

# UC Berkeley

## UC Berkeley Previously Published Works

### Title

The Exnovation of Chronic Care Management Processes by Physician Organizations

### Permalink

<https://escholarship.org/uc/item/8hq3g631>

### Journal

Milbank Quarterly, 94(3)

### ISSN

0887-378X

### Authors

RODRIGUEZ, HECTOR P  
HENKE, RACHEL MOSHER  
BIBI, SALMA  
[et al.](#)

### Publication Date

2016-09-01

### DOI

10.1111/1468-0009.12213

Peer reviewed

*Original Investigation*

## The Exnovation of Chronic Care Management Processes by Physician Organizations

HECTOR P. RODRIGUEZ,<sup>\*,†</sup>  
RACHEL MOSHER HENKE,<sup>†</sup> SALMA BIBI,<sup>\*</sup>  
PATRICIA P. RAMSAY,<sup>\*</sup>  
and STEPHEN M. SHORTELL<sup>\*,†</sup>

*\*Center for Healthcare Organizational and Innovation Research, University of California, Berkeley; †Division of Health Policy and Management, UC Berkeley School of Public Health; ‡Truven Health Analytics*

### Policy Points

- The rate of adoption of chronic care management processes (CMPs) by physician organizations has been fairly slow in spite of demonstrated effectiveness of CMPs in improving outcomes of chronic care.
- Exnovation (ie, removal of innovations) by physician organizations largely explains the slow population-level increases in practice use of CMPs over time.
- Expanded health information technology functions may aid practices in retaining CMPs. Low provider reimbursement by Medicaid programs, however, may contribute to disinvestment in CMPs by physician organizations.

**Context:** Exnovation is the process of removal of innovations that are not effective in improving organizational performance, are too disruptive to routine operations, or do not fit well with the existing organizational strategy, incentives, structure, and/or culture. Exnovation may contribute to the low overall adoption of care management processes (CMPs) by US physician organizations over time.

**Methods:** Three national surveys of US physician organizations, which included common questions about organizational characteristics, use of CMPs, and health information technology (HIT) capabilities for practices of all sizes, and Truven Health Insurance Coverage Estimates were integrated to assess organizational and market influences on the exnovation of CMPs in a longitudinal

cohort of 1,048 physician organizations. CMPs included 5 strategies for each of 4 chronic conditions (diabetes, asthma, congestive heart failure, and depression): registry use, nurse care management, patient reminders for preventive and care management services to prevent exacerbations of chronic illness, use of nonphysician clinicians to provide patient education, and quality of care feedback to physicians.

**Findings:** Over one-third (34.1%) of physician organizations exnovated CMPs on net. Quality of care data feedback to physicians and patient reminders for recommended preventive and chronic care were discontinued by over one-third of exnovators, while nurse care management and registries were largely retained. Greater proportions of baseline Medicaid practice revenue (incidence rate ratio [IRR] = 1.44,  $p < 0.001$ ) and increasing proportions of revenue from Medicaid (IRR = 1.02,  $p < 0.05$ ) were associated with greater CMP exnovation by physician organizations on net. Practices with greater expansion of HIT functionality exnovated fewer CMPs (IRR = 0.91,  $p < 0.001$ ) compared to practices with less expansion of HIT functionality.

**Conclusions:** Exnovation of CMPs is an important reason why the population-level adoption of CMPs by physician organizations has remained low. Expanded HIT functions and changes to Medicaid reimbursement and incentives may aid the retention of CMPs by physician organizations.

**Keywords:** exnovation, de-implementation, Medicaid, chronic care management, organizational change.

**E**XNOVATION IS THE PROCESS OF REMOVAL OF INNOVATIONS that do not improve organizational performance, are too disruptive to routine operations, or do not fit well with the existing organizational strategy, incentives, structure, and/or culture. John Kimberly first coined the term in 1981 to describe the removal process at the tail end of the innovation cycle.<sup>1</sup> To our knowledge, there is no empirical research examining the internal organizational capabilities and external incentives associated with the exnovation of innovations. Even before the rapid increase in innovation adoption research in health care,<sup>2</sup> Kimberly wrote that “the overwhelming emphasis of the innovation literature on adoption is more a reflection of a pro-innovation bias than of a thoughtful consideration of managerial and organizational needs.”<sup>1</sup>

Exnovation of innovations in health care delivery organizations may result from strategic organizational response of medical practices to

ensure sufficient time and resources or “absorptive capacity”<sup>3</sup> for adopting alternative innovations better aligned with the organizations’ internal capabilities and more effective in meeting external demands. Innovations are also removed because they fail to be normalized into practice because the additional demands required of frontline health care workers are not sustainable. For example, structured quality improvement and collaborative learning sometimes fail to improve organizational performance and patient outcomes<sup>4-6</sup> because frontline workers may not have the time or institutional support to integrate innovative care processes. Innovations in health care delivery may also be exnovated because of insufficient external financial incentives for maintaining them once they are adopted. Scholars have argued that given post hoc biases of organizational leaders, distinguishing strategic removal of organizational practices versus abandonment due to implementation failure or other reasons has proven difficult.<sup>1,7</sup> Our examination of exnovation does not distinguish among strategic, operational, or other reasons why innovations are removed and substituted over time. Exnovation is different from “de-implementation,”<sup>8-11</sup> “de-adoption,”<sup>12,13</sup> and “rejection”<sup>14</sup> in that these terms emphasize the strategic and deliberate removal of organizational structures and processes, whereas exnovation focuses on the removal of innovations specifically.

Exnovation may contribute to the low rate of adoption of chronic care management processes (CMPs) by physician organizations. Evidence indicates that between 2006 and 2013, the use of CMPs increased only slightly overall, from an average of 3.9 to 4.5 CMPs (out of 20 possible) in spite of the demonstrated effectiveness of CMPs in improving outcomes of chronic care<sup>15</sup> and federal and state initiatives that incentivize the patient-centered medical home (PCMH) model and the chronic care model (CCM), both of which promote organized care processes for patients with chronic conditions.<sup>16,17</sup> CMPs are disruptive innovations because implementing chronic care management structures and processes requires a significant departure from standard medical practice.<sup>2,18</sup> Certain CMPs have been more difficult for practices to adopt compared to others. Medical practices increased their use of nonphysician staff for patient education and patient reminders for prevention of and follow-up of chronic conditions, but their use of registries for chronic conditions remained very low (10% of practices) and physician performance feedback on quality of chronic illness care performance was stagnant (18%).<sup>19</sup> These population-level estimates indicate that the diffusion of CMPs

across physician organizations could be slow overall because some CMPs have been exnovated.

Little is known about the exnovation of CMPs and the factors that aid their retention in practice. We analyzed a cohort of 1,048 medical practices to examine the extent to which internal practice capabilities, such as health information technology (HIT) functionality, pay-for-performance incentives, and market factors, are associated with the exnovation of CMPs, including chronic disease registries, patient education, nurse care management, quality of care data feedback to physicians, and patient reminders.

