	Basic or Fully Functional EHR				P	Fully Functional EHR				
	2012		2009			2012		2009		
	N	%	N	%		N	%	N	%	
<b>Gender</b>										
Women	137	41.9	63	18.2	<.001	43	13.1	13	3.8	<.001
Men	109	49.8	95	32.9	<.001	34	15.5	27	9.3	.034
<b>Age, y</b>										
≥49	120	44.1	68	23.5	<.001	38	14.0	20	6.9	.006
<49	125	45.8	89	26.0	<.001	38	13.9	20	5.8	.001
<b>Race/ethnicity</b>										
Nonwhite	52	39.7	22	16.4	<.001	16	12.2	4	3.0	.004
White	181	45.9	131	27.3	<.001	55	14.0	34	7.1	.001
<b>Member type</b>										
Subspecialist	68	56.7	59	34.3	<.001	24	20.0	14	8.1	.003
General pediatrician	178	41.9	99	21.6	<.001	53	12.5	26	5.7	<.001
<b>Practice type</b>										
1–2 pediatricians	14	15.4	11	9.6	.212	3	3.3	4	3.5	.934
3–5 pediatricians	28	26.9	15	15.2	.04	6	5.8	2	2.0	.170
≥6 pediatricians	45	42.1	14	13.7	<.001	6	5.6	0	0	.015
Multispecialty group practice/HMO	71	68.9	52	44.4	<.001	31	30.1	17	14.5	.005
Hospital/clinic	65	66.3	57	39.0	<.001	23	23.5	15	10.3	.005
<b>Practice setting</b>										
Rural	32	54.2	14	17.7	<.001	9	15.3	4	5.1	.043
Urban, inner city	41	50.6	30	23.1	<.001	16	19.8	7	5.4	.001
Urban not inner city	73	52.5	51	30.0	<.001	23	16.5	10	5.9	.003
Suburban	99	37.2	58	23.9	<.001	30	11.3	16	6.6	.065
<b>Practice location</b>										
Northeast	50	39.1	27	17.6	<.001	14	10.9	6	3.9	.023
South	68	39.8	44	19.0	<.001	23	13.5	10	4.3	.001
Midwest	65	55.1	46	34.1	.001	19	16.1	13	9.6	.122
West	66	48.5	41	34.7	.026	23	16.9	11	9.3	.076
<b>Payment mix</b>										
<20% Medicaid/SCHIP patients	50	35.0	34	20.9	.006	16	11.2	10	6.1	.114
≥ 20% Medicaid/SCHIP patients	139	47.4	88	25.4	<.001	43	14.7	24	6.9	.001

P = Pearson  $\chi^2$  for difference between survey years for each characteristic. SCHIP, State Children's Health Insurance Program.

history, and follow-up notes (data not shown).

Compared with 2009, pediatricians reported increased electronic transmission capabilities in 2012, with significant changes in electronic communication of immunizations (45.3%–52.2%,  $P < .05$ ), reportable conditions (12.4%–18.9%,  $P < .01$ ), syndromic surveillance (6.8%–10.8%,  $P < .05$ ), post remittance (payments; 30.6%–37.2%,  $P < .05$ ), practice profiling and quality assurance (26.1%–35.7%,  $P < .001$ ), and medical records (16.4%–25.5%,  $P < .001$ ).

In 2012, more than half reported capability to submit claims to public (51.9%) and private payers (57.1%). More than one-third had the capability to exchange key clinical information like problem or medication lists (44.4%), and data for claims adjudication (35.4%).

### Patient Access

Regarding online patient access, 38.9% of practices supported online access to medical records and 37% to online prescription refills. Approximately one-third (35.3%) reported that patients request appointments online and 29% ask patients to complete previsit forms. Only 14% supported patients updating their medical records online. Only 16% allowed adolescents to access their information privately.

Online access to data was statistically more likely in group practices/HMOs (42.8%) and medical school/hospital/clinics (41.4%) compared with solo/2-physician practices (24.4%). Providers with higher portions of public insurance were less likely to offer online appointments (30.2% vs 43.1%,  $P < .01$ ) and online prescription refills (31.1% vs 43.6%,  $P < .01$ ).

