Published in final edited form as:

Am J Prev Med. 2012 February ; 42(2): 164–173. doi:10.1016/j.amepre.2011.10.008.

Prioritization of Evidence-Based Preventive Health Services During Periodic Health Examinations

Deirdre A. Shires, MPH, MSW, Kurt C. Stange, MD, George Divine, PhD, Scott Ratliff, MS, Ronak Vashi, BA, Ming Tai-Seale, PhD, and Jennifer Elston Lafata, PhD

Center for Health Policy and Health Services Research (Shires, Vashi, Elston Lafata), Public Health Sciences (Divine), Henry Ford Health System, Detroit, Michigan; the Department of Family Medicine (Stange), Case Western Reserve University Cleveland, Ohio; the Veterans Administration (Ratliff), the Department of Social and Behavioral Health (Elston Lafata), Virginia Commonwealth University, Richmond, Virginia; Health Policy Research (Tai-Seale), Palo Alto Medical Foundation Research Institute, Mountain View, California

Abstract

Background—Delivery of preventive services sometimes falls short of guideline recommendations.

Purpose—To evaluate the multilevel factors associated with evidence-based preventive service delivery during periodic health examinations (PHE).

Methods—Primary care physicians were recruited from an integrated delivery system in southeast Michigan. Office visit audio-recordings of PHE visits conducted from 2007–2009 were used to ascertain physician recommendation for or delivery of 19 guideline-recommended preventive services. Alternating logistic regression was used to evaluate factors associated with service delivery. Data analyses were completed in 2011.

Results—Among 484 PHE visits to 64 general internal medicine and family physicians by insured patients aged 50–80 years, there were 2662 services for which patients were due; 54% were recommended or delivered. Regression analyses indicated that the likelihood of service delivery decreased with patient age and with each concern the patient raised, and increased with increasing BMI and with each additional minute after scheduled appointment time the physician first presented. The likelihood was greater with patient/physician gender concordance and less if the physician used the electronic medical record in the exam room and had seen the patient in the past 12 months.

Conclusions—A combination of patient, physician, visit and contextual factors are associated with preventive service delivery. Additional studies are warranted to understand the complex interplay of factors that support and compromise preventive service delivery.

© 2011 American Journal of Preventive Medicine. Published by Elsevier Inc. All rights reserved.

Address correspondence to: Jennifer Elston Lafata, PhD, the Department of Social and Behavioral Health, Virginia Commonwealth University School of Medicine, PO Box 980149 1112 East Clay St., Richmond VA 23298. jelstonlafat@vcu.edu.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

No financial disclosures were reported by the authors of this paper.

Introduction

Over 20% of the U.S. population, or 44.4 million adults, receive a periodic health examination (PHE) each year.¹ The majority of both physicians and patients agree that PHEs are needed.^{2,3} Physicians report that PHEs contribute to the physician–patient relationship and provide more time for counseling, meeting patient expectations, and improving disease detection.² Patients believe that discussion of health habits and risk factors should occur during a PHE along with a physical examination and various health screening tests.³

Although many professional organizations have historically recommended that adult preventive health services be offered in the context of routine medical care rather than during PHEs,^{4,5} recent findings suggest that patients who use PHEs may be more likely to receive recommended preventive services.^{6–12} Yet, the use of such visits is not sufficient to ensure a physician recommendation for, or receipt of, evidence-based cancer screening and other preventive services.^{9,11}

Even during PHEs, time limitations and other constraints likely force primary care physicians and patients to make choices about what topics are addressed.^{13–19} Few observational studies have been conducted which evaluate the delivery of a broad range of recommended preventive services and the patient, physician, patient/physician relationship, and visit factors that may be associated with such service delivery. This study links audio-recording data from a large sample of PHEs with that from pre-visit administrative claims and patient survey data in order to evaluate the occurrence of preventive service delivery and the patient, physician, patient/physician relationship, and visit characteristics associated with service delivery. The association of service delivery with visit length is also described.

Methods

Study Setting

Physician and patient samples were identified from an integrated delivery system located in southeast Michigan. The system includes a 1000-member, salaried medical group which staffs 26 ambulatory clinics in Detroit and surrounding suburbs. At the time of the study, the medical group did not have a set policy for the scheduling of PHEs. Thus, scheduling varied by physician preference. Since 2005, the medical group's electronic medical record (EMR) has included a gender- and age-targeted prompt for routine preventive health services (Prompted services are noted in Table 2). A 'stoplight' alert is red if a patient is due for any one included service. When the physician opens the stoplight window, a list of services and due status appears.

Participant Eligibility Criteria and Recruitment

Eligible clinician and patient subjects were those enrolled in an observational study of patient–physician decision making and colorectal cancer screening.^{20–22} Eligible clinicians were family and general internal medicine physicians practicing with the medical group between 2007 and 2009. Eligible patients were insured by a health system–affiliated HMO for the past 5 years and, per administrative claims data, aged 50–80 years and due for colorectal cancer screening at the time of a scheduled PHE with a study-participating physician between February 2007 and June 2009. Study recruitment has been described previously.^{20,21} All aspects of the study were approved by the IRBs of the Henry Ford Medical Group and Virginia Commonwealth University.

