Title

Electronic health record availability among advanced practice registered nurses and physicians.

Journal

The American journal of managed care, 20(11 Spec No. 17)

ISSN

1088-0224

Authors

Coffman, Janet M
Spetz, Joanne
Grumbach, Kevin
et al.

Publication Date

2014-11-01

Peer reviewed

Electronic Health Record Availability Among Advanced Practice Registered Nurses and Physicians

Janet M. Coffman, PhD, MPP, MA; Joanne Spetz, PhD; Kevin Grumbach, MD; Margaret Fix, MPH; and Andrew B. Bindman, MD

ABSTRACT

Objectives

To characterize availability of electronic health records (EHRs) at the primary practice locations of certified nurse midwives (CNMs), nurse practitioners (NPs), and physicians in California prior to the implementation of the state's Medicaid EHR incentive program.

Study Design and Methods

Cross-sectional mail surveys of samples of CNMs, NPs, and physicians who have active California licenses and reside in California.

Descriptive statistics were calculated and multivariate regression analyses were estimated to identify characteristics associated with having an EHR. The following practice characteristics were included in the multivariate model: payer mix (% Medicaid), practice setting (hospital vs outpatient), and practice size. Variables for practitioner's age, sex, and practice location were also included.

Results

For both CNMs/NPs and physicians, practice size was the strongest predictor of EHR availability. Practicing in a large or mid-sized group was associated with higher odds of having a basic EHR or an advanced EHR. Having a high percentage of Medicaid patients was associated with lower odds of having an advanced EHR. Among physicians, but not CNMs/NPs, hospital-based practice was associated with higher odds of having an advanced EHR; being over age 45 years was associated with lower odds of having any EHR.

Conclusions

The results suggest that prior to the launch of California's Medicaid EHR incentive program, similar characteristics predicted EHR availability among both CNMs/NPs and physicians, and that availability was concentrated among large practices with fewer Medicaid patients. Future studies should assess whether Medicaid and Medicare incentive payments attenuate these relationships.

Am J Manag Care. 2014;20(11 Spec No. 17):eSP31-eSP38

A growing number of studies suggest that electronic health records (EHRs) can improve processes of care and outcomes for patients.[1-4] The rate of EHR availability among physicians has increased substantially over the past decade. Findings from the National Ambulatory Medical Care Survey (NAMCS) suggest that the percentage of physicians with any sort of EHR increased from 18% to 72% between 2002 and 2012.[5] Seeking to accelerate EHR use, the president signed the Federal Health Information Technology for Economic and Clinical Health Act into law in 2009. This legislation provides $27 billion for Medicare and Medicaid incentive payments to hospitals and certain health professionals who adopt and demonstrate "meaningful use" of EHRs.[6]

Surveys of physicians have found that availability of EHRs is associated with multiple factors, including practice size,[7-10] practice type,[10] specialty,[7,8,11] and age.[7,11,12] Little is known about the availability of EHRs in settings in which certified nurse midwives (CNMs) and nurse practitioners (NPs) practice. The few studies of CNMs' or NPs' use of EHRs that have been published have been limited to CNMs and NPs working in a single healthcare organization.[13] Assessing use of EHRs by CNMs and NPs is important because their numbers have grown substantially in recent decades.[14] CNMs and NPs are also among the health professionals that have been posited as potential solutions for the shortage of primary care physicians.[15]

This paper seeks to fill an important gap in the literature by presenting findings from a survey of California CNMs and NPs regarding their experiences with EHRs and comparing them with findings from a similar survey of California physicians. Findings from California are of nationwide importance because it is a large state representing a large share of the nation's healthcare workforce and because health professionals in California practice in a wide range of settings, from solo practices to large multi-site, multi-specialty groups. In addition, California's laws governing educational require-

Take-Away Points

We conducted surveys of the availability of electronic health records (EHRs) among certified nurse midwives (CNMs), nurse practitioners (NPs), and physicians in California prior to the launch of its Medicaid EHR incentive program.

