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Organizational integration, practice capabilities, and outcomes in clinically complex medicare beneficiaries

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Abstract

Objective: To assess the association between clinical integration and financial integration, quality-focused care delivery processes, and beneficiary utilization and outcomes.

Data Sources: Multiphysician practices in the 2017-2018 National Survey of Healthcare Organizations and Systems (response rate 47%) and 2017 Medicare claims data.

Study Design: Cross-sectional study of Medicare beneficiaries attributed to physician practices, focusing on two domains of integration: clinical (coordination of patient services, use of protocols, individual clinician measures, access to information) and financial (financial management and planning across operating units). We examined the association between integration domains, the adoption of quality-focused care delivery processes, beneficiary utilization and health-related outcomes, and price-adjusted spending using linear regression adjusting for practice and beneficiary characteristics, weighting to account for sampling and nonresponse.

Data Collection/Extraction Methods: 1 604 580 fee-for-service Medicare beneficiaries aged 66 or older attributed to 2113 practices. Of these, 414 209 beneficiaries were considered clinically complex (frailty or 2 + chronic conditions).

Principal Findings: Financial integration and clinical integration were weakly correlated (correlation coefficient = 0.19). Clinical integration was associated with significantly greater adoption of quality-focused care delivery processes, while financial integration was associated with lower adoption of these processes. Integration was not generally associated with reduced utilization or better beneficiary-level health-related outcomes, but both clinical integration and financial integration were associated with lower spending in both the complex and noncomplex cohorts: (clinical complex cohort: -\$2518, [95% CI: -3324, -1712]; clinical noncomplex cohort: -\$255 [95% CI: -413, -97]; financial complex cohort: -\$997 [95% CI: -\$1320, -\$679]; and financial noncomplex cohort: -\$143 [95% CI: -210, -\$76]).

Conclusions: Higher levels of financial integration were not associated with improved care delivery or with better health-related beneficiary outcomes. Nonfinancial forms

of integration deserve greater attention, as practices scoring high in clinical integration are more likely to adopt quality-focused care delivery processes and have greater associated reductions in spending in complex patients.

KEYWORDS

health care organizations and systems, integration, Medicare

1 | INTRODUCTION

Failures of clinical coordination, from poor communication across providers to difficulty transferring medical records, can create gaps in care quality that leave patients vulnerable to poor outcomes. These gaps in care coordination are more common in the United States than in other high-income countries¹ and are associated with increased odds of preventable adverse outcomes,² higher rates of departures from clinical best practice, more preventable hospitalizations, and increased costs.³

One of the ways in which providers have sought to address gaps in care delivery is through increased integration, or the extent to which functions and activities are coordinated across operating units,⁴ including a variety of organizational and social features between or across organizations.⁵ Though there is no universally accepted definition of health care integration,⁶ numerous frameworks and models have been developed to conceptualize the dimensions of integration,^{5,7-9} highlighting various structural, process, and interpersonal components. In recent years, practices and hospitals have been financially integrating into larger health care systems with the goals of increasing clinical coordination, improving efficiency, generating cost savings, and gaining bargaining power vis-a-vis insurers.¹⁰⁻¹² Providers have also undertaken efforts to clinically integrate, including adoption of programs focused on care transitions, readmissions, and data harmonization across clinical settings in order to improve patient care quality and outcomes.

Financial integration (which we define as the degree of financial management and planning across operating units, including the level of horizontal and vertical integration present¹³) may improve care coordination by bringing providers together within the same organizational structure, but could potentially increase costs without providing clinical benefits.¹⁴ Though providers claim that financial integration is necessary to improve the functions that produce better clinical outcomes,¹⁵ research shows mixed effects on clinical quality and outcomes,¹⁶⁻²² alongside higher prices and spending,²³⁻³⁰ and increased premiums.³¹ Recent work found moderately worse patient experience outcomes after financial integration,¹⁹ and little association between health system affiliation and the adoption of quality-focused care delivery and payment reforms.³²

Clinical integration (the degree to which the physician practice coordinates patient care services across sites and disciplines and uses protocols across settings to manage patient care^{4,33}) could potentially improve care delivery by aligning clinical processes as the patient moves through the care continuum. Increased clinical

What is Known on This Topic

- Physician practices have become increasingly financially integrated through ownership relationships in recent years, with mixed to negative effects on patient outcomes, mortality, and spending.
- Providers have argued this financial integration is necessary to improve clinical integration, in order to improve patient care.