Data Sources and Measures

Physician demographic characteristics and specialty were obtained from medical group records. Patient participation included completion of a pre-visit telephone survey and attendance at and audio-recording of a scheduled PHE. Observational and survey data were joined with available automated claims data for no less than 5 and up to 10 years preceding the audio-recorded office visit. The latter was used to determine whether services had been received previously as well as to compile information to construct summary health status measures such as an adapted Charlson Comorbidity score²³ and Framingham General Cardiovascular Disease Risk Score.²⁴

The structured pre-visit patient survey solicited information regarding patient sociodemographic characteristics and a number of other patient-reported factors, including tobacco²⁵ and alcohol use,^{25,26} psychiatric symptoms²⁷ and family history of cancer.²⁸ Research assistants who attended the visits completed an observer checklist that included information regarding the time the patient was roomed and discharged; time the physician spent in the room; and use of the EMR during the visit. For visits during which the research assistant was not present ($n=113$), research assistants remained outside the room to track physician entry/exit time. Use of the EMR during those visits was obtained from verbal cues and audible keyboarding.

Audio-recordings were used to capture physician recommendation/delivery of preventive health services during the office visit as well as service delivery by medical assistants or nurses before and after the patient/physician encounter. Recordings were transcribed and four research assistants coded patient–physician discussions using structured coding forms. Preventive topics of interest were those recommended by the U.S. Preventive Services Task Force (www.uspreventiveservicestaskforce.org) and Advisory Committee on Immunization Practices (www.cdc.gov/vaccines/recs/acip) for patients aged 50–80 years and for which patient eligibility and due status could be determined from available data sources, both of which are consistent with the preventive services guidelines used by the medical group. Coded topics included screening (cervical cancer, colorectal cancer, breast cancer, hypertension, cholesterol, diabetes, osteoporosis, vision, and hearing), counseling (aspirin, tobacco, alcohol, calcium, mental health, obesity, diet), and immunizations (pneumococcal, tetanus, influenza).

For each topic, presence of a recommendation for behavior change or service receipt as well as any indication of patient's due status for service receipt was coded. Service delivery was defined as: (1) a recommendation by the physician to change behavior or receive a service; (2) a suggestion by the physician to think about changing a behavior or receiving a service; (3) reinforcement by the physician of current or future planned behavior change; or (4) actual service delivery (i.e., completing a Pap). For the latter, services could be delivered by the physician, nurse or medical assistant during the visit. Any verbal indication during the visit that a patient was not due for service resulted in a 'not due' status being attributed regardless of other available information. Inter-rater reliability was assessed by having approximately 10% of visits ($n=53$) coded by two research assistants. Among the variables coded, Cohen's kappa averaged 0.73 (median = 0.81).

Each transcript was coded for the occurrence of three patient communication types: expressions of concern, questioning, and assertive responses. This was achieved using a system developed by Street et al (29;30). For these items, Cohen's kappa (weighted) averaged 0.68 (median = 0.72).

The primary outcome of interest was physician recommendation for or delivery of a preventive service for which the patient was eligible and due at the time of presentation.

Among those deemed eligible for service (Appendix A, available online at www.ajpmonline.org), due status was determined from the recommended screening interval and a combination of claims, medical record, office visit audio-recordings, and survey data. Patients determined 'not due' had either received the relevant service during the recommended interval or service receipt was deemed inappropriate by the physician during the discussion (i.e., patient could not tolerate daily aspirin use). For alcohol and mental health counseling, service delivery was defined by any discussion regardless of the presence or absence of a specific physician recommendation for behavior change. These exceptions were made due to the inherent limitations of survey data for determining patient need for these particular services.

Statistical Methods

To evaluate the multilevel factors associated with delivered and missed services, bivariable and multivariable alternating logistic regression models were fit in SAS. The unit of analysis for all models was the eligible and due preventive service. Alternating logistic regression was used to model the correlation structure for two levels (i.e., services nested by patient/visit and patient/visit nested by physician). The multivariable model controlled for patient, physician, patient-physician relationship, and visit contextual factors as well as a fixed effect for each service. Potential interactions between whether the physician used the EMR in the exam room and service were also considered; however, no interaction was detected.

The model was also evaluated for potentially problematic multicollinearity. As none was detected, results are reported for the full model that includes all main effect measures assessed. Trends in the relationship of service delivery to visit length (as measured by minutes the physician was present) were evaluated using a quadratic fit to the minutes. Data analyses were completed in 2011.

Results

Sample Characteristics

Five hundred patients consented to participate. Among these, there were 484 audible office visit recordings to 64 primary care physicians. Physician and patient participants/nonparticipants are described in detail elsewhere.²⁰ Sample physicians were on average aged 48 years, 56% were female and 48% were white, 17% African-American, and 34% other race. Seventy percent were general internists and 30% were family physicians. On average, 7.6 office visit recordings were recorded for each physician (range = 1–20; data not shown).

Patients were on average aged almost 60 years (Table 1). Almost two thirds were female and 28% were African-American. The mean Charlson comorbidity score was less than 1, depressive symptoms were reported by 18% at the time of the pre-visit survey, and mean BMI was 31. Patients and physicians were of the same gender in the majority of visits (72.9%). Visits contained an average of 3.9 instances of patient questioning, 0.3 instances of patient expressions of concern and 2.6 instances of patient assertive responses. Most patients had seen the physician in the past 12 months (81.3%). Physicians first presented to the exam room an average of 26 minutes after the scheduled appointment time, and most physicians accessed the EMR while present in the exam room (81.0%).

Delivered and Missed Preventive Services

At the time of presentation, patients were eligible for an average of 14.2 preventive services (range 11–19) and due for an average of 5.5 (range 1–13, Table 1). On average, three of those services (range = 0–11) were delivered during the visit. A total of $n=57$ patients (12%) had each of their eligible and due preventive services delivered (range 1–6). Across the

sample of patients, there were 2662 preventive health services for which patients were eligible and due at the time of the audio-recorded visit (Table 2).