- CNMs and NPs were less likely than physicians to have an EHR with advanced functions.
- For CNMs, NPs, and physicians, availability of advanced EHRs was concentrated among large practices with fewer Medicaid patients.
- Data from this baseline survey can be combined with data from future surveys to assess whether Medicaid and Medicare incentive payments attenuate the relationship between EHR availability and practice size and payer mix.

ments, supervision, and prescribing for CNMs and NPs are similar to those of many other states.[16]

METHODS

Data Sources

The primary sources of data for this analysis are surveys of samples of CNMs, NPs, and physicians with California licenses conducted in 2011. The physician survey was fielded before California began registering providers for the Medicaid EHR incentive program and the survey of CNMs and NPs was fielded during the program's early stages.

The sample frame for the survey of CNMs and NPs came from license and address information from the California Board of Registered Nursing. Nurses were identified as having a CNM or NP certificate, and some had dual certification. CNMs and NPs in some regions of California were oversampled to ensure adequate numbers of each type of respondent in each region. We mailed the questionnaire on October 21, 2011, accompanied by a letter indicating that completion was voluntary. The letter also included a link to an online version of the survey with login and password information. We subsequently mailed 3 reminder postcards and a second copy of the survey. Data collection closed on January 18, 2012.

We used similar methods to administer a survey to a probability sample of physicians (medical doctors; MDs) in partnership with the Medical Board of California. MDs in California must renew their licenses every 2 years. The renewal process includes completing a mandatory survey that includes questions regarding their professional activities, primary practice location, training, and demographic characteristics. For this study, we developed a 1-page, double-sided, voluntary supplemental questionnaire on EHR availability and included it in the materials sent to MDs whose license renewals were due between June 1 and July 31, 2011. Because the timing of the relicensing process is based on the applicant's birth month, the sample was essentially random.

Study Samples

The analysis of data from the survey of CNMs and NPs was limited to respondents who were potentially eligible for Medicaid EHR incentive payments.[17] We included respondents in the analysis if they lived in California, worked in a position for which certification as a CNM or NP is required, and spent at least 1% of their time providing direct patient care. A total of 4862 CNMs and NPs were eligible for inclusion in the analysis. Responses were received from 2644, resulting in a response rate of 54% among those eligible.

We mailed the physician survey to 10,353 physicians. To limit the analysis to physicians who were potentially eligible for Medicaid incentive payments, we analyzed only responses from physicians who practiced in California and who reported that they provide at least 1 hour of patient care per week. Among the 7931 eligible physicians, the response rate was 68%, yielding a final sample size of 5384 physicians.

Statistical Analysis

We calculated descriptive statistics for demographic and practice characteristics of CNMs/NPs and physicians that prior research suggests are associated with EHR availability. Frequency distributions were calculated to compare the availability of any EHR, a basic EHR, and an advanced EHR at the main practice locations of CNMs/NPs and physicians. We estimated multivariate logistic regressions to assess the association between EHR availability and characteristics of the 2 groups of health professionals. For both survey populations, we used weights to ensure that the estimates would reflect the characteristics of the populations from which the samples were drawn.

Measures of Availability of EHRs

Estimates of the percentage of practitioners who had any EHR at their main practice location were based on responses to the following question: "Does your main practice location have any type of computerized medical records system (also known as an electronic health record or an electronic medical record)?" Respondents who answered "yes" to this question were considered to have an EHR. Those who did not answer this question or who answered "no" or "don't know" and then went on to affirmatively answer questions about availability and

use of specific EHR functions were also considered to have an EHR. In most cases, the respondent skipped the question, suggesting the respondent did not notice it; those who answered "no" may have misread the question. The recoding of this question affected less than 10% of the respondents to each survey. We used definitions developed for the NAMCS EHR Supplement to classify respondents as having a "basic" or an "advanced" EHR.[18,19] The specific functions of basic and advanced EHRs are listed in Table 1.

Table 1. Functions of Basic and Advanced Electronic Health Records (EHRs)[18]

Function	Basic EHR	Advanced EHR
Collect patient demographics	X	X
Take clinical notes	X	X
Generate patient problem list	X	X
Generate list of patient medications	X	X
Generate list of medication allergies	X	X
Order/transmit prescriptions electronically	X	X
View or receive lab test results	X	X
View imaging test results	X	X
Transmit info electronically to/from providers to whom a patient is referred		X
Generate lists of patients by condition (eg, all patients with diabetes)		X
Transmit data to immunization registries		X
Patients access their own electronic health record		X
Generate routine reports of quality indicators		X

Measures of Characteristics Hypothesized to Be Associated with EHR Availability

We estimated with multivariate logistic regressions to assess the relationship between having any, a basic, or an advanced EHR and 4 practice characteristics that previous research suggests are associated with EHR availability. The regressions also controlled for age and sex.