### Pediatricians' Perceptions of EHRs

When asked if an EHR system is necessary to provide quality patient care, 50% agreed and 32.4% disagreed. Of pediatricians, who used

**TABLE 3** Multiple Logistic Regression Analyses of Characteristics Related to Use of Basic EHR (Includes Fully Functional and Pediatric-Supportive) Systems and Fully Functional EHR (Only) in 2012

Category and Variable	Basic or Fully Functional EHR (Includes 170 Basic Only, and 79 Fully Functional/Pediatric-Supportive), N = 249	Fully Functional EHR (Includes 79 Fully Functional/Pediatric- Supportive), N = 79
	OR (95% CI)	OR (95% CI)
Gender		
Women	1	1
Men	1.68 (1.05–2.67)*	1.17 (0.61–2.22)
Age, y		
≥49	1	1
<49	1.09 (0.69–1.74)	0.73 (0.38–1.40)
Race/ethnicity		
Nonwhite	1	1
White	1.10 (0.65–1.89)	1.35 (0.62–2.91)
Member type		
Subspecialist	1	1
General pediatrician	0.88 (0.46–1.67)	0.92 (0.44–1.92)
Practice type		
1–2 pediatricians	1	1
3–5 pediatricians	1.06 (0.52–2.18)	0.64 (0.15–2.69)
≥ 6 pediatrics	2.82 (1.42–5.60)**	1.20 (0.35–4.08)
Multispecialty group practice/HMO	9.57 (4.65–19.68)***	7.11 (2.65–19.00)***
Hospital/clinic	6.82 (3.03–15.35)***	6.61 (2.17–20.17)**
Practice setting		
Rural	1	1
Urban, inner city	0.46 (0.18–1.20)	0.77 (0.23–2.61)
Urban, not inner city	1.04 (0.45–2.41)	0.73 (0.23–2.26)
Suburban	0.77 (0.35–1.70)	0.82 (0.26–2.53)
Practice location		
Northeast	1	1
South	1.00 (0.54–1.85)	2.16 (0.82–5.71)
Midwest	1.68 (0.85–3.35)	1.83 (0.66–5.12)
West	1.55 (0.80–3.01)	2.13 (0.76–5.93)
Payment mix		
<20% Medicaid/SCHIP patients	1	1
≤20% Medicaid/SCHIP patients	1.63 (0.96–2.76)	0.85 (0.38–1.87)

CI, confidence interval; OR, odds ratio; SCHIP, State Children's Health Insurance Program. \*  $P < .05$ ; \*\*  $P < .01$ ; \*\*\*  $P < .001$ .

an EHR, 58% agreed compared with 24% of those without an EHR ( $P < .001$ ). Younger physicians (<49 years) were more likely to consider an EHR important to quality care (57.3% vs 43.1%,  $P < .01$ ). Only 44.1% perceived an EHR system as important when seeking a new position (younger pediatricians 55.8% vs 32.2%,  $P < .001$ ). A majority agreed that EHR implementation (57.4%) "is better left" to younger physicians.

Pediatricians with EHRs reported a positive EHR impact for communication with other providers

(75.1%), new prescriptions (79.1%) and prescription refills (82.5%), access to medical records (86.8%), plotting growth charts and computing BMI (86%), improving quality (69.3%), and practice management (62.6%).

Older pediatricians (≥49 years) were less likely to report a positive effect on practice management (68% vs 55%,  $P < .01$ ). Positive effects were reported on immunizations delivery (53.3%), anticipatory guidance (54.3%), and chronic disease management (43.4%). Physicians in urban (88.2%) and medical school/

hospital (89.4%) settings were more likely to report a positive impact on provider communication.

Little negative impact was reported (<10% for any item). Most negative impact was reported on communication with patients and practice management. Physicians reported no impact (54.2%) or positive impact (43.5%) on the quality of clinical decisions, no (55.5%) or positive impact (42.9%) on delivery of well-child care at scheduled intervals, and no (57.4%) or positive impact (41.2%) on guideline oriented care for chronic illnesses.