Services most likely to be recommended/delivered to patients were colorectal cancer screening (92.9%), hypertension screening (92.0%), and breast cancer screening (88.9%), while those least likely to be recommended or delivered were aspirin use counseling (18.3%), vision screening (18.9%), and influenza vaccination (20.0%). Overall, 54% of eligible and due services were delivered and 46% were missed; 66% of immunization services ($n=458$), 55% of counseling services ($n=1126$), and 27% of screening services ($n=1078$) were not delivered to eligible and due patients.

In unadjusted models, multiple factors were ($p<0.05$) associated with service delivery (Table 3) including patient age, income, education, employment status, Charlson Comorbidity score, CVD score, patient use of questioning, and physician arrival time. When other factors were controlled (Table 4), service delivery was associated ($p<0.05$) with patient characteristics (decreasing patient age, increasing BMI, decreasing patient expressions of concern); patient/physician relationship factors (patient/physician gender concordance, and if the physician did not see the patient in the past 12 months); and visit context factors (EMR not used during the visit, and the more minutes after the scheduled appointment time the physician arrived). With the exception of breast cancer and hypertension screening, each of the other services evaluated were less likely to be delivered when compared to colorectal cancer screening.

Visit Length and the Delivery of Preventive Services

On average, patients spent just under half an hour with the physician (26.9 minutes), although this ranged from 5 to 71 minutes. Service delivery increased with increasing visit length (Figure 1) until a visit length of 25–29 minutes, and then decreased with longer visits (a quadratic relationship, $p<0.05$).

Discussion

Although an average of three preventive health services that patients were eligible and due for at the time of a PHE were delivered, almost as many services went undelivered. While the opportunity to deliver breast cancer, colorectal cancer, and hypertension screening was rarely missed, delivery of aspirin and diet counseling, influenza immunization, and vision and hearing screening was achieved less than one third of the time. These results are generally consistent with previous findings of preventive service delivery in primary care^{11,31,32} and for the first time begin to highlight the multilevel factors associated with delivery of preventive services when a patient is due at the time of PHE.

Preventive service delivery^{33,34} and care quality^{35,36} have been found to be a function of the interaction among patient, physician, practice, and other environmental factors,^{37, 38} yet many prior studies have focused on patient factors alone or only a limited number of other factors.^{39–43} When controlling for a broad range of factors, this study found at the patient level an association of service delivery only with decreasing patient age and increasing BMI. This latter finding is consistent with a handful of other recent studies that have found obese patients to be as or more likely to receive appropriate preventive services compared to others.^{44–46}

Previous studies have also found that physician gender influences preventive service delivery.^{41,43} While this study did not find that physician gender alone affected preventive service recommendation and delivery, preventive service delivery was jeopardized when physicians were not of the same gender as their patient. Although other studies have shown

gender concordance to be unrelated to service delivery,^{41,43} the difference may be that this study credited physicians for both recommendation and delivery, or because credit was given for what happened during the visit and not how up-to-date the patient was at presentation.

Prior encounters may influence service delivery as well; patients who had seen their physicians in the past 12 months had fewer services delivered, consistent with previous findings that patient–physician familiarity seems to decrease attention to preventive service delivery.⁴⁷ The relationship of communication behaviors and prior patient–physician relationship to the recommendation for and delivery of evidence-based preventive care warrants further investigation.

Unexpectedly, preventive services were less likely to be recommended or delivered during visits where the physician accessed the EMR in the exam room. In this study setting, approximately half of the 19 preventive services studied are prompted in the EMR. While these prompted services are generally more likely to be delivered compared to the other services considered, there was no interaction between EMR use in the exam room and whether or not the EMR contained a prompt for the specific service.

Previous studies have found mixed results on whether tools or aids are associated with preventive service outcomes, although most studies have found positive results.^{37,48,49} As prompted services do not represent a random subset of services (e.g., they are more likely to be linked to performance measures), it is difficult to disentangle exactly what is at play. Although recent studies have generally indicated that using the EMR in the exam room has either neutral or positive effects on patient satisfaction and patient–physician communication,^{50–53} studies assessing whether using the EMR has adverse effects on preventive service delivery or how the presence of EMR prompts for some services may affect the delivery of a broad range of preventive services have not been conducted.

This study also points to what is likely a complex relationship between visit length and the delivery of preventive health services. Because of the likely endogeneity between visit length and service delivery, the association between the two could not formally be tested. Nonetheless, descriptive findings point to increased service delivery with increasing visit time – but only to a point. After a visit reached 25–29 minutes, service delivery then decreased with additional minutes. This trend suggests that although time spent with the patient may be associated with preventive service delivery up to a certain visit length, other factors — such as competing demands^{19,54} — are likely at play during longer visits. Service delivery also decreased with each additional concern (negative affect or emotions) that a patient expressed. It may be that patient expressions of concern are reflective of competing health demands that end up taking precedence over routine preventive service discussions.

Study findings also indicate that with each additional minute past the scheduled appointment time that a physician first presents to the exam room, the likelihood of service delivery increased. A priori, it was hypothesized that physicians who presented later might spend less time on preventive services in order to keep on schedule. This does not seem to be the case. Instead it seems likely that some physicians run behind schedule because they are more thorough in their delivery of preventive services.

Lack of time has previously been suggested as a barrier to preventive service delivery, with one study estimating that physicians would need over 21 hours per day to address all their patient's preventive service needs.¹³ In this setting, where patients were eligible and due for the receipt of over five evidence-based preventive health services at the time of presentation, time constraints likely forced both physicians and patients to make choices about what topics to address. Results here indicate that physicians seem to prioritize cancer screening

over counseling services and immunizations. While many such cancer screenings have the highest opportunity in terms of cost effectiveness and reduction of clinical burden, so too do some counseling services (e.g., aspirin use) that were frequently missed.⁵⁵

Continuing to rely on face-to-face time between patients and physicians as the primary mode for preventive service delivery will continue to result in less than optimal service delivery. Further, given patient preferences for shared decision making,^{20,56} increased calls for shared decision making⁵⁷ as well as the likelihood that technologic advances will make screening decisions more complex, alternative delivery models are clearly needed. Practice redesign approaches are emerging that may be able to better provide cost-effective preventive care in a more comprehensive manner by mobilizing resources both within and outside the exam room.