Practice Location. We hypothesized that rural respondents would have a lower likelihood of having an EHR because rural practices often have limited financial resources relative to urban practices. A crosswalk of zip codes with the California Office of Statewide Health Planning and Development's Medical Services Study Areas, which are based on census tracts, was used to classify zip codes for providers' main practice locations as urban or rural.

Practice Setting. Findings from previous research suggest that EHR availability is associated with practice size and type.[7-10] CNMs', NPs', and physicians' practices were grouped into 5 categories derived from the survey's response options: small practices (<10 CNMs, NPs, or physicians), mid-sized group practices (10-49 providers), large group practices (50 or more providers), community/public clinics, and other settings. Among CNMs and NPs, "other settings" included hospitals (both inpatient and outpatient units), military medical facilities, Department of Veterans Affairs (VA) medical facilities, and other unspecified settings. Among physicians, "other settings" included military facilities, VA facilities, and other unspecified settings. Providers practicing in community/public clinics, whose patients are primarily uninsured or enrolled in Medicaid, were analyzed separately, because they may have had fewer resources available to purchase an EHR prior to the establishment of California's Medicaid EHR incentive program.

Practice Type. We hypothesized that hospital-based CNMs, NPs, and physicians would be more likely to have EHRs at their main practice locations because hospitals have greater financial resources than physician practices and can amortize the cost of EHRs across larger numbers of providers. Consistent with the eligibility criteria for the Medicaid and Medicare EHR incentive payments,[17,20] we classified CNMs, NPs, and physicians as hospital based if they reported spending 90% or more of their patient care hours in inpatient or emergency department settings.

Percentage of Medicaid Patients. We hypothesized that prior to the launching of California's Medicaid EHR incentive program, respondents who had high percentages of Medicaid patients in their practices would be less likely to have an EHR because Medicaid typically pays lower reimbursement rates than Medicare and commercial insurers.[21] Respondents were classified as having a high percentage of Medicaid patients if 50% or more of their patients were enrolled in Medicaid.

RESULTS

Demographic and Practice Characteristics of CNMs/NPs and Physicians

Table 2 describes the demographic and practice characteristics of the CNMs, NPs, and physicians who re-

Table 2. Characteristics of CNMs/NPs and Physicians (MDs)

	CNMs/NPs N (%)	MDs N (%)
Age		
<46 years	555 (27%)	2048 (38%)
46-65 years	1351 (64%)	2483 (46%)
>65 years	185 (9%)	853 (16%)
Sex		
Male	182 (7%)	3623 (67%)
Female	2422 (93%)	1759 (33%)
Geographic location		
Rural	433 (22%)	417 (8%)
Urban	1534 (88%)	4642 (92%)
Percentage of Medi-Cal[a] patients		
0%	685 (37%)	1959 (39%)
1 to 49%	592 (32%)	2723 (53%)
≥50%	574 (31%)	401 (8%)
Practice type		
Hospital-based	201 (10%)	672 (14%)
Office-based	1810 (90%)	4155 (86%)
Practice Setting		
Solo or small group (1-9)	438 (21%)	1608 (32%)
Mid-sized group (10-49)	104 (5%)	409 (8%)
Large group (50+)	125 (6%)	839 (17%)
Community health center/public clinic	333 (16%)	312 (6%)
Kaiser Permanente	229 (11%)	791 (16%)
VA or military facilities	104 (5%)	279 (6%)
Hospital, inpatient	215 (12%)	N/A[b]
Hospital, labor & delivery	36 (1%)	N/A[b]
Hospital, outpatient	218 (12%)	N/A[b]
Other	295 (13%)	766 (15%)

CNM indicates certified nurse midwife; MD, medical doctor; NP, nurse practitioner; VA, Department of Veterans Affairs.
[a]Medi-Cal is California's Medicaid healthcare program.
[b]N/A indicates response options that were not presented in the MDs' survey. Data for some variables are missing for some respondents.

sponded to the 2 surveys. Compared with physicians, CNMs and NPs were younger, and more likely to be female, practice in a rural area, and have a high percentage of Medicaid patients in their practices. Respondents and nonrespondents were similar (results not shown).