Compared with 2009, more pediatricians in 2012 indicated that the EHR helped to avoid medication errors (71% vs 63%,  $P < .05$ ), whereas fewer in 2012 described their EHRs as having a positive impact on the quality of clinical decisions (44% vs 52%,  $P < .05$ ), provider communication (75% vs 85%,  $P < .01$ ), or patient communication (44% vs 54%,  $P < .01$ ).

One-third (34%) avoided a drug allergy in the past 6 months because of the EHR. Pediatricians reported that in the past potentially dangerous medication interactions were prevented (39.1%), preventive care provided (41.6%), well-child visits scheduled (21.7%), and recommended tests ordered (22.0%) as a function of the EHR. More than half (64.3%) reported alerts to critical laboratory values. Alerts were most frequently reported by clinicians working in a medical school/hospital setting (77.5%,  $P < .001$ ) and those who spent less than 50% of their time in general pediatrics (78.1%,  $P < .01$ ).

Pediatricians with fully functional (78%) and basic (61%) EHRs were more likely compared with those with any or no EHR (38%) to consider basic EHRs as necessary to provide quality care ( $P < .01$ ). Pediatricians with fully functional (70%) or basic (52%) EHRs were also more likely to



identify an EHR as important when seeking a new position (no EHR or any EHR, 34%;  $P < .001$ ).

Comparing surveys, the percentage of pediatricians avoiding drug allergies, receiving alerts to critical laboratory values (~64% in both surveys), avoiding potentially dangerous medication interaction, and being prompted for preventive care (~40% in both) as a function of EHR use remained stable. One-fifth of respondents in both surveys reported they scheduled a well-child visit and ordered a recommended laboratory test because of a prompt.

### Barriers

Cost was identified as a barrier by 63.5% (41.8% major barrier, 21.7% minor), and productivity loss by 74.9% (44.9%, 30.0%). Other barriers included the difficulty finding a system meeting provider needs in 72.3% (40.6%, 31.7%), concerns over systems becoming obsolete in 60% (26.4%, 33.6%), resistance to adoption in 59.5% (21.4%, 38.1%), lack of resources to select, contract, and implement a system in 57.2% (23.1%, 34.1%), and concerns over return on investment (ROI) in 53% (30.9%, 22.1%).

Legal or regulatory barriers were considered by few (<10%) as major barriers. Only 38.8% identified concerns over confidentiality breaches, 37.6% over illegal tampering, and 13.8% over violations of the Stark law.

Older physicians were more likely ( $P < .001$ ) to identify financial issues as major barriers including EHR cost (50%), lack of ROI (39.8%), and productivity loss (54.7%), whereas pediatricians in medical school/hospital settings were least likely to identify these issues as major barriers (cost, 35.7%; lack of ROI, 15.3%; loss of productivity, 35.7%). Pediatricians with a high public payer mix were less likely to be concerned about financial barriers (cost, 38.6%,  $P < .01$ ; ROI, 26%,  $P < .001$ ).

Concerns over the cost, internal capacity to implement, breaches of confidentiality, hacking, and obsolescence of the system decreased, whereas concerns over loss of productivity increased (Table 4).

### Meaningful Use

Approximately half of all pediatricians (53%) stated that their main practice EHRs met the functional criteria for stage 1 MU; 13% said it did not, and 34% did not know. Pediatricians practicing in rural areas were more likely to report meeting stage 1 MU criteria (53% inner city versus 60% other urban versus 46% suburban versus 72% rural,  $P < .01$ ), as were those with a high proportion ( $\geq 40\%$ ) of publicly insured patients (46% low versus 68% high proportion,  $P < .001$ ).

Fewer than half of pediatricians (45%) said their main practice had applied for stage 1 MU incentives; 24% said it had not, and 31% did not know. Pediatricians in rural areas were more likely to report applying for stage 1 MU incentives (47% inner city versus 48% other urban versus

39% suburban versus 65% rural,  $P < .01$ ), as were those with a high proportion ( $\geq 40\%$ ) of publicly insured patients (57% high versus 35% low proportion,  $P < .001$ ). Among the 74 pediatricians who did not and did not intend to apply for stage 1 MU incentives, the majority (64.9%) were ineligible. Forty-one percent of pediatricians say their practice intends to apply for MU within a future stage (stage 2 or 3); 48% did not know.