The patient-centered medical home is one such emerging approach (www.pcpcc.net/files/PilotGuidePip.pdf). A recent demonstration project used a reduction in practice size, a team approach, and enhanced use of a personal health record and patient outreach/communication to produce gains in care quality, including preventive service delivery.^{58,59} Personal health records in particular have shown promise in this area. Although personal health records are often lacking in terms of ideal functionality,⁶⁰ preliminary studies have shown that patients using even a basic interactive personal health record that interfaces with an EMR are more up to date on preventive care (www.ahrq.gov/about/annualconf10/krist_rosenthal/krist.HTM). Finally, population-based approaches such as mailed reminders and automated telephone calls have been shown to improve preventive screenings.⁶¹⁻⁶³

This study has some important limitations and considerations. First, the use of direct observation may have led physicians to deliver preventive services differently. However, this effect is likely small⁶⁴⁻⁶⁶ and, if anything, service delivery would have likely increased under a watchful eye. Second, a relatively broad definition of service recommendation/delivery was used. Thus, although office visit audio-recordings are arguably the prevailing gold standard to measure service delivery,⁶⁷ service delivery may be overstated as quantity, not quality, of recommendations was measured. Likewise, only one visit was considered; arguably service delivery occurs over a series of visits.

Further, although aspects of patient communication style were assessed, aspects of physician communication beyond the subject matter covered were not considered. It should also be noted that the parent study context may have affected screening discussions, either with respect to colorectal cancer screening (the primary target of the project) or for preventive services overall. Physicians were informed only that the study purpose was to examine general preventive service delivery.

Finally, all physician participants were salaried and patients were all insured, of relatively high income, and in fairly good health. The setting was limited to one integrated delivery system with relatively sophisticated performance measurement and electronic data capture capabilities, and data on preventive service performance improvement initiatives ongoing at the time of the study were not collected. As such, care needs to be taken when generalizing these findings to other populations and settings.

Although an average of three eligible and due preventive services were delivered during each PHE, 2.5 services represented missed opportunities for care. It is notable that several of the services most likely to go undelivered represent substantial opportunities not only to decrease the clinically preventable burden of disease but also to improve the cost effectiveness of care delivered.⁵⁵ These findings highlight factors associated with missed and delivered services that span multiple levels and identify potential targets for efforts to

ensure the delivery of evidence-based preventive services. Future studies should address other factors that may be associated with care delivery, such as physician communication processes and service characteristics as well as examine the potential for emerging practice redesign approaches to improve the delivery of evidence-based preventive services.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Many thanks to the research assistant team – Louise Kane, Max Kendall, Kelly Schaub, and Adam Schubatis – for all their hard work on this study.

Financial support: NIH 3R01CA112379-4S1. Kurt C. Stange's time is supported in part by a Clinical Research Professorship from the American Cancer Society. Ming Tai-Seale's time is supported in part by a grant from the NIMH MH081098.

References

1. Mehrotra A, Zaslavsky AM, Ayanian JZ. Preventive health examinations and preventive gynecological examinations in the U.S. *Arch Intern Med.* 2007; 167(17):1876–1883. [PubMed: 17893309]
2. Prochazka AV, Lundahl K, Pearson W, Oboler SK, Anderson RJ. Support of evidence-based guidelines for the annual physical examination: a survey of primary care providers. *Arch Intern Med.* 2005; 165(12):1347–1352. [PubMed: 15983282]
3. Oboler SK, Prochazka AV, Gonzales R, Xu S, Anderson RJ. Public expectations and attitudes for annual physical examinations and testing. *Ann Intern Med.* 2002; 136(9):652–659. [PubMed: 11992300]
4. Canadian Task Force. Canadian Task Force on the PHE. The PHE. *CMAJ.* 1979; 121:1193–1224. [PubMed: 115569]
5. Periodic health examination: a guide for designing individualized preventive health care in the asymptomatic patients. Medical Practice Committee, American College of Physicians. *Ann Intern Med.* 1981; 95(6):729–732. [PubMed: 7305155]
6. Boulware LE, Barnes GJ, Wilson RF, Phillips K, Maynor K, Hwang C, et al. Value of the periodic health evaluation. *Evid Rep Technol Assess (Full Rep).* 2006; (136):1–134. [PubMed: 17628127]
7. Fenton JJ, Cai Y, Weiss NS, Elmore JG, Pardee RE, Reid RJ, et al. Delivery of cancer screening: how important is the preventive health examination? *Arch Intern Med.* 2007; 167(6):580–585. [PubMed: 17389289]
8. Ferrante JM, Balasubramanian BA, Hudson SV, Crabtree BF. Principles of the patient-centered medical home and preventive services delivery. *Ann Fam Med.* 2010; 8(2):108–116. [PubMed: 20212297]
9. Lafata JE, Williams LK, Ben Menachem T, Moon C, Divine G. Colorectal carcinoma screening procedure use among primary care patients. *Cancer.* 2005; 104(7):1356–1361. [PubMed: 16092119]
10. Zapka JG, Puleo E, Vickers-Lahti M, Luckmann R. Healthcare system factors and colorectal cancer screening. *Am J Prev Med.* 2002; 23(1):28–35. [PubMed: 12093420]
11. Stange KC, Flocke SA, Goodwin MA, Kelly RB, Zyzanski SJ. Direct observation of rates of preventive service delivery in community family practice. *Prev Med.* 2000; 31(2 Pt 1):167–176. [PubMed: 10938218]
12. Pollak KI, Krause KM, Yarnall KS, Gradison M, Michener JL, Ostbye T. Estimated time spent on preventive services by primary care physicians. *BMC Health Serv Res.* 2008; 8:245. [PubMed: 19046443]
13. Yarnall KS, Pollak KI, Ostbye T, Krause KM, Michener JL. Primary care: is there enough time for prevention? *Am J Public Health.* 2003; 93(4):635–641. [PubMed: 12660210]