EHR Availability

The Figure displays the percentages of CNMs/NPs and physicians who have any EHR, a basic EHR, or an advanced EHR at their main practice location. The findings indicate that access to EHRs was widespread in California in 2011 but that many of the EHRs in use did not meet the NAMCS EHR Supplement definitions of basic and advanced EHRs. CNMs and NPs were more likely to have any sort of EHR at their main practice location than physicians (78% vs 71%) and were also more likely to have a basic EHR (54% vs 49%). However, they were less likely than physicians to have an advanced EHR (24% vs 45%) that incorporated both basic features used in individual patient encounters and advanced features used to manage population health and exchange information among providers and patients.

Despite these differences in access to EHRs with the full complement of advanced features, availability of specific functions was similar between CNMs/NPs and physicians (results not shown). In both groups, the 3 most frequently available EHR functions were: ability to take clinical notes, generate lists of patients' medications, and generate lists of patients' medication allergies. The 3 least frequently available functions were: ability to provide patients with access to their own electronic records, transmit data to immunization registries, and generate routine reports on quality indicators.

Characteristics Associated With EHR Availability

Table 3 displays the results of multivariate logistic regressions on the demographic and practice characteristics associated with the availability of EHRs in CNMs/NPs' and physicians' main practice locations. For both CNMs/NPs and physicians, practice size was the strongest predictor of having an EHR. Practicing in a mid-sized group (10-49 providers) or a large group (≥50 providers) was associated with greater odds of having any EHR, a basic EHR, or an advanced EHR relative to being in a small practice (<10 providers). Relative to CNMs and NPs in small practices, CNMs and NPs in mid-sized practices were twice as likely to have an advanced EHR (odds ratio [OR] = 2.16; 95% CI, 1.13-4.13) and CNMs and NPs in large group practices were 6 times more likely to have an advanced EHR (OR = 6.29; 95% CI, 4.09-9.66).

EHR availability was also associated with the proportion of Medicaid patients in CNMs'/NPs' and physicians' practices. CNMs/NPs who reported that 50% or more of their patients were enrolled in Medicaid had lower odds of having a basic or advanced EHR (OR = 0.63;

Table 3. Factors Associated With EHR Availability: CNMs and NPs Versus Physicians (MDs)

	Any EHR	Any EHR	Basic EHR	Basic EHR	Advanced EHR	Advanced EHR
	CNMs & NPs	MDs	CNMs & NPs	MDs	CNMs & NPs	MDs
Age <46 years	reference	reference	reference	reference	reference	reference
Age 46-65 years	1.42 (1.04-1.95)	0.79 (0.69-0.93)	1.06 (0.80-1.39)	0.77 (0.67-0.89)	0.86 (0.63-1.18)	0.83 (0.72-0.96)
Age >65 years	0.89 (0.46-1.73)	0.54 (0.43-0.68)	0.58 (0.31-1.09)	0.39 (0.31-0.48)	0.62 (0.29-1.30)	0.43 (0.34-0.54)
Male	reference	reference	reference	reference	reference	reference
Female	1.46 (0.90-2.37)	1.03 (0.88-1.22)	0.86 (0.55-1.34)	0.95 (0.82-1.10)	0.85 (0.52-1.38)	0.98 (0.85-1.13)
Urban	reference	reference	reference	reference	reference	reference
Rural	1.03 (0.73-1.45)	0.90 (0.71-1.15)	0.96 (0.71-1.30)	0.88 (0.69-1.11)	1.22 (0.85-1.76)	0.90 (0.71-1.15)
Medi-Cal[a] <50%	reference	reference	reference	reference	reference	reference
Medi-Cal[a] ≥50%	0.90 (0.65-1.24)	1.07 (0.82-1.39)	0.63 (0.48-0.83)	0.81 (0.64-1.04)	0.67 (0.47-0.95)	0.78 (0.61-1.00)
Office-based	reference	reference	reference	reference	reference	reference
Hospital-based	1.12 (0.62-2.03)	2.38 (1.84-3.07)	0.95 (0.61-1.48)	1.10 (0.90-1.34)	0.87 (0.52-1.45)	1.32 (1.09-1.61)
Solo or small group (<10)	reference	reference	reference	reference	reference	reference
Mid-sized group (10-49)	2.30 (1.21-4.37)	3.27 (2.44-4.35)	2.48 (1.42-4.35)	2.28 (1.78-2.92)	2.16 (1.13-4.13)	2.04 (1.59-2.63)
Large group (≥50)	24.59 (10.52-57.48)	12.63 (10.02-15.94)	13.66 (8.31-22.45)	6.32 (5.37-7.46)	6.29 (4.09-9.66)	6.64 (5.63-7.83)
Community/ public clinic	1.47 (0.97-2.22)	1.12 (0.85-1.47)	1.15 (0.78-1.71)	1.29 (0.97-1.71)	1.04 (0.59-1.82)	1.21 (0.90-1.62)
Other setting	2.96 (2.05-4.29)	1.00 (0.82-1.22)	1.54 (1.12-2.13)	1.28 (1.05-1.57)	1.79 (1.17-2.74)	1.42 (1.15-1.75)

