

# Medicare Chronic Care Management Payments and Financial Returns to Primary Care Practices

## A Modeling Study

Sanjay Basu, MD, PhD; Russell S. Phillips, MD; Asaf Bitton, MD, MPH; Zirui Song, MD, PhD; and Bruce E. Landon, MD, MBA, MSc

**Background:** Physicians have traditionally been reimbursed for face-to-face visits. A new non-visit-based payment for chronic care management (CCM) of Medicare patients took effect in January 2015.

**Objective:** To estimate financial implications of CCM payment for primary care practices.

**Design:** Microsimulation model incorporating national data on primary care use, staffing, expenditures, and reimbursements.

**Data Sources:** National Ambulatory Medical Care Survey and other published sources.

**Target Population:** Medicare patients.

**Time Horizon:** 10 years.

**Perspective:** Practice-level.

**Intervention:** Comparison of CCM delivery approaches by staff and physicians.

**Outcome Measures:** Net revenue per full-time equivalent (FTE) physician; time spent delivering CCM services.

**Results of Base-Case Analysis:** If nonphysician staff were to deliver CCM services, net revenue to practices would increase despite opportunity and staffing costs. Practices could expect approximately \$332 per enrolled patient per year (95% CI, \$234 to \$429) if CCM services were delivered by registered nurses

(RNs), approximately \$372 (CI, \$276 to \$468) if services were delivered by licensed practical nurses, and approximately \$385 (CI, \$286 to \$485) if services were delivered by medical assistants. For a typical practice, this equates to more than \$75 000 of net annual revenue per FTE physician and 12 hours of nursing service time per week if 50% of eligible patients enroll. At a minimum, 131 Medicare patients (CI, 115 to 140 patients) must enroll for practices to recoup the salary and overhead costs of hiring a full-time RN to provide CCM services.

**Results of Sensitivity Analysis:** If physicians were to deliver all CCM services, approximately 25% of practices nationwide could expect net revenue losses due to opportunity costs of face-to-face visit time.

**Limitation:** The CCM program may alter long-term primary care use, which is difficult to predict.

**Conclusion:** Practices that rely on nonphysician team members to deliver CCM services will probably experience substantial net revenue gains but must enroll a sufficient number of eligible patients to recoup costs.

**Primary Funding Source:** None.

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For author affiliations, see end of text.

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Primary care practices increasingly provide non-visit-based care coordination and population health management services (1-7). Previously, such care was not supported by fee-for-service payments, which generally limited reimbursement to face-to-face visits. In January 2015, the Centers for Medicare & Medicaid Services (CMS) initiated a chronic care management (CCM) payment (8), which reimburses primary care practices approximately \$40 per month for non-visit-based care of traditional Medicare fee-for-service beneficiaries with multiple chronic conditions. Practices must meet specific requirements for reimbursement (Table 1), the most important being the development of a care management plan, followed by provision of at least 20 minutes of non-visit-based chronic care services per month (for example, medication management or communication with specialists) by a physician or other practice staff for Medicare patients with 2 or more chronic conditions (8).

The CCM reimbursement presents both an opportunity and a dilemma for practices. If practices participate in the program, they must receive written consent from eligible patients (who will be billed a 20% copayment), develop care plans for them, and decide how to deliver monthly services in accordance with program requirements. Delivery of CCM services may take time away from routine patient visits and require hiring additional staff. Thus, although the CCM payment could result in nearly \$500 in annual revenue per eligible Medicare patient, practices may hesitate to seek these payments because much of this revenue may be offset by costs incurred to meet CMS requirements.

In this study, our objective was to compare the financial implications of alternative approaches to CCM service delivery for primary care practices. We used a microsimulation model because few practices are able to test alternative CCM delivery strategies when the effect of the payments is highly uncertain, and proactive practices with high early uptake of CCM services are unlikely to be representative of practices nationwide. Using a validated model that integrated nationally representative data on clinic use, staffing, expenditures, and reimbursements (10), we tested the hypothesis that

### See also:

Editorial comment . . . . . 640

**EDITORS' NOTES****Context**

Medicare recently introduced a new way of paying physicians that replaces fee-for-service payments with a monthly payment for the management of patients with multiple chronic diseases.

**Contribution**

This study modeled the financial changes likely to occur under the new payment system when chronic disease management is provided by a physician, a registered nurse, a licensed practical nurse, or a medical assistant.

**Caution**

Short-term predictions of financial changes are more reliable than long-term predictions.

**Implication**

Practices that use nonphysicians to provide chronic disease management are more likely to experience an excess of revenue over costs.

CCM delivery approaches that rely on nurse care managers would increase net revenue at primary care practices.

**METHODS****Model Structure**

We used a validated microsimulation model for the analysis, which incorporated data from a nationally representative set of patients and the primary care practices that serve them (Figure 1) (10). We used data from office- or hospital-based practices specializing in ambulatory internal medicine, general medicine, and family medicine. We excluded data from practices that did not accept Medicare patients, operated exclusively as urgent care centers, or did not meet the other requirements for CCM (Table 1). An overview of the model's design is provided in the following sections, and full details are provided in the Appendix (available at [www.annals.org](http://www.annals.org)) (11).

**Primary Data Sources**

Input data for the model were taken from 4 sources (Table 2): the Medical Group Management Association (MGMA) database of primary care costs and revenue from a national sample of clinics, the IBM Kenexa Compensation Analysis of costs and overhead expenditures per clinic employee, National Center for Health Statistics (NCHS) data on primary care use by demographic group (age, sex, race/ethnicity, income, and insurance status), and published CMS estimates for reimbursement rates by billing code (8, 12–16).

**Simulated Patients**

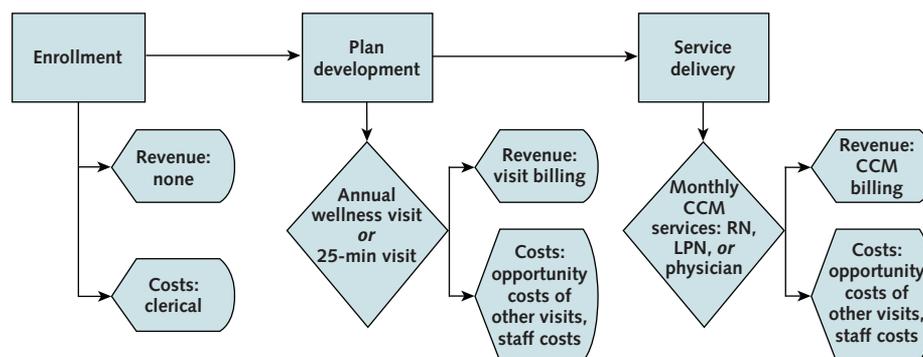
The model simulated the care of patient panels served by primary care practices. The panels were built using data on individual patients across all 50 states and the District of Columbia, defined by age, sex, race/ethnicity, and income to match current data from the U.S. Census Bureau for each state's population (23). Individual patients were assigned a predicted insurance status (private, Medicare, Medicaid/Children's Health Insurance Program, or self-pay) based on their demographic characteristics and state of residence (23) as well as recent Medicaid expansions and enrollment estimates resulting from the Patient Protection and Affordable Care Act (24). They also were assigned predicted diagnoses from each of the diagnostic groups in the International Classification of Diseases, Ninth Revision (ICD-9), to match the frequency of diagnoses among each demographic group by insurance status (25). Each patient visited the practice a predicted number of times per year based on primary care visit rates specific to that patient's demographic characteristics, insurance status, state of residence, and ICD-9 diagnostic codes, and each visit resulted in a predicted reimbursement to the clinic based on reimbursement data reflecting payer, work relative value units with a budget neutrality adjustor, practice expense relative value units, and malpractice relative value units adjusted by the geographic practice cost index (25). Costs borne by practices included staffing and overhead expenditures obtained from the MGMA database and the IBM