14. Yarnall KS, Ostbye T, Krause KM, Pollak KI, Gradison M, Michener JL. Family physicians as team leaders: "time" to share the care. *Prev Chronic Dis*. 2009; 6(2):A59. [PubMed: 19289002]
15. Abbo ED, Zhang Q, Zelder M, Huang ES. The increasing number of clinical items addressed during the time of adult primary care visits. *J Gen Intern Med*. 2008; 23(12):2058–2065. [PubMed: 18830762]
16. Nutting PA, Baier M, Werner JJ, Cutter G, Conry C, Stewart L. Competing demands in the office visit: what influences mammography recommendations? *J Am Board Fam Pract*. 2001; 14(5):352–361. [PubMed: 11572540]
17. Jaen CR, McIlvain H, Pol L, Phillips RL Jr, Flocke S, Crabtree BF. Tailoring tobacco counseling to the competing demands in the clinical encounter. *J Fam Pract*. 2001; 50(10):859–863. [PubMed: 11674888]
18. Nutting PA, Rost K, Smith J, Werner JJ, Elliot C. Competing demands from physical problems: effect on initiating and completing depression care over 6 months. *Arch Fam Med*. 2000; 9(10):1059–1064. [PubMed: 11115208]
19. Jaen CR, Stange KC, Nutting PA. Competing demands of primary care: a model for the delivery of clinical preventive services. *J Fam Pract*. 1994; 38(2):166–171. [PubMed: 8308509]
20. Wunderlich T, Cooper G, Divine G, Flocke S, Oja-Tebbe N, Stange K, et al. Inconsistencies in patient perceptions and observer ratings of shared decision making: the case of colorectal cancer screening. *Patient Educ Couns*. 2010; 80(3):358–363. [PubMed: 20667678]
21. Lafata JE, Cooper G, Divine G, Flocke SA, Oja-Tebbe N, Strange K, et al. Use of the 5 'As' during patient-physician colorectal cancer screening discussions. *Am J Prev Med*. 2011
22. Flocke S, Stange KC, Cooper GS, Wunderlich T, Oja-Tebbe N, Divine G, et al. Patient preferences and receipt of information for colorectal cancer screening. *Cancer Bio EPI*.
23. Deyo RA, Cherkin DC, Ciol MA. Adapting a clinical comorbidity index for use with ICD-9-CM administrative databases. *J Clin Epidemiol*. 1992; 45(6):613–619. [PubMed: 1607900]
24. D'Agostino RB Sr, Vasan RS, Pencina MJ, Wolf PA, Cobain M, Massaro JM, et al. General cardiovascular risk profile for use in primary care: the Framingham Heart Study. *Circulation*. 2008; 117(6):743–753. [PubMed: 18212285]
25. CDC. Behavioral Risk Factor Surveillance System Questionnaire. 2006
26. Vinson DC, Galliher JM, Reidinger C, Kappus JA. Comfortably engaging: which approach to alcohol screening should we use? *Ann Fam Med*. 2004; 2(5):398–404. [PubMed: 15506570]
27. Kroenke K, Spitzer RL, Williams JB, Lowe B. An ultra-brief screening scale for anxiety and depression: the PHQ-4. *Psychosomatics*. 2009; 50(6):613–621. [PubMed: 19996233]
28. Pinsky PF, Kramer BS, Reding D, Buys S. Reported family history of cancer in the prostate, lung, colorectal, and ovarian cancer screening trial. *Am J Epidemiol*. 2003; 157(9):792–799. [PubMed: 12727673]
29. Street RL Jr, Millay B. Analyzing patient participation in medical encounters. *Health Commun*. 2001; 13(1):61–73. [PubMed: 11370924]
30. Gordon HS, Street RL Jr, Sharf BF, Soucek J. Racial differences in doctors' information-giving and patients' participation. *Cancer*. 2006; 107(6):1313–1320. [PubMed: 16909424]
31. Backer EL, Gregory P, Jaen CR, Crabtree BF. A closer look at adult female health care maintenance visits. *Fam Med*. 2006; 38(5):355–360. [PubMed: 16729416]
32. Kottke TE, Solberg LI, Brekke ML, Cabrera A, Marquez MA. Delivery rates for preventive services in 44 midwestern clinics. *Mayo Clin Proc*. 1997; 72(6):515–523. [PubMed: 9179135]
33. Sussman AL, Williams RL, Leverence R, Gloyd PW Jr, Crabtree BF. The art and complexity of primary care clinicians' preventive counseling decisions: obesity as a case study. *Ann Fam Med*. 2006; 4(4):327–333. [PubMed: 16868236]
34. Litaker D, Flocke SA, Frolkis JP, Stange KC. Physicians' attitudes and preventive care delivery: insights from the DOPC study. *Prev Med*. 2005; 40(5):556–563. [PubMed: 15749138]
35. Zapka J, Taplin SH, Price RA, Cranos C, Yabroff R. Factors in quality care--the case of follow-up to abnormal cancer screening tests--problems in the steps and interfaces of care. *J Natl Cancer Inst Monogr*. 2010; 2010(40):58–71. [PubMed: 20386054]