## Conceptual Framework

Physician organizations may be more likely to exnovate CMPs when their internal capabilities and external incentives are insufficient to retain them and when the strength of the evidence for retaining a CMP is low. Fidelity of implementation<sup>20,21</sup> to CMPs may be low when incentives are insufficiently large to integrate innovations into practice, resulting in a high risk of implementation failure and exnovation.<sup>8,11</sup> Previous research indicates that practices with robust HIT adopt a greater number of CMPs compared to practices with low HIT functionality.<sup>22</sup> HIT capabilities may reduce risk of exnovation of CMPs by facilitating the integration of CMPs within the existing workflow and by reducing the staff burden required to make the change.<sup>18</sup>

*Hypothesis 1:* Physician organizations with relatively high baseline HIT functions and expanded HIT functions over time will be less likely to exnovate CMPs.

The strength of the evidence supporting routine use of CMPs may influence physician organizations' decisions to exnovate CMPs. For example, CMPs with an inconsistent and/or unclear evidence base, such as with physician performance measurement and feedback, may be more likely to be exnovated. Accumulating evidence highlights the low reliability of individual physician performance measurement on clinical quality measures and the fact that most individual physicians have an insufficient number of patients with specific chronic illnesses (eg, asthma, congestive heart failure) to conduct reliable comparisons of individual physicians.<sup>23,24</sup> Perceived low reliability of performance

measurement may result in the divestment of individual physician performance feedback.

*Hypothesis 2:* Physician organizations will be more likely to exnovate individual physician performance feedback compared to other CMPs.

External influences, such as the use of global payment for health services, may also influence the exnovation of CMPs by physician organizations. Global payment, in particular, may support the retention of CMPs because returns on CMP investments are more likely to be realized under risk-based payment arrangements. Global payment improves the business case for retaining CMPs and other PCMH capabilities because CMPs, particularly nurse care management and patient education, have high maintenance costs.<sup>25</sup>

*Hypothesis 3:* Practices in markets with relatively lower baseline use of global payment for health care services will be more likely to exnovate CMPs compared to practices in markets with relatively high use of global payment.

## Methods

### *Data*

Three national surveys of US physician organizations were integrated to assess change in CMP use and other organizational characteristics among a longitudinal cohort of physician organizations. Wave 2 of the National Study of Physician Organizations (NSPO2) (2006) and the National Study of Small and Medium-sized Physician Practices (NSSMPP) (2007-2009) served as the baseline period. The third wave of the National Study of Physician Organizations (NSPO3) (2012-2013) served as the follow-up period. The 3 surveys had common questions about organizational characteristics, CMP use, and HIT capabilities for practices of all sizes. All 3 surveys focused on physician organizations caring for patients with chronic conditions, including asthma, congestive heart failure, depression, and diabetes. Across all 3 surveys, large practices (those with at least 20 physicians) were eligible for inclusion if at least 30% of the physicians were primary care providers (family physicians, general internists, and general practitioners), cardiologists, endocrinologists, and/or pulmonologists as of the follow-up period. Smaller practices

(those with fewer than 20 physicians) were eligible if at least 40% of the physicians in the practice were in these specialties. The 30% and 40% primary care cutoffs were established for the survey for large and small- and medium-sized practices, respectively, because the PCMH questions are most relevant to physician organizations caring for adult patients with one or more of the following 4 chronic conditions—asthma, diabetes, depression, and congestive heart failure (CHF). The surveys measured all practice characteristics at the system level for system-owned practices and at the physician organization level for organizations with multiple locations. For single site practices, the surveys assessed practice characteristics particular to a specific site. The NSPO2 had a 60% response rate, the NSSMPP had a 64% response rate, and the NSPO3 had a 50% response rate. Detailed information about the administration of the NSPO2, NSPO3, and NSSMPP surveys is provided elsewhere.<sup>19,26,27</sup> The cohort of 1,048 organizations with baseline (NSPO2 or NSSMPP) and follow-up (NSPO3) responses included NSPO2 (n = 124) and NSSMPP (n = 924) respondents.

Truven Health Insurance Coverage Estimates for county-level health maintenance organization (HMO) and preferred provider organization (PPO) enrollment (2008, 2013) and Area Health Resources Files (AHRF) data (2008, 2013) were summarized at the county-FIPS (federal information processing standards) level and linked to the physician organization data (2008 for baseline and 2013 for follow-up) using county-FIPs codes for the counties each organization covered. AHRF measures included county-level proportions of adults living in poverty, unemployment rates, and rates of uninsured adult patients.

### *Outcome Measures*

*Exnovation of Chronic Care Management Processes.* For each of 4 chronic conditions (diabetes, asthma, congestive heart failure, and depression), 5 CMPs were assessed: registry use, nurse care management, patient reminders for preventive and care management services to prevent exacerbations of chronic illness, use of nonphysician clinicians to provide patient education, and quality of care data feedback to physicians. A composite measure (range: 0–20) was calculated for the baseline and follow-up periods using the sum of binary responses to the CMP questions. For bivariate analyses, we categorized physician organizations as (1) “net CMP exnovators” if the organization had fewer overall CMPs

in the follow-up period than in the baseline period ( $n = 357$ ), (2) practices with no net change in overall CMP use ( $n = 264$ ), and (3) “net CMP adopters” if the organization had more overall CMPs in the follow-up period than in the baseline period ( $n = 427$ ). For multivariate analyses, we examined a net CMP exnovation measure, which was calculated by taking the difference between follow-up and baseline CMP counts, setting positive values to zero, and then taking the absolute value.

### *Main Independent Variables*

*HIT Functions.* HIT functions included whether a majority of physicians used the electronic health record (EHR) for patient problem lists, progress notes, prompts, reminders not specific to chronic conditions management, and alerts for abnormal test results. The index also comprised other HIT functions, including accessing hospital discharge summaries at the main hospital, sending prescriptions directly to pharmacies, and communicating with patients via email. A count measure of HIT functions ( $\alpha = 0.88$ ) was constructed based on the sum of the 14 dichotomous questions (range: 0–14). The index did not incorporate measures of chronic disease registries or use of patient reminders, which were included in the CMP composite.

*County-Level Global Payment for Health Services.* HMO payments involve physician organization global payment for costs of care. We used Truven Health data to construct county-level measures of the proportion of HMO payments across adult patient revenue sources (Medicaid, Medicare, private, and uninsured patient sources) for each US county as a proxy for global payment penetration.

### *Control Measures*

We controlled for practice ownership and practice size (number of physicians) because these characteristics have been found to be associated with CMP use and HIT functionality<sup>4,22,28-32</sup> and may confound the estimated relationship of HIT use and exnovation of CMPs. We also controlled for pay-for-performance participation, measured using a 3-point index assessing receipt of payment for quality of care measures, adoption of information technology, and/or efficient utilization of resources, as such participation may confound the relationships of interest.<sup>33,34</sup> At the market level, we controlled for county-level proportions of adults living



in poverty, as high poverty may be associated with greater proportion of Medicaid revenue for physician organizations, higher global payment penetration at the county level, and increased CMP exnovation by physician organizations. We also controlled for the nine regional divisions used by the United States Census Bureau.

### *Analyses*

First, we examined differences in 2013 physician organization and county-level market characteristics by net CMP change category, ie, net exnovators versus net adopters versus practices with no net change in their CMP count. T-tests were used to assess the extent to which organizational characteristics differed by net CMP change category ( $p < 0.05$ ), with tests conducted by stratum for categorical organizational variables.