**Table 1.** Practice Requirements for Participation in the Medicare CCM Program\*

<b>Patient</b>	<ul style="list-style-type: none"> <li>Covered by Medicare</li> <li>Consented to enroll in the program</li> <li>≥2 chronic conditions that are expected to last ≥12 mo or until death and that represent a significant risk for death, functional decline, or acute exacerbation or decompensation</li> </ul>
<b>Practitioner or clinic staff member</b>	<ul style="list-style-type: none"> <li>Develop and document a written care management plan (in conjunction with patients who qualify) that is congruent with a patient's choices and values and is based on physical, mental, cognitive, psychosocial, functional, and environmental assessments and an inventory of resources and supports</li> <li>Provide continuity with a designated team member for successive routine appointments</li> <li>Devote ≥20 min of care management services per 30 d for each billed patient, including preventive services; medication reconciliation; self-management; medical assessments; functional assessments; and psychosocial assessments, care transitions, and home- or community-based services for psychosocial and functional needs</li> <li>Be available on a 24-hours-per-day, 7-days-per-week basis, although clinic staff can provide services at midnight on an "incident-to" billing basis without direct supervision</li> <li>Use an electronic health record system certified under the meaningful-use incentive program of the Centers for Medicare &amp; Medicaid Services</li> </ul>

CCM = chronic care management.

\* From references 8 and 9.

**Figure 1.** Alternative CCM delivery strategies.

CCM = chronic care management; LPN = licensed practical nurse; RN = registered nurse.

Kenexa Compensation Analysis and expressed on a per full-time equivalent (FTE) physician basis (12, 13).

### Validation

Validation of the model took 2 forms. First, we compared primary care clinic use by demographic group with observed use from the National Ambulatory Medical Care Survey ( $n = 31\,229$  patients) specific to each age, sex, race/ethnicity, and insurance type (14). Second, we compared clinic-level cost and revenue per FTE physician with observed cost and revenue from a survey of more than 2500 practices across the country (10, 12). In both cases, model estimates were within 5% of the absolute error of the empirical estimates (Appendix Table 1 and Appendix Figure 1, available at [www.annals.org](http://www.annals.org)).

### Simulated CCM Services

We estimated the proportion of patients eligible for CCM services among practices, practice-level expenditures incurred from delivery of CCM services, and practice-level revenue from CCM payments. To estimate eligibility, we used NCHS estimates of the proportion of patients visiting primary care practices who are covered by Medicare and have at least 2 chronic conditions (14).

To estimate delivery expenditures, we modeled CCM services in 3 stages: enrollment, care plan development, and monthly service provision (Figure 1). For enrollment, we simulated a 10-minute process conducted by a clerical staff member for each eligible patient, and we varied the proportion of patients who agreed to enroll from 0% to 100%. For care plan development, enrolled patients were scheduled for 1 of 2 possible visits: a Medicare-reimbursed annual wellness visit lasting 1 hour (billing code G0438 or G0439, with a modifier-25 attached for a level-4 evaluation and management visit [billing code 99214]), or a level-4 visit on its own. The annual wellness visit time was split between a physician and a nurse care manager trained as either a registered nurse (RN) or a licensed practical nurse (LPN) (26), whereas the 25-minute visit was en-

tirely physician-directed. Patients already attending an annual wellness visit would use their existing visit for care plan development, so the additional revenue for annual wellness visits was predicated on the CCM payments leading to increased rates of provision of this service. For monthly service provision, enrolled patients received 20 minutes of CCM services delivered by 1 of 3 persons: an RN, an LPN, or a physician. The inclusion criteria for monthly services were varied between including all enrolled patients every month and limiting a given month's services to only those patients not hospitalized, discharged from a skilled-nursing facility, or seen by a specialist during that month (48.5% of Medicare patients [95% CI, 40.9% to 56.9%]) (14). Patients in the latter group already receive CCM services given that physicians reviewing notes, test results, and other communications are delivering CCM-billable services. We included a 5-minute time cost for documentation of chart review for these patients. Other CCM costs included opportunity costs and staffing costs (Table 2). Opportunity costs included reimbursements from routine office visits forfeited by a physician to undertake CCM plan development, monthly CCM service delivery, or both. Staffing costs included hourly wages and benefits for all staff (clerical and nursing) for hours spent on CCM enrollment, plan development, and monthly service provision, in addition to overhead, office space, and information technology costs (such as electronic health record or case management system subscription costs).

To estimate reimbursements for CCM services, we tabulated inflation-adjusted reimbursements for the care plan visit and monthly services (Table 2) (8, 15). In addition, to estimate short- and long-term expenditures and reimbursements, we subjected service provision and reimbursements to a delayed rollout process by evenly distributing the development of the CCM care plan and initiation of monthly services across all 12 calendar months in year 1, followed by routine monthly services in subsequent years among previously enrolled patients.

In all scenarios, we computed 3 outcome metrics: change in net revenue per FTE physician, hours spent conducting CCM activities per week, and the number of Medicare patients who would need to enroll for practices to achieve net positive revenue if a full-time RN or LPN were hired to provide CCM services (the “break-even” threshold). We defined net revenue as the difference between all medical service fee-based reimbursements received by the clinic for the provision of CCM services minus the costs of service delivery, including all equipment, materials, employee salaries, benefit costs, and associated overhead expenditures.

**Sensitivity and Uncertainty Analysis**

We performed 5 types of sensitivity analysis. First, to capture practice variations, we estimated net revenue changes across states (given variations in Medicare patient volume and diagnoses, reimbursement rates, and staffing costs), practice sizes (given variations in patient panel, staffing, and overhead expenditures),

and practice volumes (for practices operating at less than full capacity [Appendix]) (12, 13, 27). Second, to evaluate potential CCM expansion, we examined the implications if all payers provided a CCM billing code under the same terms as CMS, using NCHS estimates of the proportion of all insured patients visiting primary care clinics who have at least 2 chronic disease diagnoses (14). Third, we computed 2 thresholds to ensure net revenue gains for practices: the amount of time spent on provision of CCM services that would result in a net revenue loss due to opportunity costs of face-to-face visits, and how much more efficient an RN would need to be than an LPN to permit the higher salary of the RN to be fully covered by the CCM service delivery reimbursements. Fourth, we estimated the effect on net revenue of altering the CCM planning and delivery approach, such as if the CCM planning visit substituted for a routine visit (rather than being an added visit), if physicians did not add a modifier-25 to the annual wellness