CNM indicates certified nurse midwife; EHR, electronic health record; MD, medical doctor; NP, nurse practitioner.
[a]Medi-Cal is California's Medicaid healthcare program.
All data: odds ratios (95% CI).

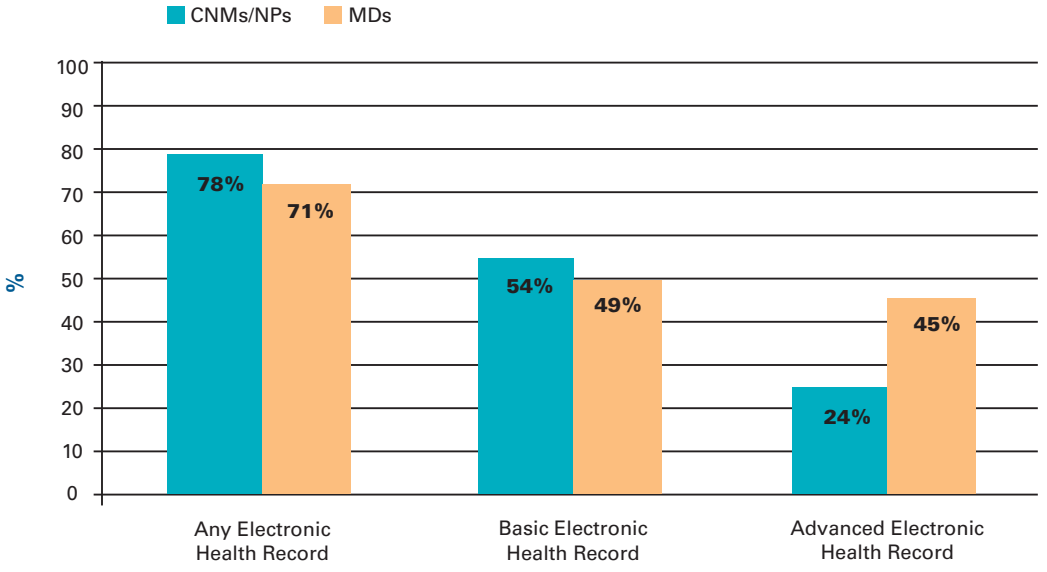
95% CI, 0.48-0.83 for a basic EHR and OR = 0.67; 95% CI, 0.47-0.95 for an advanced EHR). Physicians who had high percentages of Medicaid patients had lower odds of having an advanced EHR (OR = 0.78; 95% CI, 0.61-1.00).

Findings for CNMs/NPs and physicians differed for other variables in the model. For CNMs and NPs, none of the other variables in the model had a statistically significant association with the odds of having a basic or an advanced EHR, whereas for physicians, several other variables in the model had statistically significant associations with having a basic or an advanced EHR. Hospital-based physicians were more likely to have an advanced EHR than office-based physicians. Physicians over age 45 years were less likely to have a basic or an advanced EHR.