What this Study Adds

- Financial integration and clinical integration were not well-correlated. Clinical integration was associated with significantly greater adoption of quality-focused care delivery processes, and financial integration was associated with lower adoption of these processes.
- Integration was not consistently associated with lower utilization (inpatient admissions or ED visits) or better beneficiary-level health-related outcomes, but both clinical integration and financial integration were associated with lower spending.
- Nonfinancial forms of integration, such as clinical, deserve greater attention, as organizations with high clinical integration are more likely to adopt care processes to improve the experience and outcomes of patients.

integration has been shown to indirectly improve mortality and reduce surgical complications.³⁴ However, greater adoption of quality improvement processes, health information technology, and care management processes normally employed as a result of clinical integration has also shown no impact on quality in other work.³⁵ Previous research has shown an inconsistent relationship between financial integration and clinical integration,³³ and that adoption of clinical integration is generally limited following financial integration.³⁶ Informal methods of clinical integration, such as interacting with more providers from different specialties to care for patients, or workarounds to share clinical information (such as regional health information networks^{37,38}), may improve patient outcomes and reduce spending without the need for financial integration.^{39,40}

In this paper, we measure two practice-level domains of integration, financial and clinical, using the National Survey of Healthcare

Organizations and Systems (NSHOS). Using survey data and Medicare claims, we assess the association between these two domains of integration, practice capabilities and care delivery processes, utilization, and beneficiary outcomes.

1.1 | Conceptual framework

We hypothesize that financial integration and clinical integration (Table 1) contribute to the development of physician practice capabilities that are in turn associated with better Medicare beneficiary-level health-related outcomes and lower spending. Financial and clinical integration may also directly reduce utilization, improve health outcomes, and lower spending independent of physician practice capabilities.

Financial integration, either through mergers among practices or direct acquisition of practices by hospitals or systems, could potentially improve care delivery through several mechanisms. Financial integration can provide the resources to expand and standardize the use of health information technology, facilitate data sharing, and improve communication.^{36,41} Acquisition by a larger health care organization offers smaller practices the ability to reduce overhead by sharing resources, jointly purchasing supplies,⁴² and facilitating access to capital to make investments in new equipment.⁴³ Acquiring hospitals might also transfer clinical or operational expertise to the entities they acquire,¹⁹ and direct ownership relationships including multiple settings of care (eg, outpatient and inpatient) could improve care transitions and resulting patient outcomes.^{44,45} However, financial integration may create new bureaucratic hurdles that could divert resources away from care improvement initiatives and alter referral networks or delivery settings to increase reimbursement rates without improving outcomes.^{19,36}

Clinical integration may similarly impact care coordination efforts or patient experience. Creating clinical integration through efforts such as investing in care managers and developing a common

shared medical record across all delivery sites can make it easier for physician practices to use evidence-based guidelines, build registries, and screen for clinical and social conditions. Programs focused on handoffs, readmission reduction, and coordinated discharge planning are examples of mechanisms by which clinical integration may impact patient outcomes.⁴⁶⁻⁵⁰ While financial integration may lead to increased clinical integration, clinical integration may also develop independently of financial integration, and its usefulness could be bolstered or mitigated by elements of financial integration.³³ Furthermore, both clinical integration and financial integration may differentially affect the care for clinically complex patients, who often require more intensive care and may benefit more from care coordination efforts resulting from integration.^{51,52}

We recognize the difficulty in labeling this form of integration as strictly “clinical,” as our measure contains some elements of what has been previously described as “functional” integration (the degree to which key support functions and activities are coordinated across operating units, including practice use of protocols, access to needed information, and use of individual clinician measures^{4,5,53}). However, taking the more than 70 definitions and models of various types of integration in the research literature into account,⁵⁴ we specified this definition of clinical integration to encompass some elements that could potentially also be called functional integration when they have the potential to directly impact patient care.

Given the above, we hypothesize that (a) levels of clinical and financial integration will be correlated with one another, (b) a greater degree of clinical and financial integration will be positively associated with greater adoption of quality-focused care delivery processes, decreased utilization, improved health outcomes, and lower spending; and (c) these relationships will be stronger for the clinically complex patient group than less ill patients as clinically complex patients require more integrated care drawing on greater practice capabilities.

2 | METHODS

We developed measures of two domains of integration (financial and clinical) using nationally representative survey data from physician practices. We then tested the association between these domains and outcomes at the practice and beneficiary level, including practice adoption of various care delivery processes, beneficiary-level utilization and health outcomes, and spending.

2.1 | Data

The National Survey of Healthcare Organizations and Systems (NSHOS), fielded 2017-2018, is a set of nationally representative surveys with questions on the structure, size, ownership, and use of care delivery processes at different levels of health care organizations. In this paper, we used the physician practice-level survey (response rate = 47%), which draws samples of physician practices

TABLE 1 Integration domain definitions

Clinical integration: The degree to which the physician practice coordinates patient care services across sites and disciplines and uses protocols across settings to manage patient care. Includes:

- Onsite presence of behavioral clinicians;
- Use of care managers to coordinate care for complex, high-need patients;
- Post-hospital discharge activities; and
- Connection between the physician practice electronic health record (EHR) and the hospital EHR.