We then calculated the level of adoption and exnovation of each of the 20 individual CMPs and the adoption of 14 individual HIT functionalities by net CMP change category. We estimated unadjusted logistic regression models to compare the level of exnovation of each of the CMPs by the net CMP change category. Bivariate correlations of all study variables were examined to identify potential regression model specification problems ( $r \geq 0.60$ ).

We were interested in the extent of net CMP exnovation as our outcome variable, and most practices did not remove CMPs on net. To account for the high proportion of zero observations in the data, we used zero-inflated negative binomial regression to model net CMP exnovation. This regression model (Model 1) estimated the extent to which baseline and follow-up HIT functions, baseline pay-for-performance participation, and baseline county-level global payment use were associated with net CMP exnovation, controlling for practice ownership, size, percent Medicaid revenue, percent county-level poverty, and geographic region (Pacific, New England, Middle Atlantic, Mountain, East South Central, and East North Central). For the inflation portion of the binomial model, we included practice ownership, size, and geographic region as covariates, considering them to be predictors of physician organizations not exnovating CMPs on net.

To explore the impact of changes in internal capabilities and external incentives on net CMP exnovation, we also specified a negative binomial regression model (Model 2) for which we added variables for changes in

practice ownership, in pay-for-performance participation, in Medicaid revenue, in county-level global payment, and in poverty to the baseline variables included in Model 1. The specification of the inflation portion for Model 2 was identical to that for Model 1.

For both models, incidence rate ratios (IRRs) were calculated. We used the clustered sandwich estimator to account for the clustering of physician organizations within counties. The Vuong test was conducted to examine the extent to which the zero-inflated negative binomial models were preferred over the standard negative binomial models. The Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC) for Models 1 and 2 were compared to determine the preferred model based on goodness of fit.

All results were weighted to be nationally representative, with additional survey methodology reported elsewhere.<sup>19</sup> Stata 13.0 was used to conduct all statistical analyses.

## Results

### *Net CMP Change*

More than one-third (34.1%) of all physician organizations exnovated CMPs on net, with a mean net exnovation level of 1.3 CMPs (standard deviation [SD] = 2.9) for the full cohort and a mean net exnovation level of 4.3 CMPs (SD = 2.6) among net CMP exnovators. Net CMP exnovators had nearly twice as many CMPs at baseline compared to all organizations (7.1 vs 4.5,  $p < 0.001$ ) (Table 1). By 2013, net CMP exnovators had removed two-thirds of their CMPs, resulting in relatively low overall CMP use compared to all organizations (3.1 vs 5.6,  $p < 0.001$ ). In contrast, net CMP adopters increased CMP use to 8.2 CMPs (SD = 4.9) over time, while organizations with no net change had a mean of 2.7 CMPs at baseline and follow-up.

In bivariate analyses (see Table 1), large physician organizations (with 20 or more physicians) were more likely to be net exnovators of CMPs; 21.5% of exnovator organizations were large compared to 15.1% of adopter organizations ( $p < 0.001$ ). Physician-owned practices were more likely to have no change in the number of CMPs used over time; 85.6% of physician-owned practices had no change compared to 70.1% of net CMP adopters and 74.2% of net CMP exnovators. Net CMP adopters had higher proportions of Medicaid revenue (11.4% vs 10.4%,  $p = 0.03$ )

Table 1. Organizational and Market Characteristics by Net CMP Change Category (2013 Characteristics)

|                                      | All Physician Organizations | Net CMP Adopter | Practices              |                   | p-value |
|--------------------------------------|-----------------------------|-----------------|------------------------|-------------------|---------|
|                                      |                             |                 | With No Net CMP Change | Net CMP Exnovator |         |
| n (% of organizations)               | 1,048                       | 427 (40.7%)     | 264 (25.2%)            | 357 (34.1%)       |         |
| <b>Organizational Characteristic</b> |                             |                 |                        |                   |         |
| Number of CMPs (range: 0–20)         |                             |                 |                        |                   |         |
| Baseline (2006/2008) Mean (SD)       | 4.5 (4.5)                   | 3.4 (3.7)       | 2.7 (4.0)              | 7.1 (4.7)         | <0.001  |
| Follow-up (2012/2013) Mean (SD)      | 5.6 (5.1)                   | 8.2 (4.9)       | 2.7 (4.0)              | 3.1 (3.6)         | <0.001  |
| <b>Practice ownership</b>            |                             |                 |                        |                   |         |
| Physician-owned (%)                  | 74.1                        | 70.1            | 85.6                   | 74.2              | 0.002   |
| Hospital or health system-owned (%)  | 18.0                        | 20.5            | 11.0                   | 17.9              |         |
| Community health center (%)          | 7.9                         | 9.4             | 3.5                    | 7.9               |         |
| <b>Practice size, %</b>              |                             |                 |                        |                   |         |
| 1–2 physicians                       | 42.5                        | 39.5            | 56.1                   | 40.2              | 0.001   |
| 3–9 physicians                       | 33.0                        | 36.2            | 31.8                   | 28.9              |         |
| 10–19 physicians                     | 8.6                         | 9.2             | 5.2                    | 9.4               |         |
| 20+ physicians                       | 16.0                        | 15.1            | 6.9                    | 21.5              |         |

*Continued*

Table 1. *Continued*

|  | All Physician Organizations | Net CMP Adopter | Practices With No Net CMP Change | Net CMP Exnovator | p-value |
|--|-----------------------------|-----------------|----------------------------------|-------------------|---------|
| Revenue from Medicaid (mean % of total, SD)                      | 10.4 (13.0)                 | 11.4 (14.2)     | 8.5 (11.0)                       | 9.9 (12.0)        | 0.03    |
| Revenue from uninsured low-income patients (mean % of total, SD) | 4.7 (6.1)                   | 3.7 (5.8)       | 5.2 (6.2)                        | 5.7 (6.2)         | <0.001  |
| Practice involved in pay-for-performance (0-3) (mean, SD)        | 0.84 (0.97)                 | 0.93 (1.05)     | 0.66 (0.92)                      | 0.86 (0.87)       | 0.002   |
| <b>Market Characteristics</b>                                    |                             |                 |                                  |                   |         |
| Global payment (% of payments)                                   |                             |                 |                                  |                   |         |
| Overall (% , SD)   | 26.2 (14.0)                 | 29.1 (15.1)     | 24.7 (12.4)                      | 23.8 (13.0)       | <0.001  |
| Private (% , SD)   | 15.6 (12.9)                 | 18.8 (15.4)     | 14.0 (11.3)                      | 12.9 (12.9)       | <0.001  |
| Medicare (% , SD)  | 27.0 (14.8)                 | 30.4 (14.6)     | 22.4 (14.6)                      | 26.2 (14.4)       | <0.001  |
| Medicaid (% , SD)  | 61.7 (31.8)                 | 60.1 (30.2)     | 67.1 (31.7)                      | 59.6 (33.3)       | 0.007   |
| Uninsured (% , SD)   | 14.6 (7.0)                  | 15.1 (6.2)      | 15.3 (9.6)                       | 13.6 (5.5)        | 0.002   |
| Unemployment (% , SD)  | 7.7 (2.0)                   | 7.7 (2.2)       | 7.5 (1.7)                        | 7.8 (2.0)         | 0.17    |
| Poverty (% , SD)   | 15.6 (5.6)                  | 16.3 (5.6)      | 15.0 (6.4)                       | 15.2 (4.9)        | 0.002   |

CMP = care management process; SD = standard deviation. Results are weighted.

and lower proportions of uninsured low-income patient revenue (3.7% vs 4.7%,  $p < 0.001$ ) compared to all organizations. Net CMP adopters and net CMP exnovators participated in pay-for-performance initiatives ( $p = 0.002$ ) to a greater extent compared to organizations with no net changes in CMP use.