**Table 2. Input Data Used for Cost and Revenue Estimates\***

Parameter	Value (95% CI)	Source
Typical patient panel size per full-time physician, <i>n</i>	2435 (1061-4627)	Medical Group Management Association (19)
Medicare patients among panels at primary care practices accepting Medicare, %	31.3 (4.9-66.7)	National Center for Health Statistics (14)
Medicare patients among primary care practice panels who are eligible for the CCM program (≥2 chronic conditions), %	61.7 (14.3-100)	National Center for Health Statistics (14)
Insured patients among primary care practice panels who would be eligible for an expanded CCM program (i.e., one with payers in addition to Medicare), %	35.5 (3.8-76.7)	National Center for Health Statistics (14)
Reimbursement for annual preventive service visit, \$	170.60 (143.27-219.91) for initial visit (code G0438); 113.85 (94.93-145.27) for subsequent visits (code G0439)	Centers for Medicare & Medicaid Services (16)
Reimbursement for modifier-25 attached to annual preventive service visit (services provided within the wellness visit unbundled into separate fees) (code 99214), \$	108.11 (89.89-138.33)	Centers for Medicare & Medicaid Services (15)
Reimbursement for 25-min visit (code 99214), \$	108.11 (89.89-138.33)	Centers for Medicare & Medicaid Services (15)
Reimbursement for CCM service provision (code 99490), \$ per patient per month	40.39	Centers for Medicare & Medicaid Services (8)
Eligible Medicare patients already receiving CCM-level services (due to hospitalization or specialty visits) in any given month, %	51.1 (43.1-59.1)	National Center for Health Statistics (14)
Eligible insured patients (public or private insurers) already receiving CCM-level services (due to hospitalization or specialty visits) in any given month, %	44.0 (37.0-50.9)	National Center for Health Statistics (14)
Opportunity costs for time physician spends on CCM-related services instead of face-to-face visits, visits/h	3.3 (1.8-4.8)	DOPC (Direct Observation of Primary Care) study (20)
Opportunity costs for each face-to-face visit that the physician forgoes to provide CCM-related services (average billing rates for face-to-face visits), \$/visit	83.66 (45.33-142.87)	Medical Group Management Association (12)
Space and IT costs per new hire, \$/mo	938 (388-1483)	Medical Group Management Association and Design Cost Database (19, 21)
Annual salary plus benefits, \$		
RN	100 055 (82 545-117 564)	IBM Kenexa Compensation data (13) published previously (22), updated to 2015 U.S. dollars
LPN	57 740 (47 635-67 844)	IBM Kenexa Compensation data (13) published previously (22), updated to 2015 U.S. dollars
Medical assistant	41 360 (34 122-48 598)	IBM Kenexa Compensation data (13) published previously (22), updated to 2015 U.S. dollars
Receptionist/clerical staff	40 814 (33 671-47 956)	IBM Kenexa Compensation data (13) published previously (22), updated to 2015 U.S. dollars

CCM = chronic care management; IT = information technology; LPN = licensed practical nurse; RN = registered nurse.  
 \* All dollar values were updated to 2015 U.S. dollars using the Consumer Price Index (17). In all scenarios, we performed multivariate uncertainty analyses by rerunning the model 10 000 times while repeatedly sampling from the probability distributions of all input parameters to generate nationally representative estimates and 95% CIs (18).

**Table 3.** Net Revenue for Clinics Under Different CCM Delivery Strategies\*

CCM Delivery Approach		Net Revenue per Enrolled Medicare Patient (95% CI), \$		Net Revenue per Full-Time Physician Panel if 50% of Eligible Medicare Patients Enroll (95% CI), \$	
CCM Plan Development	CCM Monthly Services Provider	Year 1	Subsequent Years (Annualized)	Year 1	Subsequent Years (Annualized)
Annual wellness visit (50% physician, 50% RN)	RN	295.17 (162.55 to 427.79)	331.52 (233.91 to 429.12)	69 665 (30 372 to 108 958)	79 197 (39 340 to 119 054)
Annual wellness visit (50% physician, 50% LPN)	LPN	326.37 (192.81 to 459.93)	372.09 (275.98 to 468.19)	77 295 (35 199 to 119 392)	89 110 (44 856 to 133 364)
25-min visit (100% physician)	RN	176.13 (82.21 to 270.04)	282.81 (202.36 to 363.27)	41 257 (15 686 to 66 827)	67 607 (33 743 to 101 470)
25-min visit (100% physician)	LPN	196.44 (100.11 to 292.77)	315.07 (234.75 to 395.38)	46 195 (18 819 to 73 572)	75 471 (38 044 to 112 899)
Unreimbursed time (100% physician)	RN	76.03 (−4.48 to 156.55)	184.06 (77.99 to 290.13)	16 573 (−999 to 34 144)	42 962 (15 459 to 70 465)
Unreimbursed time (100% physician)	LPN	90.18 (0.67 to 179.68)	215.00 (104.90 to 325.10)	19 919 (38 to 39 798)	50 488 (20 280 to 80 696)
Annual wellness visit (100% physician)	Physician	150.38 (−37.70 to 338.45)	142.07 (−47.46 to 331.60)	17 369 (−12 197 to 46 935)	28 940 (−9017 to 66 897)

CCM = chronic care management; LPN = licensed practical nurse; RN = registered nurse.

\* Revenue per full-time equivalent physician is shown at 50% enrollment. We reran the model 10 000 times while repeatedly sampling from the probability distributions of all input parameters to generate nationally representative estimates and 95% CIs (18).

visit billing code, or if a medical assistant (MA) performed the CCM activities instead of an RN or LPN. Finally, we examined what would happen if CCM services altered primary care use among enrolled patients. We input estimates of changes in annual primary care use (from a 5% decrease to a 6% increase [28, 29]) among case-managed patients to account for the differentially high number of visits among Medicare patients (14).

### Role of the Funding Source

No specific funding was provided for this work.

## RESULTS

### Eligible Patients

Among primary care practices accepting Medicare, 31.3% of physicians' panels are currently composed of Medicare patients (CI, 4.9% to 66.7% nationwide) (14). Among Medicare patients in qualified practices, 61.7% would be eligible for the CCM reimbursement (that is, would have  $\geq 2$  chronic disease diagnoses) (CI, 14.3% to 100% across panels) (14). Thus, for a primary care physician caring for a panel of 2000 patients (near the national median of 2215 patients) (19), approximately 386 would qualify for CCM.

### Net Revenue

We found that participation in the CCM program would increase net revenue for primary care clinics across the country in most delivery scenarios, despite opportunity and staffing costs (Table 3). Net revenue improved most when CCM plans were developed through an annual preventive visit jointly delivered by a physician and a nurse care manager (RN or LPN) and monthly services were then delivered by auxiliary staff. If half of eligible Medicare patients were to enroll, prac-

tices delivering CCM through an annual wellness visit and an RN would gain \$69 665 per FTE physician (CI, \$30 372 to \$108 958) in year 1 and \$79 197 per FTE physician (CI, \$39 340 to \$119 054) in each subsequent year if services were delivered to patients without a hospitalization or specialist visit in a given month. Net revenue would increase to \$77 295 (CI, \$35 119 to \$119 392) in year 1 and \$89 110 (CI, \$44 856 to \$133 364) per subsequent year if an LPN provided the services. If practices did not include review of specialty or hospital discharge notes as part of monthly CCM services, net revenue would be 36.2% lower than our baseline estimates but would still remain positive.

On a per-patient basis, net revenue averaged \$295 (CI, \$163 to \$428) in year 1 of implementation and \$332 (CI, \$234 to \$429) annually thereafter. If an LPN delivered the services instead of an RN, net revenue increased to \$326 (CI, \$193 to \$460) per patient in year 1 and \$372 (CI, \$276 to \$468) annually thereafter because of the lower LPN salary and benefit costs.