36. Wagner EH, Austin BT, Von Korff M. Improving outcomes in chronic illness. *Managed Care Quarterly*. 1996; 4(2):12–25. [PubMed: 10157259]
37. Carpiano RM, Flocke SA, Frank SH, Stange KC. Tools, teamwork, and tenacity: an examination of family practice office system influences on preventive service delivery. *Prev Med*. 2003; 36(2): 131–140. [PubMed: 12590987]
38. Carney PA, Dietrich AJ, Keller A, Landgraf J, O'Connor GT. Tools, teamwork, and tenacity: an office system for cancer prevention. *J Fam Pract*. 1992; 35(4):388–394. [PubMed: 1402726]
39. Shenson D, Adams M, Bolen J. Delivery of preventive services to adults aged 50–64: monitoring performance using a composite measure, 1997–2004. *J Gen Intern Med*. 2008; 23(6):733–740. [PubMed: 18317846]
40. Gowin E, Avonts D, Horst-Sikorska W, Ignaszak-Szczepaniak M, Michalak M. Gender makes the difference: the influence of patients' gender on the delivery of preventive services in primary care in Poland. *Qual Prim Care*. 2009; 17(5):343–350. [PubMed: 20003720]
41. Flocke SA, Gilchrist V. Physician and patient gender concordance and the delivery of comprehensive clinical preventive services. *Med Care*. 2005; 43(5):486–492. [PubMed: 15838414]
42. Fiscella K, Goodwin MA, Stange KC. Does patient educational level affect office visits to family physicians? *J Natl Med Assoc*. 2002; 94(3):157–165. [PubMed: 11918385]
43. Henderson JT, Weisman CS. Physician gender effects on preventive screening and counseling: an analysis of male and female patients' health care experiences. *Med Care*. 2001; 39(12):1281–1292. [PubMed: 11717570]
44. Yancy WS Jr, McDuffie JR, Stechuchak KM, Olsen MK, Oddone EZ, Kinsinger LS, et al. Obesity and receipt of clinical preventive services in veterans. *Obesity (Silver Spring)*. 2010; 18(9):1827–1835. [PubMed: 20203629]
45. Chang VW, Asch DA, Werner RM. Quality of care among obese patients. *JAMA*. 2010; 303(13): 1274–1281. [PubMed: 20371786]
46. Peytremann-Bridevaux I, Santos-Eggimann B. Use of preventive services of overweight and obese Europeans aged 50–79 years. *J Gen Intern Med*. 2007; 22(7):923–929. [PubMed: 17404799]
47. Bertakis KD, Callahan EJ. A comparison of initial and established patient encounters using the Davis Observation Code. *Fam Med*. 1992; 24(4):307–311. [PubMed: 1601243]
48. Weyer SM, Konrad N, Esola D, Goodwin MA, Stange KC, Flocke SA. Features of medical records in community practices and their association with preventive service delivery. *Med Care*. 2005; 43(1):28–33. [PubMed: 15626931]
49. Dubey V, Mathew R, Iglar K, Moineddin R, Glazier R. Improving preventive service delivery at adult complete health check-ups: the Preventive health Evidence-based Recommendation Form (PERFORM) cluster randomized controlled trial. *BMC Fam Pract*. 2006; 7:44. [PubMed: 16836761]
50. Irani JS, Middleton JL, Marfatia R, Omana ET, D'Amico F. The use of electronic health records in the exam room and patient satisfaction: a systematic review. *J Am Board Fam Med*. 2009; 22(5): 553–562. [PubMed: 19734402]
51. Nagy VT, Kanter MH. Implementing the electronic medical record in the exam room: the effect on physician–patient communication and patient satisfaction. *Perm J*. 2007; 11(2):21–24. [PubMed: 21461089]
52. Frankel R, Altschuler A, George S, Kinsman J, Jimison H, Robertson NR, et al. Effects of exam-room computing on clinician–patient communication: a longitudinal qualitative study. *J Gen Intern Med*. 2005; 20(8):677–682. [PubMed: 16050873]
53. Hsu J, Huang J, Fung V, Robertson N, Jimison H, Frankel R. Health information technology and physician–patient interactions: impact of computers on communication during outpatient primary care visits. *J Am Med Inform Assoc*. 2005; 12(4):474–480. [PubMed: 15802484]
54. Kottke TE, Brekke ML, Solberg LI. Making "time" for preventive services. *Mayo Clin Proc*. 1993; 68:785–791. [PubMed: 8331981]
55. Maciosek MV, Coffield AB, Edwards NM, Flottemesch TJ, Goodman MJ, Solberg LI. Priorities among effective clinical preventive services: results of a systematic review and analysis. *Am J Prev Med*. 2006; 31(1):52–61. [PubMed: 16777543]