All market characteristics assessed, with the exception of unemployment rate, differed for organizations across net CMP change categories (see Table 1). Organizations with no net change in CMP use were more likely to operate in counties with proportionally higher global payment for Medicaid compared to net CMP adopters (67.1% vs 60.1%) and net CMP exnovators (67.1% vs 59.6%). County-level poverty (16.3% vs 15.6% overall) was slightly higher in counties where net CMP adopters operated.

### *Exnovation and Adoption of Individual CMPs*

Individual CMPs were differentially adopted and exnovated across the 3 CMP change categories ( $p < 0.001$  for each of the 20 individual CMPs). Of the 5 CMPs for each of the 4 chronic conditions, quality of care data feedback to physicians and patient reminders for recommended preventive and chronic care were exnovated by approximately one-third of net exnovators, ranging from 32.3% to 39.9% (Table 2). Nevertheless, quality of care data feedback to physicians and patient reminders were just as likely to be adopted by net CMP adopters as other CMPs; 20.2%–37.1% and 27.3%–42.1%, respectively.

Net CMP exnovators had low adoption across all 20 CMPs (range: 0.0%–10.6% of organizations adopting), while net CMP adopters had low levels of exnovation across all 20 CMPs (range: 0.0%–6.1% of organizations exnovating). Nurse care management was the CMP maintained by most organizations over time, with only 4.2%–11.8% exnovation among net CMP exnovators. Similarly, registries were generally maintained once put into place.

### *HIT Functionality*

HIT functionalities expanded over time across all 3 net CMP change categories. Net adopters of CMPs had relatively higher HIT functionality at baseline (5.1 of 14 capabilities,  $p < 0.001$ ) and at follow-up (8.3 capabilities,  $p < 0.001$ ) compared to other organizations (Table 3). Of the HIT functionalities, the most commonly adopted

Table 2. The Adoption and Exnovation of Individual CMPs by Net CMP Change Category

|  | All Physician Organizations |      | Net CMP Adopter |            | Practices with No Net CMP Change |            | Net CMP Exnovator |            |
|--|-----------------------------|------|-----------------|------------|----------------------------------|------------|-------------------|------------|
|  | n (% of organizations)      |      | n               | (%)        | n                                | (%)        | n                 | (%)        |
|  |                             | %    | Adopting        | Exnovating | Adopting                         | Exnovating | Adopting          | Exnovating |
|  | 1,048                       |      | 427             | (40.7%)    | 264                              | (25.2%)    | 357               | (34.1%)    |
|  |                             | %    | Adopting        | Exnovating | Adopting                         | Exnovating | Adopting          | Exnovating |
| <b>Registries</b>                                  |                             |      |                 |            |                                  |            |                   |            |
| Diabetes   | 14.0                        | 5.8  | 32.2            | 0.0        | 0.0                              | 0.0        | 2.7               | 16.4       |
| Asthma   | 14.7                        | 2.8  | 30.0            | 0.0        | 5.3                              | 0.0        | 3.2               | 10.7       |
| Congestive heart failure                           | 9.3                         | 4.8  | 21.9            | 0.0        | 0.0                              | 0.0        | 1.0               | 13.3       |
| Depression   | 7.7                         | 5.5  | 16.8            | 3.1        | 2.8                              | 0.0        | 0.1               | 12.2       |
| <b>Quality of Care Data Feedback to Physicians</b> |                             |      |                 |            |                                  |            |                   |            |
| Diabetes   | 16.8                        | 15.6 | 37.1            | 5.5        | 0.0                              | 5.0        | 4.7               | 35.3       |
| Asthma   | 15.2                        | 15.2 | 33.5            | 1.1        | 0.0                              | 7.1        | 4.2               | 38.1       |
| Congestive heart failure                           | 15.3                        | 17.9 | 34.4            | 4.5        | 0.0                              | 9.9        | 3.4               | 39.9       |
| Depression   | 8.6                         | 15.3 | 20.2            | 2.4        | 0.0                              | 9.7        | 10.6              | 35.0       |
| <b>Patient Reminders</b>                           |                             |      |                 |            |                                  |            |                   |            |
| Diabetes   | 19.4                        | 13.5 | 42.1            | 0.5        | 2.9                              | 1.6        | 4.5               | 37.9       |
| Asthma   | 12.5                        | 13.8 | 28.5            | 4.8        | 2.8                              | 3.2        | 0.0               | 32.3       |
| Congestive heart failure                           | 13.6                        | 14.6 | 32.8            | 1.6        | 0.0                              | 3.4        | 0.0               | 38.4       |
| Depression   | 11.2                        | 13.9 | 27.3            | 4.7        | 0.0                              | 3.1        | 0.0               | 32.7       |

*Continued*

Table 2. *Continued*

|                              | All Physician Organizations |              | Net CMP Adopter |              | Practices with No Net CMP Change |              | Net CMP Exnovator |              |
|------------------------------|-----------------------------|--------------|-----------------|--------------|----------------------------------|--------------|-------------------|--------------|
|                              | n (% of organizations)      | 1,048        | 427 (40.7%)     | 264 (25.2%)  | 357 (34.1%)                      |              |                   |              |
|                              | % Adopting                  | % Exnovating | % Adopting      | % Exnovating | % Adopting                       | % Exnovating | % Adopting        | % Exnovating |
| <b>Patient Education</b>     |                             |              |                 |              |                                  |              |                   |              |
| Diabetes                     | 19.0                        | 12.1         | 37.2            | 6.1          | 5.4                              | 4.5          | 7.3               | 24.9         |
| Asthma                       | 16.5                        | 12.4         | 36.4            | 4.7          | 5.4                              | 4.5          | 0.1               | 27.6         |
| Congestive heart failure     | 18.0                        | 11.0         | 38.5            | 0.8          | 8.1                              | 4.6          | 0.1               | 27.7         |
| Depression                   | 18.4                        | 8.5          | 36.1            | 1.2          | 7.3                              | 4.3          | 5.3               | 20.2         |
| <b>Nurse Care Management</b> |                             |              |                 |              |                                  |              |                   |              |
| Diabetes                     | 11.5                        | 4.7          | 19.8            | 1.6          | 7.2                              | 0.2          | 4.6               | 11.8         |
| Asthma                       | 9.0                         | 3.8          | 19.3            | 2.1          | 4.4                              | 0.2          | 0.2               | 8.5          |
| Congestive heart failure     | 10.6                        | 2.7          | 20.5            | 1.1          | 5.1                              | 0.0          | 2.8               | 6.5          |
| Depression                   | 5.0                         | 1.9          | 9.2             | 1.2          | 4.3                              | 0.0          | 0.4               | 4.2          |

CMP = care management process.  
 All % adoption and % exnovation differences among the 3 CMP change categories are statistically significant at the  $p < 0.001$  level.  
 Results are weighted.  
 Data from the National Study of Physician Organizations II, the National Study of Small and Medium-Sized Physician Practices, and the National Study of Physician Organizations III.