Financial integration: The degree of financial management and planning across operating units, including the level of horizontal and vertical integration present. Includes:

- Ownership (whether an independent practice, medical group, or integrated delivery system); and
- The level at which budgeting and net income occurred (within each individual practice; shared between the practice and a larger entity such as medical group or system; or budgeting done and income pooled system-wide).

from the IQVIA OneKey database using a stratified-cluster sampling design⁵⁵ to account for practice ownership as part of a larger medical group, health system (which owns hospitals and physician practices), or none (independent). The NSHOS limited its sample to primary and multispecialty practices with at least three primary care physicians. Practices represent single location practices. We contacted up to three individuals at each physician practice, conducting outreach to a second, and sometimes third, set of contacts for those organizations that had not already completed the survey. Each practice survey response reflects the survey of one individual, responding on behalf of the practice as a whole. We conducted a nonresponse analysis to test for significant differences between responding and nonresponding practices, examining size, geography, and system characteristics, and only found significant differences in region across the 23 characteristics compared (Table S1: Appendix S1). All analyses are adjusted for geography and weighted to adjust for nonresponse.

We used the 2017 Medicare Part A and Part B fee-for-service claims data to determine diagnoses, use, and spending and the Master Beneficiary Summary File to capture patient demographics and date of death.

2.2 | Patient cohorts

We identified fee-for-service Medicare beneficiaries aged 66 or older that were attributed to NSHOS practices living in the 50 states or the District of Columbia. From this overall cohort, we identified a subcohort of beneficiaries that were considered clinically complex, defined as having at least two claims-based frailty indicators^{56,57} or at least 2 of 18 chronic conditions⁵⁸ based on International Statistical Classification of Diseases, Tenth Revision (ICD-10) diagnostic codes associated with mortality and costs as defined in the hierarchical condition categories (HCCs). As a sensitivity test, we dropped nursing home residents from the clinically complex cohort (as they have different care patterns from the non-nursing home population and are less likely to receive care in a traditional physician practice than within their nursing home residence or an acute care setting) and found similar results.

2.3 | Integration measures

When creating the NSHOS, we reviewed the literature on integration and its domains and created questions relying on previous measures of integration.^{5-8,54} When developing measures of clinical and financial integration, we selected questions based on alignment with concepts in existing literature.^{5,7-9} For developing our measure of clinical integration, we also relied upon Federal Trade Commission Antitrust Guidance around common elements of clinically integrated networks, including use of clinical practices and guidelines, monitoring and enforcement of program goals, and data capture and access to information through electronic health platforms.^{59,60} After deciding on question inclusion based on theory, we compared Cronbach's alpha scores, which measure internal consistency and scale reliability

among a set of question items, and selected the set of items with the highest Cronbach's alpha. We constructed a composite index for each integration domain, where each question response was assigned a value from 0 to 1, and each set of questions was summed and divided by the number of questions to create an average. This process resulted in a final overall score between 0 and 1 and an equal weight for each question item. Therefore, our regression coefficients on the clinical integration variable should be interpreted as moving from negative responses (overall score = 0) on all survey domains related to clinical integration to all positive responses (overall score = 1). Similarly, the financial integration measures should be interpreted as moving from an independent practice to an integrated delivery system that pools revenue, shares profits and losses, and develops budgets at the system level. We compared this approach to use of factor scores to measure each domain of integration and found similar results; therefore, we used the composite index approach for ease of exposition.

Based on the above approach, the specific measurement items for each domain of integration are presented in Table 1 and Table S2: Appendix S1 contains survey instrument items. In a sensitivity analysis, we used solely the type of practice (independent, medical group, or integrated delivery system) as the measure of financial integration.

2.4 | Practice-level quality-focused care delivery processes

We used five of the care delivery indices developed by Fisher et al³², to measure self-reported use of care delivery processes based on survey responses. These indices were developed based on a review of existing literature, qualitative interviews with practice leaders, and anticipated ability to measure their impact using claims data. The indices themselves are standardized summary scores (linear combinations of individual items) based on the relevant questions included in the survey (Table S3: Appendix S1). These indices included the practice capabilities to care for complex patients (eg, Does your practice have a system in place to identify complex, high-need patients?), implementation of evidence-based guidelines (eg, Does your practice use evidence-based guidelines that have been written down and approved as the preferred treatment protocols for treatment for diabetes, congestive heart failure, asthma/chronic obstructive pulmonary disease, hypertension, depression, serious mental illness, and preventive services), screening for clinical needs, screening for social needs, and use of patient registries for specific disease conditions.