56. Hawley ST, Volk RJ, Krishnamurthy P, Jibaja-Weiss M, Vernon SW, Kneuper S. Preferences for colorectal cancer screening among racially/ethnically diverse primary care patients. *Med Care*. 2008; 46(9 Suppl 1):S10–S16. [PubMed: 18725820]
57. Sheridan SL, Harris RP, Woolf SH. Shared decision making about screening and chemoprevention. a suggested approach from the U.S. Preventive Services Task Force. *Am J Prev Med*. 2004; 26(1): 56–66. [PubMed: 14700714]
58. Reid RJ, Fishman PA, Yu O, Ross TR, Tufano JT, Soman MP, et al. Patient-centered medical home demonstration: a prospective, quasi-experimental, before and after evaluation. *Am J Manag Care*. 2009; 15(9):e71–e87. [PubMed: 19728768]
59. Reid RJ, Coleman K, Johnson EA, Fishman PA, Hsu C, Soman MP, et al. The group health medical home at year two: cost savings, higher patient satisfaction, and less burnout for providers. *Health Aff (Millwood)*. 2010; 29(5):835–843. [PubMed: 20439869]
60. Krist AH, Woolf SH. A vision for patient-centered health information systems. *JAMA*. 2011; 305(3):300–301. [PubMed: 21245186]
61. Lafata JE, Kolk D, Peterson EL, McCarthy BD, Weiss TW, Chen YT, et al. Improving osteoporosis screening: results from a randomized cluster trial. *J Gen Intern Med*. 2007; 22(3): 346–351. [PubMed: 17356966]
62. Gierisch JM, DeFrank JT, Bowling JM, Rimer BK, Matuszewski JM, Farrell D, et al. Finding the minimal intervention needed for sustained mammography adherence. *Am J Prev Med*. 2010; 39(4):334–344. [PubMed: 20837284]
63. DeFrank JT, Rimer BK, Gierisch JM, Bowling JM, Farrell D, Skinner CS. Impact of mailed and automated telephone reminders on receipt of repeat mammograms: a randomized controlled trial. *Am J Prev Med*. 2009; 36(6):459–467. [PubMed: 19362800]
64. Goodwin, M. The Hawthorne effect in direct observation research with physicians and patients. Cleveland: Epidemiology & Biostatistics, Case Western Reserve University; 2001.
65. Adair J. The Hawthorne Effect: A reconsideration of the methodological artifact. *J Appl Psychol*. 1984; 69(2):334–345.
66. Jones S. Was there a Hawthorne effect? *Am J Sociol*. 1992; 98(3):451–468.
67. Stange KC, Zyzanski SJ, Smith TF, Kelly R, Langa DM, Flocke SA, et al. How valid are medical records and patient questionnaires for physician profiling and health services research? A comparison with direct observation of patient visits. *Med Care*. 1998; 36(6):851–867. [PubMed: 9630127]

Figure 1.
Percentage of preventive services opportunities missed by visit length

Table 1Patient/visit characteristics ($n = 484$)

Characteristic	%
<u>Patient sociodemographics</u>	
Age (years), M, SD	58.7 (8.3)
Female	65.3
Race	
White	65.5
African-American	27.9
Other	6.6
Income (\$)	
<20,000	7.9
20,000–39,999	17.3
40,000–59,999	21.5
60,000–79,999	18.4
\$80,000 or more	34.9
Education	
Less than high school diploma	4.0
High school diploma	24.3
Some college or more	71.7
Employed	61.1
Currently married	66.7
<u>Patient health status and risk factors</u>	
Charlson comorbidity score (M, SD)	0.8 (1.3)
CVD risk score (M, SD)	17.0 (9.3)
Depressive symptoms	18.2
BMI (M, SD)	31.0 (7.3)
Family history of cancer	61.3
Smoker	18.8
Problem Drinker	15.4
Number preventive services due (M, SD)	5.5 (2.3)
<u>Patient communication behavior (M, SD)</u>	
Questioning	3.9 (3.9)
Expression of concern	0.3 (0.6)
Assertive responses	2.6 (2.8)
<u>Patient/physician relationship</u>	
Patient saw physician in prior 12 months	81.3
Gender concordance	72.9
Race concordance	49.4
<u>Visit context</u>	
EMR used during visit	81.0
Minutes physician arrived after scheduled appointment (M, SD)	26.0 (17.2)

CVD, cardiovascular disease; EMR, electronic medical record

Table 2

Delivered and missed services by service type

Preventive service	Patients eligible and due at time of visit, <i>n</i>	Delivered, %	Missed, %
Immunizations	458		
Influenza ^b	144	20.0	80.0
Tetanus ^b	253	39.9	60.1
Pneumococcal ^b	61	41.0	59.0
Counseling	1126		
Aspirin	109	18.3	81.7
Diet	295	31.9	68.1
Calcium ^a	287	42.9	57.1
Alcohol	38	50.0	50.0
Mental health	90	57.8	42.2
Obesity ^b	222	59.5	40.5
Tobacco	85	77.6	22.4
Screening	1078		
Vision	53	18.9	81.1
Hearing	102	30.4	69.6
Cervical cancer ^{ab}	46	34.8	65.2
Diabetes	38	36.8	63.2
Osteoporosis ^a	36	47.2	52.8
Cholesterol ^b	110	55.4	44.6
Breast cancer ^{ab}	69	89.9	10.1
Hypertension ^b	162	92.0	8.0
Colorectal cancer ^b	462	92.9	7.1
Total	2662		

^a Female patients only^b EMR prompt available

Table 3

Patient, patient/physician, physician, and visit contextual factors by preventive health service delivery status (Services Due $n=2662$)