If the annual wellness visit were replaced with a 25-minute face-to-face visit led by a physician to develop the CCM plan, net revenue would be lower. As shown in Table 3, practices could expect to generate 15% to 40% less revenue than in scenarios using an annual wellness visit to construct the CCM plan, although they would still have a net gain in revenue.

If physicians did not use any reimbursable billing codes for time spent developing the CCM plan, net revenue would decrease in year 1 of the program for 5.9% of practices (due to opportunity costs of forfeited face-to-face visits) but would become positive by year 2 (Table 3). As also shown in Table 3, sustained net revenue decreases were possible if a physician conducted all CCM activities (including monthly service delivery)

without assistance from auxiliary staff due to opportunity costs of billable visit time being used for CCM activities. About 25% of practices nationwide would have a net decrease in revenue under this scenario. Detailed itemization of major opportunity costs and expenses across all delivery scenarios is provided in **Table 4**.

**Time Costs and Break-Even Threshold**

We found that the net time costs for staffing monthly CCM services would increase rapidly with enrollment. A staff member would spend 12.0 hours per week (CI, 2.5 to 21.4 hours) per FTE physician on plan development and monthly services if half of eligible Medicare patients were to enroll in the CCM program versus 23.9 hours per week (CI, 5.0 to 42.7 hours) at full enrollment.

We calculated the number of Medicare patients who would need to enroll for practices to financially break even (that is, have total revenue exceed total costs for CCM delivery) if they hired a full-time (40 hours per week) RN or LPN exclusively to provide CCM services rather than paying such staff members for hours spent on CCM services and deriving their remaining salary from other clinical activities (**Figure 2**). If a full-time RN were hired, at least 131 Medicare patients (CI, 115 to 140 patients), or 28% of the national mean of eligible patients per panel, would have to enroll for practices to recoup the full salary, benefit costs, and overhead costs of the RN as well as all other costs of CCM delivery. If an LPN were hired, 76 Medicare patients (CI, 66 to 81 patients), or 16% of the national mean of eligible patients per panel, would have to enroll.

**Sensitivity Analysis**

We observed that net revenue gains would vary across states, practice sizes, capacity levels, and panel sizes (**Appendix Tables 2 and 3**, available at [www.annals.org](http://www.annals.org)), but not dramatically enough to change whether CCM services would generate net positive revenue.

If other payers in addition to Medicare provided a CCM billing code, approximately 35.5% (CI, 3.8% to 76.7%) of primary care patients would be eligible (14). If half of eligible patients enrolled, CCM reimbursements would generate \$106 036 annually per FTE physician (CI, \$79 317 to \$132 755) if an RN were used or \$212 072 (CI, \$158 634 to \$265 510) if an LPN were used.

In further sensitivity analyses, we estimated that a full-time RN would need to provide services to 1.7 times as many patients per month compared with a full-time LPN to match the net revenue gains from the baseline LPN scenario and to compensate for the higher salary and benefit costs. If an MA were used, estimated net practice revenue would increase by 3.6% (exclusive of potential training or supervision time) compared with our baseline LPN estimates, given the lower MA salary and benefit costs (**Table 2**).

Net revenue remained positive across a broad range of alternative CCM delivery scenarios. It increased by 13.1% if CCM plan development required 50 minutes of combined staff time rather than the 60 minutes simulated in the baseline scenario. If the plan development visit happened regardless of the CCM program (that is, no new revenue accrued from the plan development visit), net revenue would be 37.3% lower than our baseline estimates because the plan development visit would accrue more revenue than a regular visit; however, the net revenue change would still be positive from the monthly CCM service payments. Similarly, if clinicians did not add a modifier-25 at level 4 to the annual wellness visit, net revenue would be 24.7% lower than our baseline estimates after inclusion of all delivery costs but would remain positive overall. Net revenue would remain positive unless services required more than 51 minutes per patient per month rather than 20 minutes.

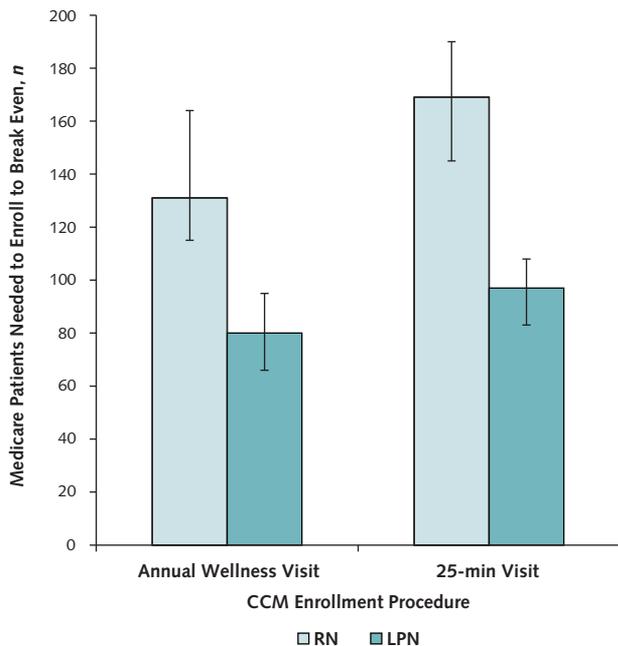
Finally, if primary care use by CCM-enrolled patients decreased by 5%, net revenue would decrease

**Table 4.** Detailed CCM Revenue, Opportunity Costs, and Major Personnel and Overhead Expenditures, Annualized After the First Year, Across Alternative CCM Delivery Strategies\*

CCM Delivery Approach		Gross CCM Revenue, Including Plan Development Visit and Monthly Reimbursements (95% CI), \$ per enrolled patient per year	Opportunity Costs† (95% CI), \$ per enrolled patient per year	Auxiliary Staffing Expenditures for RN or LPN (95% CI), \$ per enrolled patient per year
CCM Plan Development	CCM Monthly Services Provider			
Annual wellness visit (50% physician, 50% RN)	RN	706.70 (674.90-738.50)	148.12 (5.20-301.43)	125.16 (119.18-131.14)
Annual wellness visit (50% physician, 50% LPN)	LPN	706.70 (674.90-738.50)	148.12 (5.20-301.43)	72.23 (68.78-75.68)
25-min visit (100% physician)	RN	592.84 (568.75-616.93)	123.43 (4.33-251.19)	50.22 (49.01-51.44)
25-min visit (100% physician)	LPN	592.84 (568.75-616.93)	123.43 (4.33-251.19)	29.18 (28.46-29.90)
Unreimbursed time (100% physician)	RN	484.68	148.12 (5.20-301.43)	50.22 (49.01-51.44)
Unreimbursed time (100% physician)	LPN	484.68	148.12 (5.20-301.43)	29.18 (28.46-29.90)
Annual wellness visit (100% physician)	Physician	484.68	573.68 (32.07-1115.30)	NA

CCM = chronic care management; LPN = licensed practical nurse; NA = not applicable; RN = registered nurse.  
 \* We reran the model 10 000 times while repeatedly sampling from the probability distributions of all input parameters to generate nationally representative estimates and 95% CIs (18). The mean revenue minus costs displayed here will not necessarily equal the mean net revenue estimates in **Table 3** because those data include the covariance between revenue and costs (i.e., some practices are at the high end of both revenue and costs, whereas others have a mix of higher revenue accrual and lower costs). Additional costs for space, information technology, and secretarial labor (itemized in **Table 2**) are also included in the overall net revenue estimates shown in **Table 3**.  
 † Lost reimbursements for routine visits due to CCM time.