2.5 | Beneficiary-level health-related utilization, outcomes, and spending

We linked Medicare beneficiary claims data with NSHOS practice survey data through an attribution process in which beneficiaries

were attributed to physician practices based on the plurality of their primary care use, analogous to common accountable care organization (ACO) methodology.⁶¹ To measure the effect of integration on individual beneficiary health-related outcomes, we examined annual, beneficiary-level utilization (inpatient admissions, emergency department (ED) visits) and outcomes (all-cause mortality, 30-day readmissions, and ambulatory care sensitive admissions (defined by prevention quality indicators⁶²)). We also examined annual per-beneficiary price-adjusted spending, which adjusts for geographic differences in Medicare prices and includes both hospital inpatient utilization (using diagnosis-related group-based quantity measures) and physician outpatient services (using relative value units).⁶³

2.6 | Statistical analysis

We described all outcome and explanatory variables for Medicare beneficiaries and practices and measured the within-practice correlation between each of the integration domains. We estimated practice- and beneficiary-level utilization and outcomes as a function of integration, controlling separately for clinical and financial integration as the primary explanatory variables of interest. We used linear regression to model each outcome as a function of degree of practice-level integration, adjusting for practice characteristics (practice size, and indicators for whether the practice was a federally qualified health center (FQHC), whether the practice was affiliated with an academic medical center, and whether the practice was participating in an ACO, beneficiary demographics (age (5-year categories), sex, census region, race, dual eligibility for Medicaid, rural/urban setting, living in high-poverty area (>20%)). All results were weighted to account for sampling and nonresponse, and standard errors were clustered at the practice and system level (in the beneficiary-level regressions) or system level only (in the care delivery process regressions) using Huber-White Sandwich estimators to account for the correlation of observations within practices. All analyses were conducted using Stata version 16.

3 | RESULTS

3.1 | Beneficiary characteristics

The overall cohort included 1.6 million age-eligible fee-for-service Medicare beneficiaries, with 4.7% eligible for the complex cohort due to frailty and 23.9% due to multimorbidity (with 2.8% of beneficiaries eligible for both cohorts) (Table 2). Both cohorts were predominately white. The complex cohort had a higher proportion of black beneficiaries (7.5% vs. 5.1% in the noncomplex cohort), beneficiaries living in high-poverty areas (17.0% vs. 14.8%), and beneficiaries dually eligible for Medicaid (16.8% vs. 7.4%). As defined, patients in the complex cohort had far higher clinical needs than noncomplex patients based on percent residing in nursing homes (22.8%

compared with 2.8% in the noncomplex) and mean HCC score (2.2 versus 0.7 in noncomplex).

Across all beneficiary outcomes, the complex cohort had greater utilization and spending, and worse health outcomes than the mean beneficiary in the noncomplex cohort, as expected: utilization as measured by admissions (851 per 1000 beneficiaries in complex vs. 87 in noncomplex cohort) and ED visits (1364 per 1000 beneficiaries vs. 302), health outcomes measured as all-cause mortality (98 per 1000 beneficiaries vs. 12), 30-day unplanned readmissions (285 per 1000 beneficiaries vs. 73) and ambulatory care sensitive admissions (as defined by prevention quality indicators; 404 per 1000 beneficiaries vs. 21), and price-adjusted medical spending (\$25 135 vs. \$4809). Among organizational group types (independent, medical group, and integrated delivery system), beneficiary characteristics were largely similar, with independent practices having a slightly higher percentage of complex patients than medical groups and integrated delivery systems (Table S4: Appendix S1). Medical groups had the lowest mean utilization, lowest mean occurrence of poor health outcomes, and lowest spending (Table S5: Appendix S1).

3.2 | Practice administrative and demographic characteristics

The sample beneficiaries were assigned to 2113 practices (588 independent practices, 357 practices associated with a medical group (containing physician practices but no hospitals), and 1168 practices associated with an integrated delivery system (containing hospitals)) (Table 3). Most practices were small (<7 physicians, 65%). Over 16% were part of an FQHC, and a quarter (25%) were affiliated with an academic medical center. Practices were relatively equally distributed across US regions, though there were more independent practices in the south (36% of independent practices) and in rural regions (21% of independent practices). Slightly fewer than half of the practices were participating in a Medicare ACO contract during the study period.