A majority of pediatricians believed more pediatric focused EHRs (60%), more pediatric specific measures (60%), support for EHR maintenance/improvement (54%), and higher start-up cost reimbursement (52%) would be useful in adopting an EHR. General pediatricians ( $\geq 50\%$  time in general pediatrics) and pediatricians practicing in small practices were more likely to identify the above as helpful (all  $P < .05$ ).

Survey responses revealed that few pediatricians (20%) are aware of the regional extension centers (RECs).

**TABLE 4** Perceived "Major Barrier" to Adopting EHR System (Percent of Pediatricians Reporting)

	PS 83, 2012, N = 557, %	PS 74, 2009, N = 637, %
<b>Financial barriers</b>		
The amount of capital needed to acquire and implement an EHR	41.8***	56.4
Uncertainty about the ROI from an EHR	30.9	34.2
<b>Organizational barriers</b>		
Resistance to adoption from practice physicians	21.4	19.0
Capacity to select, contract, install, and implement an EHR	23.1*	28.4
Concern about loss of productivity during transition to the EHR system	44.9**	36.5
<b>Legal or regulatory barriers</b>		
Concerns about inappropriate disclosure of patient information (ie, breaches of patient confidentiality)	6.5**	11.2
Concerns about illegal records tampering or "hacking"	6.3**	11.5
Concerns about the legality of accepting an EHR that is donated from a hospital	2.9	4.1
Concerns about physicians' legal liability if patients have more access to information in their medical records	5.3	5.7
<b>State of technology</b>		
Finding an EHR system that meets providers' needs	40.6	40.2
Concerns that the system will become obsolete	26.4**	33.8
Other: specify	80.5	81.3

\* $P < .05$ ; \*\* $P < .01$ ; \*\*\* $P < .001$ .

Among those who are aware of their local REC, most (73%) knew where they were and how to contact them, and 50% have worked with them to adopt an MU EHR system. Most (63%) were very or moderately satisfied with that experience.

## DISCUSSION

The AAP surveyed its membership twice on EHR use in pediatric offices within 3 years, during which time many pediatricians implemented EHRs. In 2009, the HITECH Act had already been passed; however, its effects had not taken hold. Subsequently, the percent of pediatricians using EHRs increased from 58% (2009) to 79% (2012). Although we cannot prove a causal relationship, it seems probable that American Recovery and Reinvestment Act-associated stimulus monies had a significant impact on EHR implementation by pediatricians. This assumption is supported by the findings that pediatricians with a higher public payer mix were less likely to be concerned about EHR cost or ROI and that the majority reported meeting MU stage 1 criteria. Further, providers with  $\geq 20\%$  public insurance patients (MU eligibility threshold) were more likely to have an EHR.

One-fifth of the 53% reporting to meet MU stage 1 in 2012 do not intend to apply for MU incentives in later stages. Because MU is "front-loaded" with the largest incentives in the first year, pediatricians may be electing not to implement later MU criteria, thus hampering the intended goal of increased adoption of functional EHRs.

Despite increased adoption, pediatricians seldom use fully functional EHRs. Concerns around the high cost, generational gaps among adopters, lackluster perception of the overall quality gains, and efficiency losses are evident in the survey responses.

## Pediatric Functionality

Challenges to implementing EHRs in pediatric settings include content barriers (ie, the lack of pediatric functionality).<sup>2</sup> Using an EHR generates very different experiences and benefits depending on the type of EHR. Although in 2012, 79% of pediatricians used EHRs, only few used an EHR with basic (31%) or full functionality (14%). The use of EHRs with optimal functionality including pediatric features remained disappointingly low (8%).

Lack of fully functional EHRs leads to the absence of critical functions and poses a significant safety risk to children.<sup>13,14</sup> Lack of pediatric functionalities like weight-based dosing,<sup>15</sup> age-specific normal values, or calculation of catch up immunizations further jeopardizes children.