**Figure 2.** Minimum number of eligible Medicare patients required to enroll in the CCM program to fund a full-time RN or LPN and pay for other CCM expenditures for a primary care clinic.



CCM = chronic care management; LPN = licensed practical nurse; RN = registered nurse.

by 4.2% from baseline. However, if these appointment slots were filled by new patients, net revenue would increase by 0.8% above the baseline estimates. Conversely, if visits by CCM-enrolled patients increased by as much as 6%, as seen in some case management programs (28), revenue would remain at the baseline estimates for clinics operating at full capacity, which would fit these additional appointments into existing slots.

## DISCUSSION

The new Medicare CCM payment is among the first broad changes to primary care payment nationwide. We found that CCM reimbursements would substantially increase net revenue for primary care practices if auxiliary staff delivered most CCM services. The average time cost of CCM service provision would be approximately 24 hours per week for each full-time physician's panel if all eligible Medicare patients enrolled in the program. The expenses associated with a full-time RN or LPN would be recouped among most practices that enroll at least half of eligible Medicare patients who visit them. Sensitivity analyses found these results to be robust to variations in practice type and size, location, Medicare patient volume, patient demographic characteristics, service delivery strategies, and practice costs across the nation.

Our findings highlight the critical nature of nonphysician staff in delivery of CCM services. Net revenue

would increase universally among practices where RNs, LPNs, or MAs provide monthly CCM services; conversely, many practices could experience a net revenue loss if physicians exclusively provide the services due to the opportunity costs of forfeited face-to-face visits. The CCM payment may therefore incentivize practices to transition to team-based models of primary care. Primary care practices in the process of adding nonphysician providers during transformation to the patient-centered medical home model may find unanticipated additional gains from the CCM payment, which may guard against financial risk or provide extra resources for investment into population health management.

Our results are applicable to practices that are eligible for CCM payments (which technically include specialist practices beyond primary care, although a patient can only be billed at 1 practice for CCM); such practices must provide 24-hour access for comprehensive care (8). Full transformation to the patient-centered medical home requires additional efforts, such as improved patient access (30). A key unknown is whether the additional expenses of primary care resulting from delivery of CCM services could be offset by decreases in primary care, emergency department, specialist, and hospital visits (31-50). Another key unknown is how the required 20% CCM copayment will affect enrollment (51), although for many patients, the copayment will be covered by supplemental insurance or Medicaid.

As with any model-based assessment, our analysis required assumptions. First, we assumed that practices would follow regulatory guidelines. We also assumed that practices would provide 20 minutes of CCM services per month, as per CMS guidelines (8), but in sensitivity analyses, we observed that new revenue from CCM payments would be neutralized if monthly services required an hour per patient, which is unlikely. Over the long term, CCM services may alter the volume of face-to-face visits among eligible patients, which may open new appointment slots that generate new revenue. In some of our simulated scenarios, we assumed that RNs, LPNs, or MAs are able to complete CCM activities, but RNs may do so most efficiently or with the highest quality. Overall, our model simulated the "top-of-license" practice concept, in which staff perform to the full extent of their training, leaving physicians to focus on the most complex diagnostic and management tasks. An emerging literature suggests that overall practice functionality, quality, and patient and provider satisfaction may be increased through such team-based care (32); however, different provider types may differ in their coordination abilities for more complex patients.

Despite these uncertainties, our model suggests that staffing decisions of practices will probably affect how well the CCM payment is received and how it translates into fiscal solvency. If practices hire nonphysician staff to provide routine care under the CCM reimbursement program and are able to enroll a sufficient number of Medicare patients, a net gain in revenue at the practice level would result despite the opportunity and staffing costs associated with CCM de-

livery. These financial returns provide incentives for primary care practices to deliver team-based care.

From Stanford University School of Medicine, Stanford, California, and Harvard Medical School, Brigham and Women's Hospital, Beth Israel Deaconess Medical Center, and Massachusetts General Hospital, Boston, Massachusetts.

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**Reproducible Research Statement:** *Study protocol:* Available in the Appendix. *Statistical code:* Available at <http://sdr.stanford.edu>. *Data set:* Available at <http://data.mgma.org>, [www.cdc.gov/nchs/ahcd.htm](http://www.cdc.gov/nchs/ahcd.htm), [www.cms.gov/Outreach-and-Education/Outreach/NPC/National-Provider-Calls-and-Events-Items/2015-02-18-Chronic-Care-Management-new.html](http://www.cms.gov/Outreach-and-Education/Outreach/NPC/National-Provider-Calls-and-Events-Items/2015-02-18-Chronic-Care-Management-new.html), and [www-03.ibm.com/software/products/en/ibm-kenexa-companalyst-market-data-for-us-on-cloud](http://www-03.ibm.com/software/products/en/ibm-kenexa-companalyst-market-data-for-us-on-cloud).

**Requests for Single Reprints:** Sanjay Basu, MD, PhD, Stanford University School of Medicine, Medical School Office Building, X322, 1265 Welch Road, Mail Code 5411, Stanford, CA 94305-5411.

Current author addresses and author contributions are available at [www.annals.org](http://www.annals.org).

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**Current Author Addresses:** Dr. Basu: Stanford University School of Medicine, Medical School Office Building, X322, 1265 Welch Road, Mail Code 5411, Stanford, CA 94305-5411. Dr. Phillips: Harvard Medical School, 635 Huntington Avenue, 2nd Floor, Boston, MA 02115.

Drs. Bitton and Landon: Harvard Medical School, Department of Health Care Policy, 180 Longwood Avenue, Boston, MA 02115-5899.

Dr. Song: Massachusetts General Hospital, Department of Medicine, 55 Fruit Street, Boston, MA 02114.

**Author Contributions:** Conception and design: S. Basu, R.S. Phillips, A. Bitton, B.E. Landon.

Analysis and interpretation of the data: S. Basu, R.S. Phillips, A. Bitton, Z. Song, B.E. Landon.

Drafting of the article: S. Basu, R.S. Phillips, A. Bitton.

Critical revision of the article for important intellectual content: R.S. Phillips, A. Bitton, Z. Song, B.E. Landon.

Final approval of the article: S. Basu, R.S. Phillips, A. Bitton, Z. Song, B.E. Landon.

Provision of study materials or patients: S. Basu.

Statistical expertise: S. Basu, A. Bitton.

Obtaining of funding: R.S. Phillips.

Administrative, technical, or logistic support: R.S. Phillips.

Collection and assembly of data: S. Basu, A. Bitton, B.E. Landon.

## APPENDIX: CONSTRUCTION AND IMPLEMENTATION OF THE MODEL

In this section, we follow standard international modeling guidelines (52) to describe the construction and implementation of the model.