We conducted a sensitivity analysis to assess whether the finding that CNMs/NPs and physicians in large groups were more likely to have EHRs was due to the inclusion of providers who practice in Kaiser Permanente, the VA, or military facilities—3 integrated delivery systems that were early adopters of advanced EHRs. CNMs, NPs, and physicians who practice in Kaiser Permanente, the VA, or military facilities were removed from the multivariate regression models for the sensitivity analysis. The alternate approach of including separate categorical variables for practicing in one of these integrated delivery systems could not be used because rates of EHR availability among professionals who practice in these organizations approach 100%. Findings from the sensitivity analysis suggest that for CNMs/NPs and physicians practicing in a large group other than Kaiser Permanente, the VA, or the military is associated with higher odds of having any EHR, a basic EHR, or an advanced EHR, but the size of the effect is not as large (results not shown).

We performed an additional sensitivity analysis to examine whether the findings changed if the samples were restricted to CNMs/NPs and physicians who reported providing 20 or more hours of patient care per week—the threshold the American Medical Association uses to classify physicians as active in patient care.[22] Findings for CNMs/NPs and physicians who provide 20 or more hours of patient care per week were generally similar to findings for those providing 1 or more hours of patient care per week. Among physicians, the association between having a high percentage of Medicaid patients and having an EHR was stronger among those who provide 20 or more hours of patient care per week (OR = 0.78; 95% CI, 0.61-1.00 for all patient care physicians and OR = 0.69; 95% CI, 0.50-0.95 for patient care 20 or more hours per week).

Figure. Availability of Electronic Health Record at Main Practice Location



CNM indicates certified nurse midwife; MD, medical doctor/physician; NP, nurse practitioner.
All differences between NPs/CNMs and MDs are statistically significant at $P < .05$.

DISCUSSION

Findings from multivariate analyses suggest that among both CNMs/NPs and physicians, practicing in a large or mid-sized group is associated with higher odds of having a basic or advanced EHR, and having a high percentage of Medicaid patients is associated with lower odds of having an advanced EHR. Among physicians, EHR availability is also associated with younger age and with practicing in a hospital-based setting.

For the most part, practice characteristics were more strongly associated with EHR availability than demographic characteristics. This finding is consistent with the manner in which decisions about implementation of EHRs are often made. Decisions about whether to install an EHR are usually made at the organizational level rather than by individual clinicians. The organizational locus of decision making may also explain why predictors of EHR adoption were similar for CNMs/NPs and physicians. Most CNMs and NPs in California practice in organizations in which physicians also practice.

The strong association between practice size and EHR adoption found in this study is consistent with previous studies of physicians in other states and the United States as a whole.[5,7-10] The sensitivity analyses suggest that, at least in California, the size effect is not due solely to the presence of Kaiser Permanente and other large, integrated delivery systems that were early adopters of advanced EHRs. The effect was attenuated when these large, integrated delivery systems were excluded from the model, but nonetheless persisted. This suggests that large size incurs advantages for EHR adoption, independent of the degree to which a practice is integrated into a larger system.

The finding that having a high percentage of Medicaid patients is associated with lower odds of having an advanced EHR may also reflect differences in access to resources. Medicaid generally reimburses CNMs, NPs, and physicians at lower rates than Medicare and commercial insurers. The gap is especially stark in California because the state's Medicaid rates are among the lowest in the nation and are substantially lower than Medicare rates.[21] Practices that have high percentages of Medicaid patients also often have high percentages of uninsured patients, a situation that further limits their financial resources.

Despite the similarities between CNMs/NPs and physicians in California, there were also some important differences. CNMs/NPs and physicians had similar rates of having any EHR or a basic EHR, but CNMs and NPs were much less likely to have an advanced EHR at their main practice locations. The reasons for this discrepancy may be rooted in differences in the distribution of CNMs/NPs and physicians across practice settings. Twenty-five percent of CNMs and NPs in the sample practice in hospitals. Historically, hospitals have had greater financial resources to invest in EHRs than physician practices.