3.3 | Association between practice-level clinical and financial integration

The mean clinical integration score across practices was 0.63 (with a standard deviation of 0.15), and the mean financial integration score was 0.36 (SD = 0.40) (Table 3). In terms of integration, integrated delivery systems had overall higher scores for clinical integration compared with medical groups and independent practices. Integrated delivery systems also had higher scores for financial integration, based in part on participation in an integrated delivery system being a prime element in how we define financial integration. Integrated delivery systems had the highest mean clinical integration at 0.67, followed by medical groups (0.63) and then independent practices (0.59). By definition, independent practices had a score of zero on financial integration (the degree of financial management and

TABLE 2 Beneficiary characteristics, 2017^a

	Full cohort (N = 1 604 580)		Complex cohort (N = 414 209)		Noncomplex cohort (N = 1 190 371)	
	%		%		%	
Cohort						
Frail and older ^b	4.70		18.30		18.30	
Multimorbidities ^c	23.90		92.80		92.80	
Demographic characteristics						
Age (mean ± SD)	7.4		7.8		7.1	
Female	58.40		54.50		59.70	
Race and ethnicity						
White	86.10		85.10		86.40	
Black	5.70		7.50		5.10	
Hispanic	3.10		3.30		3.00	
Asian	2.60		2.20		2.70	
Other	2.50		1.80		2.70	
Lives in high-poverty (>20%) ZIP code	15.40		17.00		14.80	
Dual eligibility for Medicaid	9.80		16.80		7.40	
Nursing home resident	8.00		22.80		2.80	
Clinical conditions^d						
Cancer	10.30		24.10		5.50	
Congestive heart failure	10.00		32.80		2.00	
Chronic obstructive pulmonary disease	9.00		26.50		2.90	
Diabetes	23.70		50.00		14.60	
Peripheral vascular disease	9.70		29.30		2.80	
	Mean	SD	Mean	SD	Mean	SD
HCC score	1	1	2.2	1.4	0.7	0.4
Spending						
Price-adjusted Medicare spending ^e	\$10 056.30	\$20 216.40	\$25 134.80	\$32 181.30	\$4809.40	\$9160.10
Utilization (per 1000 beneficiaries)						
Inpatient admissions/1000 beneficiaries	284.4	765.5	851.3	1230.50	87.2	335.2
Emergency department visits/1000 beneficiaries	576.8	1237.70	1364.3.4	1895.10	302.8	724.0
Outcomes (per 1000 beneficiaries)						
All-cause mortality/1000 beneficiaries	34.6	182.9	98.1	297.5	12.6	111.4
30-day readmission/1000 beneficiaries ^e	201.9	602.9	285.3	720.4	73	309.4
Ambulatory care sensitive admissions/1000 beneficiaries ^f	119.8	618	403.6	1089.40	21	253

Notes: HCC = hierarchical condition category.

^aIncludes beneficiaries 66 years or older. Frail and older group and multimorbid group are not mutually exclusive. 2.8% of beneficiaries met the criteria for being frail and older and with multimorbidity.

^bFrailty indicators included abnormality of gait, malnutrition or abnormal loss of weight and underweight, adult failure to thrive, cachexia, debility, difficulty in walking, fall, muscular wasting and disuse atrophy, muscle weakness, decubitus ulcer of skin or pressure ulcer, senility without mention of psychosis, malaise and fatigue, durable medical equipment use, and nursing or personal care services.

^cSelected chronic conditions included coronary artery disease, cancer, connective tissue disorders, congestive heart failure, diabetes, dementia, chronic obstructive pulmonary disease, hematologic or thrombotic disease, HIV infection or AIDS, immune disease, liver disease, Parkinson or Huntington disease, paralysis, peripheral vascular disease, renal disease, cerebral hemorrhage or stroke, severe mental illness, and substance use disorder.

^dRepresent 5 most common chronic conditions of 18 used to define multimorbidity for inclusion in the complex patient cohort. A full list can be found in Table S6: Appendix S1.

^eReadmissions included unplanned only and were only reported for beneficiaries with observable inpatient admissions.

^fAmbulatory care sensitive admissions were defined using prevention quality indicators' methodology.

^gPrice-adjusted Medicare spending adjusted for regional variation. Specific HCCs or any of the 18 chronic conditions used to define multimorbidity were not included in regression analyses, only overarching HCC significant at $P < .01$. P -values comparing complex and noncomplex cohorts for each characteristic are all strongly significant.