The first stage of the model generated a simulated patient population to reflect the demographic makeup of each state and the District of Columbia. Persons in the model were assigned demographic features in a probabilistic manner to match U.S. Census Bureau estimates (23) of covariance among the following characteristics: age (organized in cohorts of <5, 5 to 13, 14 to 17, 18 to 24, 25 to 44, 45 to 64, 65 to 84, and >84 years), sex (dichotomous), race/ethnicity (in standard census categories of non-Hispanic white, non-Hispanic black, Hispanic, and other), and income (expressed as a poverty-income ratio [to correct for household size] in 5 standard categories: <100% of the federal poverty level [FPL], 100% to 138% of the FPL, 139% to 250% of the FPL, 251% to 400% of the FPL, and >400% of the FPL). To assign these characteristics to simulated patients, we used Monte Carlo sampling from the joint probability distributions of these demographic features, using census data for each state to construct a demographically representative state population. The joint probability distributions were captured using a copula function, which allowed the covariance between variables to be taken into account (53). The input data are freely accessible online ([www.census.gov/cps/data](http://www.census.gov/cps/data)). On the basis of these demographic features and state of resi-

dence, patients were similarly assigned an insurance status (private, Medicare, Medicaid/Children's Health Insurance Program, or self-pay) based on their demographic characteristics and their state of residence, again using Monte Carlo sampling from each state's distribution of insurance among each demographic group (23). The insurance data are also freely accessible online (<http://kff.org/state-category/health-coverage-uninsured>).

Insurance status assignments were updated to reflect recent Medicaid expansion decisions among states and the anticipated enrollment in private insurance due to the Affordable Care Act, based on Medicaid expansion decisions from the CMS as of November 2014 (24). Specifically, the baseline model included the CMS adjustment for Medicaid participation rates in Arkansas and Iowa to account for their Section 1115 waivers for Medicaid expansion; at the time of this writing, Indiana, Minnesota, and Pennsylvania had pending waivers for Medicaid expansion and were similarly included as expansion states under the assumption of expansion approval, also using the CMS adjustment estimate (24). Wisconsin was not included as an expansion state because it amended its Medicaid state plan and existing Section 1115 waiver to cover adults at up to 100% of the FPL but had not adopted the expansion at the time of this writing.

The second stage of the model assigned diagnoses to patients by ICD-9 code based on data from the Agency for Healthcare Research and Quality (25), which are linked to the number of primary care visits and reimbursements associated with those visits given patient demographic characteristics, insurance, and diagnoses. As with the demographic assignment, we assigned each simulated patient a diagnosis and number of practice visits per year by performing Monte Carlo sampling in that patient's demographic and insurance group in the data. The data for this stage are also freely accessible online ([http://meps.ahrq.gov/mepsweb/data\\_stats/download\\_data\\_files.jsp](http://meps.ahrq.gov/mepsweb/data_stats/download_data_files.jsp)). We distributed these visits across simulated patient panels and overall practices; Monte Carlo sampling for these 2 variables was performed from data on practice panel and practice size in the MGMA database (Table 2) (12), which collects data from primary care practices across the country. By summing the overall primary care use and billing reimbursements across these simulated practices, we estimated overall practice revenue (Appendix Figures 1 and 2).

The third stage of the model estimated practice expenses. The model calculated these expenses in separate modules reflecting both personnel and overhead expenditures. Staffing ratios per FTE physician and detailed compensation data were available from the IBM Kenexa Compensation Analysis (13), are summarized in Table 2 of the text, and are further detailed in a prior

publication (10). Additional overhead expenditures were taken from the MGMA DataDive database and included physical and service infrastructure costs; liability insurance; and information technology and telecommunications expenses, including electronic medical record expenditures (also published in tabular format previously [10]).

The model's estimates of the number of visits per year were validated against NCHS data ( $n = 31\,229$ ) (14) by comparing modeled versus observed primary care use by age, sex, race/ethnicity, insurance, and ICD-9 diagnostic category (**Appendix Table 1**). The model was further validated by comparing modeled estimates of revenue and expenses against estimates derived from independent cost data from 2518 primary care practices of varying sizes across the nation (**Appendix Figure 1**) (12).

For the CCM analysis (**Appendix Figure 2**), we first estimated the proportion of Medicare patients who were eligible by determining what proportion were identified by the primary care providers as having 2 or more chronic conditions per a prior survey by the NCHS (14). In contrast to using ICD-9 codes alone, this survey explicitly asked providers to list "the total number of chronic conditions" for each patient chart reviewed, which provided a more accurate assessment of what the providers themselves would consider a chronic disease (and avoided errors given that ICD-9 coding does not necessarily correspond to chronicity). In our survey analysis, patient weights were used to correct for nonresponse and to generate nationally representative estimates, with Taylor series linearization used to calculate SEs. We corrected for availability bias because the NCHS survey was representative of visits but not demography or panel size. In other words, a Medicare patient may have more visits than a younger patient and may therefore be more likely to appear in a survey of visits; hence, Medicare patients may make up a smaller proportion of a physician panel than they make up as a proportion of visits. We corrected for availability bias by calculating the propensity for visits by Medicare and non-Medicare patients, clustered by physician panel, and then computed the proportion of each physician panel comprising Medicare patients, other insured patients (private or public), and uninsured patients (54). The proportion of each physician panel in the model that comprised eligible Medicare recipients was then subjected to CCM enrollment, which cost salary for a 10-minute clerical period per patient (computed using a typical clerical salary [**Table 2**]).

The enrolled patients then had a 1-hour annual preventive visit, which we counted toward net revenue

specific to the first or subsequent year of enrollment (**Table 2**) (16). We also subtracted the opportunity cost of this visit, in terms of other face-to-face visits typically conducted at a rate of 3.3 visits per hour among primary care practices (CI, 1.8 to 4.8 visits) (20) and billed at the average rate of \$83.66 per visit (CI, \$45.33 to \$142.87) (12) (**Table 2**). After the preventive visit, patients enrolled in the CCM program who were not hospitalized or seeing a specialist in a given month received 20 minutes of CCM services every month (51.1% of Medicare patients [CI, 43.1% to 59.1%] have hospital visits or see specialists in a given month) (14). Per CMS estimates (8), the monthly CCM services generated \$40.39 in revenue per month per patient. The costs associated with these 20 minutes included the forgone 20-minute sessions at the aforementioned rate of visitation and billing (if a physician provided the sessions) or the partial compensation of an RN or LPN for the time spent conducting the 20-minute sessions if these auxiliary staff performed the monthly CCM sessions. Salary data for RN and LPN staff are given in **Table 2**. Additional space and electronic medical record costs per new hire (\$938 per month [CI, \$388 to \$1483]) were adopted from previous analyses (19, 21).

We conducted state-specific analyses using state-specific data on staff salaries and typical visit and billing rates (**Appendix Table 2**) (12, 13, 27). We also conducted a sensitivity analysis involving all patients eligible for the CCM program by using NCHS data (14) on the proportion of all insured patients who were diagnosed with at least 2 chronic disease conditions.

Model results were expressed for the first year of implementation and for each subsequent year over a 10-year planning horizon, with costs and reimbursements expressed in 2015 U.S. dollars discounted at a standard 3% annual rate (17, 55). Modeling was performed in R, version 3.1.0 (R Foundation for Statistical Computing). The study was deemed exempt from institutional review board approval (Stanford University eProtocol eP-34359).