Yet, until the Medicare and Medicaid EHR incentive programs were implemented, hospitals had little incentive to install advanced functions that facilitate assessment of population health and exchange of information with other providers. CNMs and NPs were also less likely to practice in Kaiser Permanente or other large group practices, the entities with the highest rates of availability of advanced EHRs.

Limitations

This study has several important limitations. Response rates for CNMs/NPs and physicians were 54% and 68%, respectively, and some responses were incomplete. Although weights were used to generate estimates that reflect the populations of CNM/NPs and physicians in California, it is possible that the respondents differ systematically from the population in ways that are not easily observed. The analysis also relied primarily on self-reported data that were not independently verified. In addition, the study can only identify associations between EHR adoption and the predictor variables. Causal inferences cannot be drawn because the data are cross-sectional.

In addition, the surveys were not in the field at the exact same time. The physician survey was administered prior to implementation of the Medicaid incentive program in California, whereas the CNM/NP survey was administered during the program's early stages. The percentage of physicians with an EHR may have been larger if the physician survey had been distributed at the exact same time as the CNM/NP survey, because the availability of Medicaid incentive payments may have led additional physician practices to install EHRs during the months between the times the physician and CNM/NP surveys were administered.

CONCLUSIONS

For both CNMs/NPs and physicians in California, availability of advanced EHRs is concentrated among large practices with fewer Medicaid patients. These findings may change now that both Medicaid and Medicare have begun issuing incentive payments to CNMs, NPs, and physicians in California. One of the goals of the Medicaid incentive program is to "level the playing field" by providing funds to practices with high percentages of Medicaid patients to enable them to purchase EHRs capable of achieving meaningful use. Future studies should assess whether the availability of incentive payments attenuates the relationships between availability of advanced EHRs and practice size and payer mix and is associated with improvement in quality of care.

Acknowledgments

The authors thank Raul Ramirez and Larry Dickey, MD, MPH, of the California Department of Health Services; Christopher Perrone, MPP, of the California HealthCare Foundation; and Catherine Hoffman, ScD, RN, FAAN, of the California Medicaid Research Institute for their thoughtful comments on previous versions of this manuscript. They also thank Dennis Keane, Lela Chu, Jessica Lin, and Patrick Madigan for their assistance in conducting the NP/CNM survey, and Leon Traister for his assistance in conducting the physician survey.

Author Affiliations: University of California - San Francisco (JMC, JS, KG, MF, ABB), San Francisco, CA.

Source of Funding: This study was funded by the California Department of Health Care Services, Office of Health Information Technology, and the California HealthCare Foundation.

Author Disclosures: The authors report no relationship or financial interest in any entity that would pose a conflict of interest with the subject matter of this article.

Authorship Information: Concept and design (JMC, JS, KG, ABB); acquisition of data (JMC, JS, MF); analysis and interpretation of data (JMC, JS, KG, MF, ABB); drafting of the manuscript (JMC, JS, MF, ABB); critical revision of the manuscript for important intellectual content (JS, KG, ABB); statistical analysis (JS); provision of study materials or patients (JS); obtaining funding (JMC, KG, ABB); administrative, technical, or logistic support (JS, MF); and supervision (JMC, JS).

Address correspondence to: Janet M. Coffman PhD, MPP, MA, 3333 California St, Ste 265, San Francisco, CA 94118. E-mail: Janet.Coffman@ucsf.edu.

REFERENCES

1. Buntin MB, Burke MF, Hoaglin MC, Blumenthal D. The benefits of health information technology: a review of the recent literature shows predominantly positive results. *Health Aff (Millwood).* 2011; 30(3):464-471.

2. Cebul RD, Love TE, Jain AK, Hebert CJ. Electronic health records and quality of diabetes care. *N Engl J of Med.* 2011;365(9):825-833.

3. Parente ST, McCullough JS. Health information technology and patient safety: evidence from panel data. *Health Aff (Millwood).* 2009;28(2):357-360.

4. Reed M, Huang J, Graetz I, et al. Outpatient electronic health records and the clinical care and outcomes of patients with diabetes mellitus. *Ann Intern Med.* 2012;157(7):482-489.