Table 3. The Adoption of HIT by Net CMP Change Category

|  | All Physician Organizations | Net CMP Adopter | Practices with No Net CMP Change | Net CMP Exnovator | p-value |
|--|-----------------------------|-----------------|----------------------------------|-------------------|---------|
| n (% of organizations)                                 | 1,048                       | 427 (40.7%)     | 264 (25.2%)                      | 357 (34.1%)       |         |
| <b>Number of HIT Functions (range: 0–14)</b>           |                             |                 |                                  |                   |         |
| Baseline (2006/2008) Mean (SD)                         | 4.7 (3.4)                   | 5.1 (3.6)       | 3.9 (2.7)                        | 4.9 (3.4)         | ***     |
| Follow-up (2012/2013) Mean (SD)                        | 7.3 (3.9)                   | 8.3 (4.1)       | 6.0 (3.4)                        | 7.0 (3.6)         | ***     |
| <b>HIT Function Adopted (% adopting)</b>               |                             |                 |                                  |                   |         |
| <i>Electronic documentation</i>                        |                             |                 |                                  |                   |         |
| EHR use for listing patient medications                | 27.3                        | 34.1            | 16.7                             | 27.2              | ***     |
| EHR use for listing patient problems                   | 26.5                        | 30.3            | 19.5                             | 27.0              | **      |
| EHR use for making progress notes                      | 24.2                        | 29.8            | 15.6                             | 23.8              | ***     |
| <i>Clinical decision support</i>                       |                             |                 |                                  |                   |         |
| EHR use for identifying potential drug interactions    | 33.5                        | 36.6            | 38.5                             | 26.1              | ***     |
| EHR use for generating prompts and reminders           | 22.6                        | 33.0            | 12.2                             | 17.8              | ***     |
| EHR use for generating alerts on abnormal test results | 24.9                        | 35.1            | 13.2                             | 21.3              | ***     |

*Continued*



Table 3. Continued

|  | All Physician Organizations | Net CMP Adopter | Practices with No Net CMP Change | Net CMP Exnovator | p-value |
|--|-----------------------------|-----------------|----------------------------------|-------------------|---------|
| <i>Quality measurement</i>                                 |                             |                 |                                  |                   |         |
| EHR use for collecting data for clinical quality measures  | 28.6                        | 38.7            | 21.4                             | 21.9              | ***     |
| <i>Physician order entry</i>                               |                             |                 |                                  |                   |         |
| Transmission of prescriptions electronically to pharmacy   | 46.1                        | 53.8            | 44.3                             | 38.3              | ***     |
| <i>Electronic access to clinical data</i>                  |                             |                 |                                  |                   |         |
| Clinical information on patient ER visits at main hospital | 11.0                        | 8.5             | 18.4                             | 8.6               | ***     |
| Hospital discharge summaries at main hospital              | 11.9                        | 11.0            | 13.7                             | 11.7              | *       |
| Laboratory results from main lab                           | 8.1                         | 6.9             | 6.2                              | 10.9              | *       |
| Pharmacy record of prescriptions filled by patients        | 31.2                        | 38.6            | 25.7                             | 26.4              | ***     |
| <i>Electronic connectivity for patients</i>                |                             |                 |                                  |                   |         |
| Patient ability to view medical record online              | 18.1                        | 28.2            | 8.7                              | 13.0              | ***     |
| Physician communication with patients via email            | 11.7                        | 18.2            | 0.0                              | 12.1              | ***     |

HIT = health information technology; CMP = care management process; EHR = electronic health record; ER = emergency room.  
 \* not statistically significant (p < 0.05), \*\* p < 0.01, \*\*\* p < 0.001 for overall net CMP change category comparisons.

functions were transmission of prescriptions electronically to the pharmacy (46.1% adoption), which was adopted at high levels across all CMP change categories (range: 38.3%–53.8%), and EHR use to assess potential drug interactions (33.5% adoption), adopted at similar levels across organizations (range: 26.1%–38.5%). Net CMP adopters were more likely than other organizations to adopt electronic connectivity functionalities that allow patients to view their medical records online (28.2% vs 18.1% for all organizations) and physicians to communicate with patients via email (18.2% vs 11.7% for all organizations).

### *Multivariate Analyses*

Vuong test results ( $z = 3.42$ ;  $p < 0.001$ ) indicated that the zero-inflated negative binomial models were preferred over standard negative binomial models, so we present the zero-inflated Model 1 and Model 2 results in Table 4. Model 1, which included baseline predictors and change in HIT functions only, and Model 2, which added other change predictors, had similar findings. Goodness of fit for Model 2, however, was better based on AIC and BIC statistics. Model 2 results indicated that larger increases in HIT functionality were linked to less exnovation of CMPs (IRR = 0.91,  $p < 0.01$ ) compared to practices with smaller increases in HIT functionality. Net CMP exnovation did not differ by practice ownership. Greater proportions of baseline Medicaid practice revenue (IRR = 1.44,  $p < 0.001$ ) and increasing proportions of revenue from Medicaid (IRR = 1.02,  $p < 0.05$ ) were associated with more CMP exnovation by physician organizations on net. In terms of market characteristics, practices in counties with greater baseline proportions of residents living in poverty (IRR = 0.79,  $p < 0.05$ ) had significantly less CMP exnovation.

## **Discussion**

Exnovation of CMPs by physician organizations largely explains the slow population-level increases in CMP use over time. More than one-third (34.1%) of physician organizations exnovated CMPs on net, while 25.2% had no net change in CMP use. Early adopter physician organizations appear to be moving away from CMPs in general, although certain CMPs were retained at higher levels than others. Systematic reviews have examined the strength of the evidence supporting CMPs for asthma,<sup>35</sup>

Table 4. Multivariate Analyses: Organizational and Market Influences on the Net Exnovation of Chronic CMPs

|   | Exnovation of CMPs |              |         |         |              |         |
|---|--------------------|--------------|---------|---------|--------------|---------|
|   | Model 1            |              |         | Model 2 |              |         |
|   | IRR                | 95% CI       | p-value | IRR     | 95% CI       | p-value |
| <b>Organizational Characteristics</b>     |                    |              |         |         |              |         |
| Practice ownership                        | —                  |              |         | —       |              |         |
| Physician-owned (reference)               |                    |              |         |         |              |         |
| System-owned                              | 0.87               | 0.42 to 1.81 |         | 0.79    | 0.40 to 1.54 |         |
| Community health center                   | 0.85               | 0.40 to 1.82 |         | 0.87    | 0.42 to 1.80 |         |
| Ownership change                          |                    |              |         | 1.16    | 0.79 to 1.71 |         |
| Practice size                             |                    |              |         |         |              |         |
| 1–2 physicians (reference)                | —                  |              |         | —       |              |         |
| 3–9 physicians                            | 1.13               | 0.83 to 1.52 |         | 1.10    | 0.83 to 1.45 |         |
| 10–19 physicians                          | 1.18               | 0.64 to 2.19 |         | 1.11    | 0.65 to 1.87 |         |
| 20+ physicians                            | 0.94               | 0.58 to 1.57 |         | 0.90    | 0.52 to 1.55 |         |
| Medicaid revenue at baseline (% of total) | 1.34               | 1.19 to 1.51 | ***     | 1.44    | 1.22 to 1.70 | ***     |
| Change in % of Medicaid revenue           |                    |              |         | 1.02    | 1.00 to 1.03 | *       |
| <b>Organizational Capabilities</b>        |                    |              |         |         |              |         |
| HIT functionality at baseline             | 0.98               | 0.93 to 1.02 |         | 0.99    | 0.95 to 1.03 |         |
| Change in HIT functionality               | 0.92               | 0.87 to 0.97 | **      | 0.91    | 0.86 to 0.96 | **      |