TABLE 3 Organizational characteristics by system type

Practice type	Overall		Independent		Medical group ^a		Integrated delivery system ^b		Chi-square
	N	%	N	%	N	%	N	%	
Number of practices responding (with attributed beneficiaries)	2113	100.0%	588	27.8%	357	16.9%	1168	55.3%	
Structural and environmental characteristics of practices									
Primary care physicians (mean ± SD)	10.8	70.6	6.1	5.0	11.8	26.5	16.1	128.2	
Practice size									
Very small (≤3 physicians)	508	30.2%	205	38.0%	68	20.7%	235	23.3%	***
Small (4-6 physicians)	726	35.0%	236	38.8%	119	34.0%	371	30.7%	
Medium (7-12 physicians)	450	18.2%	99	13.8%	86	24.7%	265	21.9%	
Large (13 + physicians)	429	16.6%	48	9.5%	84	20.7%	297	24.0%	
Practice is an FQHC	299	16.2%	78	18.5%	85	22.1%	136	11.9%	**
System size (# physicians, mean ± SD)	2596.5	4675.1	-	-	153.2	315.2	3237.5	4972.4	***
System size (# hospitals, mean ± SD)	20.6	35.5	-	-	-	-	26.05	37.5	***
In system that contains academic medical center	655	24.5%	-	-	-	-	655	60.3%	***
Urban [RUCA = 1-3]	1788	82.2%	494	78.8%	325	88.5%	969	84.7%	*
Midwest	611	24.2%	128	16.1%	62	19.8%	421	35.0%	***
Northeast	420	21.7%	143	24.5%	62	19.0%	215	19.1%	
South	563	29.6%	198	35.6%	103	26.0%	262	23.3%	
West	519	24.5%	119	23.8%	130	35.3%	270	22.6%	
Practice participation in alternative payment and delivery models									
Medicare ACO participation	1064	43.6%	298	37.9%	195	50.9%	571	48.4%	*
Integration domains (mean ± SD)									
Clinical	0.63	0.15	0.59	0.12	0.63	0.18	0.67	0.16	***
Financial	0.36	0.40	0.00	0.00	0.43	0.27	0.79	0.25	***
Care delivery processes (mean ± SD)									
Care of complex, high-need patients	0.41	0.19	0.39	0.14	0.46	0.24	0.43	0.22	***
Use of evidence-based guidelines	0.61	0.40	0.59	0.32	0.64	0.48	0.63	0.45	
Screening for clinical conditions	0.81	0.24	0.81	0.20	0.84	0.22	0.81	0.28	
Screening for social needs	0.37	0.34	0.37	0.25	0.36	0.43	0.38	0.39	
Use of registries	0.47	0.41	0.42	0.32	0.55	0.49	0.51	0.46	**

Note: All estimates are weighted for sampling frame and nonresponse. P-values are run using Pearson's chi-square for categorical outcomes and simple weighted regression (approximating ANOVA) for continuous outcomes. Inference: *P-value < .05, **P-value < .01, ***P-value < .001.

ACO, accountable care organization; FQHC, Federally Qualified Health Center; RUCA, rural-urban commuting area.

^aMedical groups contain physician practices but no hospitals.

^bIntegrated delivery systems contain physician practices, hospitals, and may contain owner subsidiaries.

planning across operating units). Also by definition, integrated delivery systems had greater scores on financial integration than medical groups. Financial integration and clinical integration were positively (but weakly) correlated at 0.19. When we conducted a sensitivity analysis comparing our financial integration measure with a only the practice's categorization as integrated delivery system, medical group, or independent practice, we did not find a difference in the direction or magnitude of the outcomes of interest.

3.4 | Association between integration and use of care delivery processes

After adjusting for practice characteristics, clinical integration was associated with better self-reported care delivery processes while financial integration was negatively associated with these processes, although not all of these associations were statistically significant (Table 4). Clinical integration was associated with better care delivery

capabilities on all processes (care of complex, high-need patients, use of evidence-based guidelines, screening for social conditions, screening for social needs, use of registries), while financial integration was negatively associated with screening for clinical conditions and social needs.

3.5 | Association between integration and beneficiary-level utilization/spending

Clinical integration and financial integration were generally associated with lower price-adjusted spending, as hypothesized, while only clinical integration was associated with lower utilization of inpatient admissions and ED visits. We report these results in Table 5 as dollars (for price-standardized spending) or utilization events (admissions/visits) per 1000 beneficiaries. Greater clinical integration and financial integration were associated with lower price-adjusted Medicare spending for both the complex and noncomplex cohorts: complex clinical: -10%, $P < .001$ (coefficient=-2518.10 and mean spending=\$25 134.80) and complex financial: -4%, $P < .001$ (coefficient=-999.63); and noncomplex clinical: -5%, $p = P < .01$ (coefficient=-255.12 and mean spending=\$4809.40) and noncomplex financial: -3% (coefficient=-143.05), $p = P < .05$. In other words, a one standard deviation increase in clinical integration (SD = 0.15, Table 3) results in a reduction in price-adjusted spending of \$378 in the complex cohort. Greater clinical integration was associated with lower inpatient admissions in both complex and noncomplex cohorts (complex cohort coefficient=-51.63, $P < .05$; noncomplex cohort coefficient = -12.95, $P < .001$). In contrast, greater financial integration was associated with more ED visits (complex cohort coefficient = 81.05, $P < .001$; noncomplex cohort coefficient = 20.43, $P < .001$).