5. Hsiao C-J, Hing E, Socey TC, Cai B; National Center for Health Statistics. Use and characteristics of electronic health records systems among office-based physician practices: United States, 2001-2012. National Center for Health Statistics Data Brief, No. 111. CDC website. http://www.cdc.gov/nchs/data/databriefs/db111.htm. Accessed May 21, 2013.

6. Blumenthal D, Tavenner M. The "meaningful use" regulation for electronic health records. *N Engl J Med.* 2010;363(6):501-504.

7. Decker SL, Jamoom EW, Sisk JE. Physicians in nonprimary care and small practices and those age 55 and older lag in adopting electronic health record systems. *Health Aff (Millwood).* 2012;31(5):1108-1114.

8. Menachemi N, Langley A, Brooks RG. The use of information technologies among rural and urban physicians in Florida. *J Med Syst.* 2007;31(6):483-488.

9. Rao SR, Desroches CM, Donelan K, Campbell EG, Miralles PD, Jha AK. Electronic health records in small physician practices: availability, use, and perceived benefits. *J Am Med Inform Assoc.* 2011;18(3):271-275.

10. Simon SR, McCarthy ML, Kaushal R, et al. Electronic health records: which practices have them, and how are clinicians using them? *J Eval Clin Pract.* 2008;14(1):43-47.

11. Yan H, Gardner R, Baier R. Beyond the focus group: understanding physicians' barriers to electronic medical records. *Jt Comm J Qual Patient Saf.* 2012;38(4):184-191.

12. Menachemi N, Powers TL, Brooks RG. Physician and practice characteristics associated with longitudinal increases in electronic health record adoption. *J Healthc Manag.* 2011;56(3):183-197; discussion 197-198.

13. Linder J, Schnipper J, Tsurikova R, Melnikas AJ, Volk LA, Middleton B. Barriers to electronic health records use during patient visits. *AMIA Annu Symp Proc.* 2006;499-503.

14. The registered nurse population: findings from the 2008 national sample survey of registered nurses. HHS website. http://bhpr.hrsa.gov/healthworkforce/rnsurveys/rnsurveyfinal.pdf. Published September 2010. Accessed May 21, 2013.

15. When the doctor is not needed. *New York Times.* December 16, 2012: SR10. Editorial.

16. Consensus model implementation status. National Council of State Boards of Nursing website. http://www.ncsbn.org/736htm. Published 2012. Accessed May 21, 2013.

17. An introduction to the Medicaid EHR Incentive Program for eligible professionals. CMS website. http://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/eligibility.html#BOOKMARK1. Published 2012. Accessed May 21, 2013.

18. Hsiao C-J, Hing E, Socey TC, Cai B; National Center for Health Statistics. Electronic health record systems and intent to apply for meaningful use incentives among office-based physician practices: United States, 2001-2011. National Center for Health Statistics Data Brief, No. 79. CDC website. http://www.cdc.gov/nchs/data/databriefs/db79.htm. Published November 2011. Revised February 8, 2012. Accessed May 21, 2013.

19. King J, Patel V, Furukawa MF; The Office of the National Coordinator for Health Information Technology. Physician adoption of electronic health record technology to meet meaningful use objectives: 2009-2012. ONC Data Brief, No. 7. http://www.healthit.gov/sites/default/files/onc-data-brief-7-december-2012.pdf. Published December 2012. Accessed May 21, 2013.

20. An introduction to the Medicare EHR Incentive Program for eligible professionals. beginner's guide. CMS website. http://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/eligibility.html#BOOKMARK1. Published 2012. Accessed May 21, 2013.

21. Zuckerman S, Goin D; Henry J. Kaiser Family Foundation. How much will Medicaid physician fees for primary care rise in 2013? evidence from a 2012 survey of Medicaid physician fees. http://kaiserfamilyfoundation.files.wordpress.com/2013/01/8398.pdf. Published December 2012. Accessed May 21, 2013.

22. The physician workforce: projections and research into current issues affecting supply and demand. HHS Health Resources and Services Administration website. http://bhpr.hrsa.gov/healthworkforce/reports/physwfissues.pdf. Published December 2008. Accessed May 21, 2013. ■

www.ajmc.com Published as a Web Exclusive