*Continued*

Table 4. *Continued*

|  | Exnovation of CMPs |               |         |         |               |         |
|--|--------------------|---------------|---------|---------|---------------|---------|
|  | Model 1            |               |         | Model 2 |               |         |
|  | IRR                | 95% CI        | p-value | IRR     | 95% CI        | p-value |
| Pay-for-performance at baseline          | 1.21               | 1.03 to 1.41  | *       | 1.22    | 0.98 to 1.51  |         |
| Change in pay-for-performance            |                    |               |         | 0.98    | 0.83 to 1.17  |         |
| <b>Market Characteristics</b>            |                    |               |         |         |               |         |
| Global payment (%), 2008                 | 1.11               | 0.93 to 1.33  |         | 1.08    | 0.90 to 1.27  |         |
| Change in % of global payment, 2008-2013 |                    |               |         | 0.98    | 0.83 to 1.17  |         |
| Poverty (%), 2008                        | 0.81               | 0.67 to 0.97  | *       | 0.79    | 0.64 to 0.96  | *       |
| Change in % of poverty, 2008-2013        |                    |               |         | 0.86    | 0.73 to 1.01  |         |
| Constant                                 | 5.86               | 3.90 to 8.80  | ***     | 5.38    | 3.72 to 7.78  | ***     |
| <b>Inflation Portion</b>                 |                    |               |         |         |               |         |
| Practice ownership                       |                    |               |         |         |               |         |
| Physician-owned (reference)              | —                  |               |         | —       |               |         |
| System-owned                             | 0.40               | -1.03 to 1.82 |         | 0.38    | -1.08 to 1.83 |         |
| Community health center/other            | 0.47               | -1.47 to 2.41 |         | 0.52    | -1.33 to 2.37 |         |
| Practice size                            |                    |               |         |         |               |         |
| 1-2 physicians (reference)               | —                  |               |         | —       |               |         |

*Continued*

Table 4. Continued

|                  | Exnovation of CMPs |               |         |         |               |         |
|------------------|--------------------|---------------|---------|---------|---------------|---------|
|                  | Model 1            |               |         | Model 2 |               |         |
|                  | IRR                | 95% CI        | p-value | IRR     | 95% CI        | p-value |
| 3-9 physicians   | -0.40              | -1.25 to 1.82 |         | -0.43   | -1.08 to 1.83 |         |
| 10-19 physicians | 1.26               | -0.12 to 2.65 |         | 1.26    | -0.15 to 2.67 |         |
| 20+ physicians   | -0.93              | -1.96 to 0.10 |         | -0.86   | -1.91 to 0.19 |         |
| Constant         | 0.30               | -0.50 to 1.11 |         | 0.28    | -0.55 to 1.11 |         |
| AIC              |                    | 132,447.6     |         |         | 129,394.8     |         |
| BIC              |                    | 132,620.3     |         |         | 129,590.7     |         |

CMP = care management process; IRR = incidence rate ratio; CI = confidence interval; HIT = health information technology; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion.

\*p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001.

Geographic region dummy variables are also controlled for in the count and inflation portions of the negative binomial regression model (Models 1 and 2).

diabetes,<sup>36</sup> depression,<sup>37</sup> and CHF.<sup>38</sup> The evidence base is strongest for diabetes and depression, and physician organizations adopt CMPs for diabetes at much higher levels than depression. In spite of the strong evidence base, CMPs are least adopted for depression of the 4 conditions assessed. Asthma CMPs and CHF CMPs have been less extensively examined. When we compared CMP exnovation by chronic condition, exnovation levels were no different by disease. Important differences in exnovation levels by the type of CMP, however, were observed.

Nurse care management and registries were relatively robust CMPs, as they were retained by most physician organizations once adopted. Consistent with Hypothesis 2, CMPs for quality of care data feedback were the CMPs most often removed, exnovated by more than one-third (35.0%–39.9%) of net CMP exnovators. Physician performance feedback may have been removed more relative to other CMPs because of the concern about unreliable measurement based in part on an inadequate number of patients per physician to produce reliable measures. Patient reminder systems may have been removed because HIT advancements can generate patient lists to aid patient identification and performance assessment. For example, some EHRs are able to stratify patients based on their clinical outcomes for interventions as well as provide clinicians with a real-time sense of their level of performance on the quality indicators. Thus, some exnovation of CMPs may be partially due to advancements in HIT, as these innovations may replace or outdate the use of certain CMPs.

There were no individual CMPs that were systematically adopted at higher levels by net CMP exnovators. Moreover, no individual CMPs were exnovated at higher levels by net CMP adopters. Instead, the patterns of adoption and exnovation suggest that net adopter and net exnovator organizations are at different stages of a similar innovation diffusion process and cycle.<sup>39,40</sup> Physician organizations that exnovate CMPs on net are a subset of “early adopters” of CMPs, while CMP adopters represent a combination of the “early majority” and early adopters that continue to expand their use of CMPs. Diffusion research indicates that early and late majorities tend to be organizations that are more likely to be influenced by legitimacy and reputational pressures to adopt innovations. Organizational scholars have observed that the early majority will adopt innovations even when the new practices are not effective in improving organizational performance.<sup>41</sup> This may be one reason why physician organizations adopting CMPs on net took up quality

of care data feedback to physicians, a CMP that net exnovators often removed.

Consistent with Hypothesis 1, expanded HIT functions appear to support CMP retention. In multivariate analyses, increases in HIT functionality over time were associated with less exnovation of CMPs. Electronic access to patient hospital discharge summaries and to clinical information on patient ER visits and electronic connectivity for patients support care management structures and processes, as patient outreach and education can be more targeted and efficient when organizations have these data to inform the implementation of CMPs. EHRs with functionality to detect potential drug interactions and to generate alerts on abnormal test results, and to prompt and remind users of recommended chronic care measures, also support the work of chronic care managers and patient educators.

We posited that county-level global payment for health services and pay-for-performance would foster business model alignment with CMP adoption and retention. Contrary to our hypothesis (Hypothesis 3), lower county-level global payment and physician organization participation in pay-for-performance were not associated with greater CMP exnovation in multivariate analyses. These findings suggest that external incentives may be more effective in influencing initial adoption of CMPs,<sup>42</sup> but not their retention. In contrast, internal capabilities such as HIT functionality reduce exnovation risk by supporting the retention of CMPs. The overall use of global payment is still relatively low in most markets and may be insufficient to support the retention of chronic care management for physician organizations. This could explain why greater county-level global payment was not associated with CMP retention.