3.6 | Association between integration and beneficiary-level health outcomes

Relationships between integration measures and beneficiary outcomes (readmissions, ambulatory care sensitive admissions, and mortality) did not match our hypotheses. Although clinical integration was associated with fewer readmissions in the non-complex cohort (coefficient=-24.41, $P < .05$), it was not associated with fewer readmissions in the complex cohort. Financial integration was not significantly associated with fewer readmissions in either cohort. The number of ambulatory care sensitive admissions had no significant association with clinical or financial integration in either cohort. Finally, clinical integration was associated with higher all-cause mortality in the complex cohort (coefficient = 19.93, $P < .001$), but not in the noncomplex cohort. Similarly, practices with higher financial integration had higher all-cause mortality in both cohorts (complex cohort coefficient = 4.36, $P < .05$; noncomplex cohort coefficient = 1.11, $P < .05$). Relying solely on practice ownership type to determine financial integration (independent, medical group, or integrated delivery system) did not qualitatively change our findings. Combining the complex and noncomplex cohorts, clinical integration was associated with higher mortality.

4 | DISCUSSION

Using a representative survey of physician practices in the United States, we measured two domains of integration: clinical and financial. We hypothesized that clinical and financial integration would be correlated with one another and found a positive but weak correlation at 0.19. We also hypothesized that a greater degree of clinical and financial integration would lead to greater adoption of care

TABLE 4 Linear regression estimates of association between care delivery processes and integration domains, adjusted for beneficiary and organizational characteristics

Dependent variables	Mean	SD	Independent variables			
			Clinical integration		Financial integration	
			Coeff	SE	Coeff	SE
Care delivery processes						
Care of complex, high-need patients	0.41	0.19	0.59 ^{***}	0.04	-0.01	0.02
Use of evidence-based guidelines	0.61	0.40	0.97 ^{***}	0.09	-0.02	0.04
Screening for clinical conditions	0.81	0.24	0.42 ^{***}	0.06	-0.05 [*]	0.02
Screening for social needs	0.37	0.34	0.81 ^{***}	0.07	-0.06 [*]	0.03
Use of registries	0.47	0.41	1.05 ^{***}	0.08	0.00	0.04

Note: Each row presents estimates from a single model estimating that care delivery process scale as a function of the two integration scales, adjusted for average age, average sex, average race, average dual status, average nursing facility, rural (RUCA>=4)/urban (RUCA < 4) group, region, average HCC score, whether it is in a system containing an academic medical center, participation in an ACO, and practice size category. All estimates weighted for survey sample frame and nonresponse, and standard errors were estimated using Huber-White sandwich estimators clustered at the system level. Inference: * P -value < .05, ** P -value < .01, *** P -value < .001.

TABLE 5 Linear regression estimates of association between beneficiary-level outcomes and integration domains by complex and noncomplex cohorts, adjusted for beneficiary and organizational characteristics^{a,b}

Dependent variables	Independent variables											
	Full cohort			Complex			Noncomplex			Noncomplex		
	Coeff	SE	SE	Coeff	SE	SE	Coeff	SE	SE	Coeff	SE	SE
Beneficiary-level utilization/outcomes												
Spending												
Price-adjusted Medicare spending (\$) ^e	-915.47*	360.60	170.70	-2518.10***	411.03	163.49	-999.63***	255.12**	80.74	-143.05*	33.99	
Utilization (per 1000 beneficiaries)												
Inpatient admissions	-24.86	13.19	5.46	-41.63†	15.94	6.38	3.28	-12.95***	3.17	0.18	1.31	
Emergency department visits	2.98	26.36	11.03	45.13	27.45	11.71	81.05***	-9.63	7.00	20.43***	2.99	
30-day readmissions ^c	-12.26	15.74	6.28	-1.88	17.55	7.37	13.34	-24.41*	11.05	-0.38	4.33	
Outcomes (per 1000 beneficiaries)												
All-cause mortality	5.43†	2.48	1.21	19.93***	4.57	4.36*	1.89	1.80	1.07	1.11*	0.48	
Ambulatory care sensitive admissions ^d	1.38	9.87	3.85	15.52	17.35	8.85	7.10	-0.02	2.53	0.41	1.08	

Note: Inference: *P-value < .05, **P-value < .01, ***P-value < .001. Values labeled with ** and *** remain significant under the Bonferroni adjustment, and those labeled * become nonsignificant.