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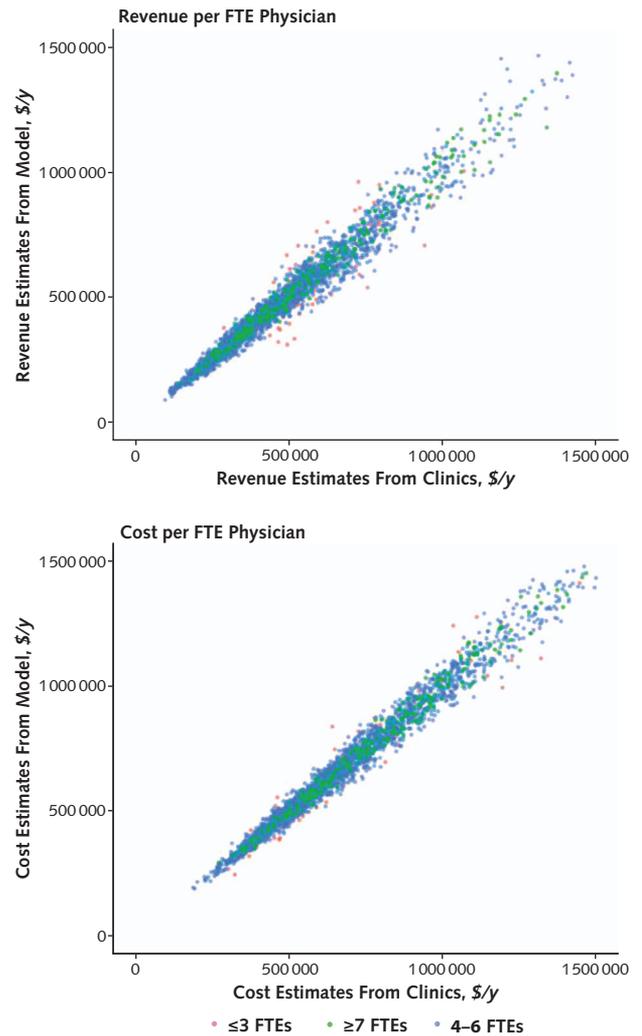
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**Appendix Table 1.** Model Validation: Primary Care Use, by Demographic Group\*

Validation Category	Primary Care Use per 100 Persons per Year	
	Data (95% CI)	Model (95% CI)
<b>Age</b>		
<5 y	190.5 (158.7-222.3)	196.8 (163.0-230.7)
5-24 y	92.5 (80.8-104.2)	91.5 (79.1-104.0)
25-44 y	123.1 (109.5-136.8)	122.5 (108.0-137.1)
45-65 y	178.6 (160.9-196.4)	170.8 (152.0-189.7)
>65 y	320.5 (283.2-357.8)	321.2 (281.6-360.9)
<b>Sex</b>		
Male	136.4 (123.9-148.8)	134.9 (121.6-148.1)
Female	182.7 (165.2-200.1)	173.7 (155.2-192.3)
<b>Race</b>		
White	168.0 (151.6-184.4)	166.3 (148.8-183.7)
Black	145.8 (123.1-168.4)	144.9 (120.8-169.0)
Hispanic	113.0 (85.7-140.3)	111.4 (82.4-140.4)
Other	100.7 (78.0-123.4)	103.2 (79.1-127.3)

\* See also Appendix Figure 2. We compared the model's estimates of primary care use by age, sex, and race/ethnicity with nationally representative data from the National Center for Health Statistics ( $n = 31\,229$ ) (14). Rates of primary care use include SEs estimated from Taylor series linearization using the data set sample weights to project a nationally representative population. We computed 95% CIs from 10 000 replications of the model in which repeated samples were drawn from the input data to generate the outcomes of primary care use, cost, and revenue while accounting for the variations in characteristics of patients and practices across the country.

**Appendix Figure 1.** Model validation: clinic-level cost and revenue per FTE physician.



Annual estimated practice revenue (*top*) and costs (*bottom*) per FTE physician across practice sizes are displayed. Revenue and costs were estimated by the model using input data from a survey of 2518 primary care practices across the country and are plotted against actual revenue and cost estimates derived from the clinics' self-reports (12). See Appendix Table 2 for validation of primary care use and revenue outcomes against alternative national data sets of primary care use. We also compared the model's estimates of primary care use with data from the National Center for Health Statistics (14) as part of its National Ambulatory Medical Care Survey ( $n = 31\,229$  patients), organized by age, sex, and race/ethnicity (as shown in Appendix Table 1). FTE = full-time equivalent.

**Appendix Table 2. State-Specific Annualized Net Revenue (After the First Year) From the CCM at 50% Enrollment, Under 2 Scenarios\***

State	Revenue per FTE Physician per Year (95% CI), \$	
	Scenario 1†	Scenario 2‡
Alabama	73 204 (41 052 to 105 356)	82 743 (47 938 to 117 548)
Alaska	73 164 (39 944 to 106 383)	81 108 (45 574 to 116 642)
Arizona	75 886 (38 688 to 113 083)	84 153 (45 254 to 123 052)
Arkansas	72 034 (38 266 to 105 802)	81 242 (45 087 to 117 397)
California	71 148 (40 090 to 102 206)	81 507 (47 392 to 115 621)
Colorado	77 330 (42 217 to 112 443)	85 478 (48 451 to 122 504)
Connecticut	73 951 (43 428 to 104 475)	84 104 (50 265 to 117 942)
Delaware	75 838 (37 791 to 113 886)	84 605 (44 971 to 124 239)
District of Columbia	77 617 (31 592 to 123 643)	86 371 (40 318 to 132 423)
Florida	73 651 (39 878 to 107 424)	82 530 (46 461 to 118 599)
Georgia	70 314 (38 142 to 102 487)	80 536 (45 572 to 115 500)
Hawaii	78 274 (42 116 to 114 432)	84 907 (47 111 to 122 702)
Idaho	77 635 (43 773 to 111 497)	85 400 (49 351 to 121 450)
Illinois	72 392 (41 719 to 103 064)	82 265 (48 564 to 115 965)
Indiana	73 660 (40 106 to 107 215)	83 019 (47 096 to 118 943)
Iowa	73 193 (41 027 to 105 359)	82 004 (47 244 to 116 763)
Kansas	74 841 (35 352 to 114 330)	83 332 (42 384 to 124 281)
Kentucky	76 355 (44 066 to 108 645)	84 571 (49 758 to 119 384)
Louisiana	75 491 (41 062 to 109 919)	83 355 (46 787 to 119 924)
Maine	75 894 (43 755 to 108 033)	84 313 (49 577 to 119 050)
Maryland	75 049 (40 084 to 110 015)	84 455 (47 260 to 121 650)
Massachusetts	69 236 (39 423 to 99 049)	79 973 (46 793 to 113 153)
Michigan	76 808 (42 544 to 111 073)	85 963 (49 367 to 122 559)
Minnesota	75 038 (42 317 to 107 758)	83 583 (48 347 to 118 818)
Mississippi	67 024 (33 619 to 100 429)	78 028 (42 098 to 113 958)
Missouri	74 478 (38 203 to 110 754)	83 807 (45 518 to 122 096)
Montana	70 388 (33 879 to 106 896)	79 957 (41 437 to 118 476)
Nebraska	74 356 (41 751 to 106 961)	81 906 (46 985 to 116 826)
Nevada	77 258 (40 250 to 114 265)	86 007 (47 285 to 124 728)
New Hampshire	72 110 (40 607 to 103 613)	81 385 (47 062 to 115 707)
New Jersey	73 158 (41 983 to 104 334)	83 129 (48 941 to 117 317)
New Mexico	74 140 (40 059 to 108 220)	82 549 (46 245 to 118 853)
New York	72 164 (41 681 to 102 648)	83 189 (49 405 to 116 973)
North Carolina	71 505 (38 506 to 104 505)	80 765 (45 273 to 116 256)
North Dakota	73 215 (39 031 to 107 399)	82 024 (45 470 to 118 578)
Ohio	78 759 (46 812 to 110 707)	87 624 (52 847 to 122 401)
Oklahoma	73 537 (42 161 to 104 913)	82 142 (48 081 to 116 203)
Oregon	73 677 (41 300 to 106 054)	82 466 (47 578 to 117 355)
Pennsylvania	78 185 (46 248 to 110 123)	86 486 (51 889 to 121 084)
Rhode Island	74 103 (39 509 to 108 697)	83 548 (46 792 to 120 304)
South Carolina	76 079 (42 049 to 110 110)	84 583 (48 362 to 120 804)
South Dakota	74 152 (38 119 to 110 185)	81 557 (43 799 to 119 315)
Tennessee	74 157 (40 885 to 107 428)	83 040 (47 387 to 118 693)
Texas	74 600 (43 243 to 105 958)	83 503 (49 289 to 117 717)
Utah	76 131 (42 702 to 109 561)	84 336 (48 605 to 120 067)
Vermont	78 015 (46 564 to 109 467)	86 805 (52 463 to 121 148)
Virginia	74 854 (42 614 to 107 093)	84 223 (49 193 to 119 253)
Washington	70 185 (40 075 to 100 294)	80 933 (47 533 to 114 332)
West Virginia	75 163 (38 561 to 111 766)	84 453 (46 212 to 122 694)
Wisconsin	75 240 (40 858 to 109 623)	83 429 (46 934 to 119 924)
Wyoming	77 176 (41 824 to 112 527)	85 780 (48 206 to 123 355)