Several other important results emerged from our analyses. Physician organizations with a relatively high and increasing proportion of revenue from Medicaid removed significantly more CMPs over time. Our post hoc explanation is that Medicaid provider reimbursement may not sufficiently incentivize the retention of CMPs and that high and increasing dependence on Medicaid reimbursement results in exnovation of CMPs by early adopting organizations. We also found that physician organizations serving patients in counties with greater proportions of residents living in poverty exnovated fewer CMPs. Highly impoverished counties tend to care for patients with greater likelihood and severity of exacerbations of chronic illnesses.<sup>43</sup> It may be that even when practices are relatively more dependent on Medicaid

revenue and have low reimbursement rates, the high clinical and social needs of the populations they serve contribute to the retention of CMPs.

Our results should be considered in light of important limitations. First, due to measurement challenges and post hoc biases, we do not distinguish the reasons why physician organizations exnovated CMPs. Important differences in the organizational determinants of strategic exnovation, implementation failure, leadership turnover, and cost-cutting measures could clarify the patterns of CMP removal we observed. These distinct causes of exnovation may be one reason why we identified few statistically significant predictors of exnovation in multivariate models. Measurement advances are needed to distinguish the multiple determinants of exnovation and to examine the strategic exnovation of structures and processes when organizations need to accommodate new innovations. Second, we used 2 different baseline surveys for different populations of practices and these surveys were fielded sequentially (in 2006 and 2008) rather than in tandem. We were unable to account for the 2-year baseline measurement difference analytically because practice size was perfectly correlated with the baseline survey years. To reduce bias resulting from different surveys, our analyses relied on measures that were comparable across surveys. Third, the NSPO2 and NSSMPP surveys did not assess whether or not practices were PCMH certified by the National Committee for Quality Assurance (NCQA), so we were unable to specifically examine the association of PCMH certification with exnovation of CMPs. Similarly, we did not have a practice-level measure of global payment. Future research should examine the extent to which PCMH certification by NCQA and practice use of global payment influence the retention of CMPs. Finally, we restricted the analytic sample to organizations with responses to the baseline and follow-up surveys. This could limit the generalizability of the findings; for example, nonrespondent organizations may behave differently. Limiting the respondents, however, improved internal validity since differences observed over time could not be attributed to having had different respondents in each sample. We also accounted for nonresponse through weighted analyses.

Our study reveals that there is a high level of net CMP exnovation among physician organizations and that enhanced HIT functionality and other practice capabilities may reduce the exnovation of CMPs. Some exnovation of CMPs may be needed to increase absorptive capacity for



organizations to integrate new innovations with better fit and effectiveness. Existing theories of innovation implementation rarely discuss the need to exnovate; most implicitly assume that continuous improvement is key to the “normalization” of innovations into practice.<sup>5,44</sup> For example, continuous improvement and stakeholder engagement are central to change management theories,<sup>45-47</sup> as rapid-cycle testing of organizational changes, measurement, and refinement of innovations aid integration.<sup>5,44</sup> The fast pace of technological and service innovation in health care, however, can create “change fatigue” among frontline implementers of innovations. Strategic exnovation may aid in preventing such fatigue among organizations undergoing transformative change. Distinguishing strategic de-implementation from failed implementation and other reasons for exnovation can provide insight as to why the overall adoption of many innovations in health services delivery organizations remains low. Future research is needed to clarify the conditions under which the exnovation of innovations improves rather than harms organizational performance, including patient care experiences, quality of care, and costs of care.

## References

1. Kimberly JR. Managerial innovation. In: Nystrom PC, Starbuck WH, eds. *Handbook of Organizational Design*. Vol 1. New York, NY: Oxford University Press; 1981:84-104.
2. Rye CB, Kimberly JR. The adoption of innovations by provider organizations in health care. *Med Care Res Rev*. 2007;64(3):235-278.
3. Kash BA, Spaulding A, Gamm L, Johnson CE. Health care administrators' perspectives on the role of absorptive capacity for strategic change initiatives: a qualitative study. *Health Care Manage Rev*. 2013;38(4):339-348.
4. Nembhard IM. All teach, all learn, all improve?: the role of interorganizational learning in quality improvement collaboratives. *Health Care Manage Rev*. 2012;37(2):154-164.
5. Nadeem E, Olin SS, Hill LC, Hoagwood KE, Horwitz SM. Understanding the components of quality improvement collaboratives: a systematic literature review. *Milbank Q*. 2013;91(2):354-394.
6. Gustafson DH, Quanbeck AR, Robinson JM, et al. Which elements of improvement collaboratives are most effective? A cluster-randomized trial. *Addiction*. 2013;108(6):1145-1157.

7. Williams I. Organizational readiness for innovation in health care: some lessons from the recent literature. *Health Serv Manage Res.* 2011;24(4):213-218.
8. Prasad V, Ioannidis JP. Evidence-based de-implementation for contradicted, unproven, and aspiring healthcare practices. *Implement Sci.* 2014;9:1.
9. Voorn VM, Marang-van de Mheen PJ, So-Osman C, et al. De-implementation of expensive blood saving measures in hip and knee arthroplasties: study protocol for the LISBOA-II cluster randomized trial. *Implement Sci.* 2014;9:48.
10. Aron DC, Lowery J, Tseng CL, Conlin P, Kahwati L. De-implementation of inappropriately tight control (of hypoglycemia) for health: protocol with an example of a research grant application. *Implement Sci.* 2014;9:58.
11. Montini T, Graham ID. “Entrenched practices and other biases”: unpacking the historical, economic, professional, and social resistance to de-implementation. *Implement Sci.* 2015;10:24.
12. Massatti RR, Sweeney HA, Panzano PC, Roth D. The de-adoption of innovative mental health practices (IMHP): why organizations choose not to sustain an IMHP. *Adm Policy Ment Health.* 2008;35(1-2):50-65.
13. Gnjudic D, Elshaug AG. De-adoption and its 43 related terms: harmonizing low-value care terminology. *BMC Med.* 2015;13:273.
14. Abrahamson E. Managerial fads and fashions: the diffusion and rejection of innovations. *Acad Manage Rev.* 1991;16(3):586-612.
15. Coleman K, Austin BT, Brach C, Wagner EH. Evidence on the Chronic Care Model in the new millennium. *Health Aff (Millwood).* 2009;28(1):75-85.
16. Rodriguez HP, McClellan SR, Bibi S, Casalino LP, Ramsay PP, Shortell SM. Increased use of care management processes and expanded health information technology functions by practice ownership and Medicaid revenue. *Med Care Res Rev.* 2016;73(3):308-328.
17. McHugh M, Shi Y, Ramsay PP, et al. Patient-centered medical home adoption: results from Aligning Forces for Quality. *Health Aff (Millwood).* 2016;35(1):141-149.
18. Wagner EH, Coleman K, Reid RJ, Phillips K, Abrams MK, Sugarman JR. The changes involved in patient-centered medical home transformation. *Prim Care.* 2012;39(2):241-259.
19. Wiley JA, Rittenhouse DR, Shortell SM, et al. Managing chronic illness: physician practices increased the use of care management