Lack of pediatric functionality requires that pediatricians perform tasks outside the EHR or develop workarounds adding to workload and reducing productivity<sup>16</sup> and efficiency. Not using EHRs that effectively support the care of children results in failure to achieve promised benefits of increased safety, decreased cost, and improved outcomes. Organizations like Health Level 7 and government agencies like the Agency for Healthcare Research and Quality have recognized that EHRs used with pediatric patients require pediatric specific functionality as described in Health Level 7's Child Health functional Profile<sup>17</sup> and the Model Pediatric EHR Format.<sup>3</sup>

The trend toward market consolidation (with 5 vendors accounting for 58.5% of MU attestations, and 15 vendors accounting for 80.1%) is a trend toward generic EHRs and away from best-of-breed systems that supported specialty and subspecialty needs.<sup>18</sup> This unintended consequence of MU may be hampering the development of fully functional pediatric specific EHRs. Pediatric EHR functionality

could be improved through future MU certification requiring pediatric functionality in products used with pediatric patients, including EHRs, Personal Health Records, and patient portals.

## Adoption, Barriers, and Perceptions

Younger age was associated with adoption of EHRs. Solo/2-physician practices had the highest risk of nonadopting, perhaps because of inability to distribute the effort and cost on multiple providers. Multispecialty groups and medical schools/hospital/clinic settings had the highest adoption rate most likely because of the implementation support available. More than half of pediatricians surveyed supported an increase of start-up cost reimbursement especially for small practices.

Substantial barriers to EHR implementation and adoption remain. Cost concerns remain prevalent but are decreasing, whereas concerns for loss of productivity are increasing. The difficulty of the EHR selection process remains a major barrier especially as pediatricians worry about obsolete technology.

RECs are the vehicle developed by the Office of the National Coordinator for HIT to aid EHR implementation. Only 20% of respondents were aware of their local REC. RECs must better engage and support pediatricians in the selection, implementation, and support of EHRs.

A negative perception of EHRs can be a significant barrier to adoption. A recent survey revealed rising physician dissatisfaction with EHRs.<sup>19</sup> Half of surveyed pediatricians thought that an EHR was necessary to provide quality care. However, since 2009, perceptions on the EHR utility changed. Reduction of medication errors is appreciated more, whereas clinical decision support and communication tools with patients and providers are appreciated less. Half of the respondents denied that

the EHR influenced quality of clinical decisions, delivery of well-child care, and guideline oriented care for chronic illnesses. Further, the number of pediatricians who reported a positive effect on child-specific tasks (well-child visit scheduling, age-specific ordering) was very low.

Improving the quality of care by using an EHR has been widely touted as an important reason and incentive for adoption. The survey data indicate that the current state of pediatric EHRs may be falling short. The most frequently mentioned negative EHR impact was decreased efficiency and added documentation burden.

More research on best practices and the effects of EHRs on pediatric offices is necessary to develop improvements needed to increase pediatricians' confidence in EHR technology.

### Generational Gap

Younger physicians were more likely to use an EHR and to consider it important for quality care and recruiting. Physicians close to retirement may not wish to invest in EHRs. The majority of pediatricians responded that EHR

implementation "is best left" to younger physicians.

### Data Exchange

EHR products used in pediatric offices lack the meaningful data exchange with other EHRs or public health repositories. The benefit of increased communication because of EHR implementation remains largely limited to within the practice or the enterprise EHR.

### Limitations

Respondents may have given answers that they perceived to be more acceptable to themselves, their peers, their employer, or the AAP. This social acceptability bias may lead to overestimations or underestimations of perception-based questions such as perceived barriers to implementation. The survey included only physicians who are AAP members, and responses may not be generalizable to non-AAP members. Nonresponse bias is a concern but for AAP surveys has been found in the past to be negligible.<sup>20</sup>

The number of questions was limited as a tradeoff to achieving a high response rate. Several topics were not addressed including the impact of

EHRs on office and provider efficiency and on documentation efforts.

This survey was limited to asking about exchange capabilities. Future surveys will focus on actual exchange.

### CONCLUSIONS

After the HITECH Act, the percent of office-based pediatricians using an EHR has risen to almost 80%. EHR cost and reduction in productivity remain serious concerns. Despite the widespread adoption, only few use a basic or fully functional EHR and even fewer have pediatric functionality. It is critically important to the health maintenance of our children that pediatricians adopt EHRs, which support the basic practices of pediatrics. There is a role for the EHR certification process to mainstream key pediatric functionalities to improve usability for pediatricians.

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