CCM = chronic care management; FTE = full-time equivalent; LPN = licensed practical nurse; RN = registered nurse.

\* The estimates were derived from 10 000 iterations of the model in which Monte Carlo sampling was conducted from data obtained from primary care practices across the country. The calculations accounted for the proportion of patients who were eligible for the program; reimbursement for an annual preventive services visit during which the CCM plan was developed; reimbursement for 12 monthly CCM service sessions that were not face-to-face office visits but were reimbursed by Medicare; and costs of forgone office visits, staff salary, and benefits. Practices in Hawaii would earn the largest net revenue when delivering CCM through an RN (8% higher than the national mean estimates cited here), and practices in Ohio would earn the largest net revenue when using an LPN (5% above the mean), whereas practices in Mississippi would earn the smallest revenue gains (10% lower than the mean) under either scenario.

† Half of preventive services visit and all of CCM monthly sessions provided by an RN.

‡ Half of preventive services visit and all of CCM monthly sessions provided by an LPN.

**Appendix Table 3.** Relationship Among Net Revenue, Practice Size, and Practice Capacity\*

Practice Characteristic	Revenue per FTE Physician per Year, \$	
	Scenario 1†	Scenario 2‡
≤3 FTE physicians	71 753	80 734
≥7 FTE physicians	87 354	98 289
Operating at 95% capacity	75 238	84 654
Operating at 85% capacity	67 318	68 016
25th percentile of national panel size (1425 patients per FTE physician)	64 149	72 402
75th percentile of national panel size (3455 patients per FTE physician)	105 818	94 245

CCM = chronic care management; FTE = full-time equivalent; LPN = licensed practical nurse; RN = registered nurse.

\* Annualized net revenue (after the first year) from the CCM program at 50% enrollment is shown. The calculations accounted for the proportion of patients who were eligible for the program; reimbursement for an annual preventive services visit during which the CCM plan was developed; reimbursement for 12 monthly CCM service sessions that were not face-to-face office visits but were reimbursed by Medicare; and costs of forgone office visits, staff salary, and benefits.

† Half of preventive services visit and all of CCM monthly sessions provided by an RN.

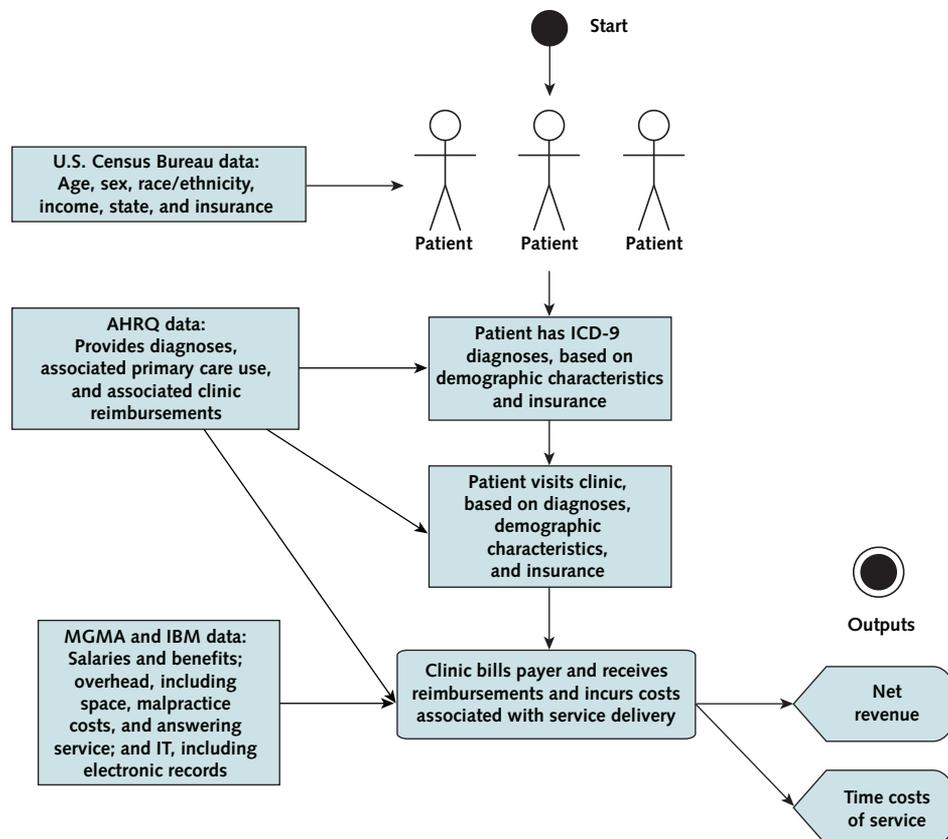
‡ Half of preventive services visit and all of CCM monthly sessions provided by an LPN.

**Appendix Table 4.** Model Data Sources

Input Parameter	Source
Demographic characteristics of simulated patients (age, sex, race/ethnicity, and income)	U.S. Census Bureau (23)
Baseline insurance status of simulated patients	U.S. Census Bureau (23)
Adjustments to baseline insurance status expected under the Affordable Care Act	Centers for Medicare & Medicaid Services (24)
ICD-9 diagnoses, practice visits, and CPT charges, by demographic characteristics and insurance status	Agency for Healthcare Research and Quality (25)
Staffing ratios per full-time physician	Medical Group Management Association (12)
Staff salaries per full-time physician	IBM Kenexa Compensation Analysis (13)
Proportion of patients, by insurance type, whom provider labels as having ≥2 chronic disease diagnoses (i.e., patients eligible for CCM program)	National Center for Health Statistics (14)

CCM = chronic care management; CPT = Current Procedural Terminology; ICD-9 = International Classification of Diseases, Ninth Revision.

**Appendix Figure 2.** Model diagram.



See Table 2 and Appendix Table 4 for data sources and references. AHRQ = Agency for Healthcare Research and Quality; ICD-9 = International Classification of Diseases, Ninth Revision; IT = information technology; MGMA = Medical Group Management Association.