- and medical home processes. *Health Aff (Millwood)*. 2015;34(1):78-86.
20. Grace SM, Rich J, Chin W, Rodriguez HP. Fidelity of implementation to a care team redesign and improved outcomes of diabetes care. *Int J Qual Health Care*. 2015;27(1):60-66.
  21. Keith RE, Hopp FP, Subramanian U, Wiitala W, Lowery JC. Fidelity of implementation: development and testing of a measure. *Implement Sci*. 2010;5:99.
  22. Casalino L, Gillies RR, Shortell SM, et al. External incentives, information technology, and organized processes to improve health care quality for patients with chronic diseases. *JAMA*. 2003;289(4):434-441.
  23. Sequist TD, Schneider EC, Li A, Rogers WH, Safran DG. Reliability of medical group and physician performance measurement in the primary care setting. *Med Care*. 2011;49(2):126-131.
  24. Hofer TP, Hayward RA, Greenfield S, Wagner EH, Kaplan SH, Manning WG. The unreliability of individual physician "report cards" for assessing the costs and quality of care of a chronic disease. *JAMA*. 1999;281(22):2098-2105.
  25. Nocon RS, Sharma R, Birnberg JM, Ngo-Metzger Q, Lee SM, Chin MH. Association between patient-centered medical home rating and operating cost at federally funded health centers. *JAMA*. 2012;308(1):60-66.
  26. Rittenhouse DR, Casalino LP, Gillies RR, Shortell SM, Lau B. Measuring the medical home infrastructure in large medical groups. *Health Aff (Millwood)*. 2008;27(5):1246-1258.
  27. Rittenhouse DR, Casalino LP, Shortell SM, et al. Small and medium-size physician practices use few patient-centered medical home processes. *Health Aff (Millwood)*. 2011;30(8):1575-1584.
  28. Casalino LP, Wu FM, Ryan AM, et al. Independent practice associations and physician-hospital organizations can improve care management for smaller practices. *Health Aff (Millwood)*. 2013;32(8):1376-1382.
  29. Shortell SM, Gillies R, Siddique J, et al. Improving chronic illness care: a longitudinal cohort analysis of large physician organizations. *Med Care*. 2009;47(9):932-939.
  30. Rundall TG, Shortell SM, Wang MC, et al. As good as it gets? Chronic care management in nine leading US physician organizations. *BMJ*. 2002;325(7370):958-961.
  31. McClellan SR, Casalino LP, Shortell SM, Rittenhouse DR. When does adoption of health information technology by physician practices lead to use by physicians within the practice? *J Am Med Inform Assoc*. 2013;20(e1):e26-32.

32. Rodriguez HP, Ivey SL, Raffetto BJ, et al. As good as it gets? Managing risks of cardiovascular disease in California's top-performing physician organizations. *Jt Comm J Qual Patient Saf.* 2014;40(4):148-158.
33. Damberg CL, Shortell SM, Raube K, et al. Relationship between quality improvement processes and clinical performance. *Am J Manag Care.* 2010;16(8):601-606.
34. Ramsay PP, Shortell SM, Casalino LP, Rodriguez HP, Rittenhouse DR. A longitudinal study of medical practices' treatment of patients who use tobacco. *Am J Prev Med.* 2016;50(3):328-335.
35. Gibson PG, Powell H, Coughlan J, et al. Self-management education and regular practitioner review for adults with asthma. *Cochrane Database Syst Rev.* 2003;(1):CD001117.
36. Stellefson M, Dipnarine K, Stopka C. The chronic care model and diabetes management in US primary care settings: a systematic review. *Prev Chronic Dis.* 2013;10:E26.
37. Williams JW Jr, Gerrity M, Holsinger T, Dobscha S, Gaynes B, Dietrich A. Systematic review of multifaceted interventions to improve depression care. *Gen Hosp Psychiatry.* 2007;29(2):91-116.
38. Clark AM, Hartling L, Vandermeer B, McAlister FA. Meta-analysis: secondary prevention programs for patients with coronary artery disease. *Ann Intern Med.* 2005;143(9):659-672.
39. Rogers EM. Lessons for guidelines from the diffusion of innovations. *Jt Comm J Qual Improv.* 1995;21(7):324-328.
40. Berwick DM. Disseminating innovations in health care. *JAMA.* 2003;289(15):1969-1975.
41. DiMaggio PJ, Powell WW. The iron cage revisited: institutional isomorphism and collective rationality in organizational fields. *Am Sociol Rev.* 1983;48(2):147-160.
42. Robinson JC, Casalino LP, Gillies RR, Rittenhouse DR, Shortell SS, Fernandes-Taylor S. Financial incentives, quality improvement programs, and the adoption of clinical information technology. *Med Care.* 2009;47(4):411-417.
43. Russo CA, Andrews RM, Coffey RM. *Statistical Brief #10: Racial and Ethnic Disparities in Potentially Preventable Hospitalizations, 2003.* Healthcare Cost and Utilization Project (HCUP). Rockville, MD: Agency for Healthcare Research and Quality; 2006.
44. May CR, Mair F, Finch T, et al. Development of a theory of implementation and integration: Normalization Process Theory. *Implement Sci.* 2009;4:29.

45. Wise CG, Alexander JA, Green LA, Cohen GR, Koster CR. Journey toward a patient-centered medical home: readiness for change in primary care practices. *Milbank Q*. 2011;89(3):399-424.
46. Kotter JP. Leading change: why transformation efforts fail. *Harvard Bus Rev*. 1995;73(2):59-67.
47. Campbell RJ. Change management in health care. *Health Care Manag (Frederick)*. 2008;27(1):23-39.

---

*Funding/Support:* The National Study of Small and Medium-Sized Physician Practices and the National Study of Physician Organizations III were funded by the Robert Wood Johnson Foundation (Award Nos. 35305, 68847, and 71110). The National Study of Physician Organizations II was supported by the Robert Wood Johnson Foundation (Award No. 51573), the Commonwealth Fund (Award No. 20050334), and the California Health Care Foundation (Award No. 04-1109).

*Conflict of Interest Disclosures:* All authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest. No disclosures were reported.

*Acknowledgments:* The authors thank Lawrence P. Casalino for his contributions in helping to develop and field the NSPO survey and Kennon R. Copeland for constructing survey weights. The statements, findings, conclusions, views, and opinions contained and expressed in this article are based in part on data obtained under license from the following IMS Health information services: Healthcare Organizational Services, (2007) IMS Health Incorporated. The statements, findings, conclusions, views, and opinions contained and expressed herein are not necessarily those of IMS Health Incorporated or any of its affiliated or subsidiary entities. The University of California, Berkeley, Committee for Protection of Human Subjects protocol (#2014-06-6480) approved the research project.

*Address correspondence to:* Hector P. Rodriguez, Center for Healthcare Organizational and Innovation Research, School of Public Health, University of California, Berkeley, 50 University Hall, Rm 245, Berkeley, CA 94720 (email: hrod@berkeley.edu).