	Missed % ($n=1212$)	Delivered % ($n=1450$)	Missed % ($n=1212$)	Delivered % ($n=1450$)
<u>Patient sociodemographics</u>				
Age, years (M, SD) *	62.0 (9.7)	58.4 (8.1)		
Female			3.7 (3.7)	4.1 (4.0)
Race	67.6	69.7	0.3 (0.8)	0.3 (0.7)
White	65.5	64.6	2.8 (2.9)	2.8 (2.9)
African American	28.6	28.6		
Other	5.9	6.8		
Income (\$) *				
<20,000	12.4	7.1		
20,000 – 39,999	21.1	17.4		
40,000 – 59,999	23.0	22.8		
60,000 – 79,999	18.9	18.5		
>80,000	24.6	34.2		
Education **				
Less than high school diploma	5.1	4.2		
High school diploma	29.6	23.7		
Some college or more	65.4	72.2		
Employed *	49.0	62.0		
Currently married	63.9	65.6		
<u>Patient Health Status and Risk Factors</u>				
Charlson Comorbidity Score (M, SD) *	0.9 (1.4)	0.7 (1.2)		
CVD Risk Score (M, SD) *	19.9 (9.2)	17.1 (9.1)		
Depression symptoms	21.8	22.6		
BMI (M, SD)	31.6 (7.4)	31.9 (7.7)		
Family history of cancer	63.8	60.9		
Smoker	20.1	23.5		
<u>Patient Communication Behavior</u>				
Questioning **				
Expressions of concern				
Assertive responses				
Patient/Physician Relationship				
Physician saw patient in past 12 months			83.1	79.5
Gender concordance			70.1	73.7
Race concordance			50.4	49.9
<u>Physician Characteristics</u>				
Age, years (M, SD)			49.7 (8.0)	49.4 (7.9)
Female			54.1	58.4
Race				
White			52.8	51.3
African-American			12.9	13.5
Other			34.3	35.2
Specialty				
Family Medicine			32.2	31.3
Internal Medicine			67.8	68.7
<u>Visit Contextual Factors</u>				
EMR used during visit			82.8	78.8
Minutes physician arrived after scheduled time (M, SD) **			24.4 (16.0)	26.8 (17.5)

	Missed % (n=1212)	Delivered % (n=1450)	Missed % (n=1212)	Delivered % (n=1450)
Problem drinker	15.1	17.4		
Number preventive services due (M, SD) *	6.8 (2.5)	6.1 (2.7)		

* p<0.01

** p<0.05

Bivariable tests of association were computed using alternating logistic regression (ALR) models accounting for nesting of services by patients and physicians.

CVD, cardiovascular disease; EMR, electronic medical record

Table 4AOR for services delivered (*n*=2662)

Characteristic	OR (95% CI)	Characteristic	OR (95% CI)
<u>Patient Sociodemographics</u>		<u>Physician Characteristics</u>	
Age, years	0.97 (0.95, 0.99)	Age, years	1.01 (0.99, 1.04)
Female	0.90 (0.63, 1.29)	Female	1.00 (0.65, 1.53)
Race		Race	
White	1.00	White	1.00
African-American	1.11 (0.79, 1.57)	African-American	0.85 (0.52, 1.38)
Other	1.03 (0.65, 1.62)	Other	1.24 (0.79, 1.94)
Income		Specialty	
Less than \$20,000	1.00	Family Medicine	1.00
\$20,000– \$39,999	0.9 (0.63, 1.29)	Internal Medicine	0.99 (0.70, 1.39)
\$40,000 – \$59,999	1.19 (0.78, 1.83)	<u>Visit Contextual factors</u>	
\$60,000 – \$79,999	1.10 (0.68, 1.79)	EMR used during visit	0.72 (0.53, 0.98)
\$80,000 or more	1.27 (0.79, 2.04)	Minutes physician arrived after scheduled time	1.01 (1.00, 1.02)
Education		<u>Service</u>	
Less than high school diploma	1.00	Influenza immunization	0.02 (0.01, 0.03)
High school diploma	0.64 (0.40, 1.02)	Tetanus immunization	0.05 (0.03, 0.08)
Some college or more	0.76 (0.47, 1.24)	Pneumococcal immunization	0.10 (0.06, 0.17)
Employed	0.94 (0.73, 1.20)	Aspirin use counseling	0.02 (0.01, 0.04)
Currently married	0.91 (0.72, 1.16)	Diet counseling	0.04 (0.02, 0.06)
<u>Patient Health Status and Risk Factors</u>		Calcium use counseling	0.07 (0.03, 0.14)
Charlson Comorbidity Score	0.95 (0.88, 1.03)	Alcohol misuse counseling	0.06 (0.02, 0.16)
CVD Risk Score	0.99 (0.97, 1.01)	Mental health counseling	0.12 (0.05, 0.26)
Depression symptoms	0.78 (0.49, 1.26)	Obesity counseling	0.11 (0.06, 0.19)
BMI	1.02 (1.00, 1.03)	Tobacco counseling	0.27 (0.14, 0.52)
Family history of cancer	0.88 (0.71, 1.09)	Vision screening	0.04 (0.02, 0.08)
Smoker	1.12 (.086, 1.46)	Hearing screening	0.05 (0.03, 0.09)
Problem Drinker	1.06 (0.84, 1.34)	Cervical cancer screening	0.07 (0.03, 0.14)
Number preventive services due	0.98 (0.92, 1.04)	Diabetes screening	0.04 (0.02, 0.11)
<u>Patient Communication Behavior</u>		Osteoporosis screening	0.16 (0.07, 0.36)
Questioning	1.01 (0.99, 1.04)	Cholesterol screening	0.09 (0.05, 0.18)
Expressions of concern	0.81 (0.71, 0.92)	Breast cancer screening	0.82 (0.36, 1.83)
Assertive responses	1.00 (0.95, 1.05)	Hypertension screening	0.84 (0.38, 1.83)
<u>Patient/Physician Relationship</u>		Colorectal cancer screening	1.00
Physician saw patient in past 12 months	0.71 (0.54, 0.95)		
Gender concordance	1.37 (1.05, 1.79)		
Race concordance	1.15 (0.78, 1.68)		

*
p<0.05.

Multivariable model was computed using alternating logistic regression (ALR) models accounting for nesting of services by patients and patients by physicians.

CVD, cardiovascular disease; EMR, electronic medical record