^aIncludes beneficiaries 66 years or older.

^bEach row presents estimates from a single regression model estimating that utilization or spending outcome as a function of the four integration scales, adjusted for 5-year age category, sex, race, dual eligibility for Medicaid status, nursing facility, rural (RUCA>=4)/urban (RUCA < 4) group, region, HCC score, whether the practice is affiliated with an academic medical center, whether the practice participates in an ACO, and practice size category. All estimates weighted for survey sample frame and nonresponse, and standard errors were estimated using Huber-White sandwich estimators clustered at practice and system level.

^cReadmissions included unplanned only and were only reported for beneficiaries with observable inpatient admissions.

^dAmbulatory care sensitive admissions are defined using the Agency for Healthcare Research and Quality prevention quality indicator methodology.

^eMedicare spending is price-adjusted to account for regional price variation.

delivery processes. We found that clinical integration was indeed positively associated with greater adoption of quality-focused care delivery processes such as complex patient care management, use of evidence-based guidelines, screening for clinical and social conditions, and use of registries. Consistent with previous work, financial integration was not as closely tied to use of these processes and capabilities.³²

We further hypothesized that higher levels of financial and clinical integration would lead to decreased utilization, improved health outcomes, and lower spending. We expected to see greater effects in the clinically complex patient group than the noncomplex patient group. Greater financial integration was associated with more ED visits and higher mortality in both complex and noncomplex cohorts, whereas clinical integration was associated with fewer inpatient admissions in both cohorts, fewer readmissions in the noncomplex cohort, and higher mortality in the complex cohort. Integration was associated with reductions in medical spending ranging from 3% to 10% depending on the cohort or type of integration.

Contrary to our hypotheses, we were surprised to find a significant positive association between increased clinical integration and mortality. Although we adjusted for many patient characteristics in this cross-sectional analysis, it seems more likely that this is due to our failure to account for an unmeasured characteristic of the patients in these practices than to a causal relationship between clinical integration and mortality. Another potential contributor to this finding could be the cross-sectional design of this study—this relationship could represent a need to care for a sicker or more complex population, as organizations may more proactively seek out opportunities for clinical integration if they have a higher patient need.⁶⁴

Our findings have important implications. First, health care providers have become substantially more financially integrated in the past decade, both through horizontal integration (physician practices combining into a single entity or hospitals consolidating with other hospitals) and vertical integration (hospitals and hospital systems purchasing or merging with outpatient practices). Fulton found that from 2010 to 2016, hospital, specialist physician, and primary care physician markets became increasingly concentrated, with a majority of metropolitan statistical areas deemed “highly concentrated” for each group.⁶⁵ Furthermore, primary care physicians have increasingly shifted away from solo or medical group practice over time, shifting to employment by a hospital or health system. A majority of all hospitals (70%) and nearly half of all physicians (43%) are now in financially integrated delivery systems.⁶⁶ Consolidation results in higher commercial prices.^{23,29,30} The evidence suggests that prices of health care services account for much of the differences in spending between the United States and other industrialized nations.^{67,68}

Yet, providers continue to argue that financial integration is necessary to achieve greater quality, clinical and functional integration, economies of scale, reductions in duplication of services, and ability to take on risk-based payment contracts.^{30,69,70} The evidence to support this claim, however, is at best mixed. The correlation between the financial and clinical integration domains was only 0.19.

In previous work, financial integration was positively associated with participation in risk-based payment models,⁷¹ but other potential benefits have not been demonstrated. For example, improvements in input cost efficiencies, such as savings on administrative staff, procurement, or other fixed costs, due to horizontal hospital mergers, are estimated to be small (<2%).⁷² Casalino et al found that, on average, larger physician practices had higher risk-adjusted Medicare spending.³⁵ Similarly, Ho et al found that commercially insured patients incurred spending which was 5.8 percentage points higher when treated by doctors in hospital-owned versus physician-owned practices.²⁴ In contrast, we found that financial integration was associated with a 3% reduction in Medicare spending, after adjusting for geographic differences in prices, patient characteristics, and other structural characteristics of practices. One potential explanation for this difference is, of course, Medicare's administratively set prices, which dampen price increases observed for commercial patients after consolidation occurs. Clinical integration, however, may prove to be more important than financial integration, as it was associated with a 9% reduction in price-adjusted spending.

Prior studies, in part due to the difficulty of measuring nonfinancial types of integration, have focused on associations between ownership (an easily defined measure of financial integration) and quality. Some studies have found that care processes in financially integrated systems are better than those in independent practices, for example, finding higher levels of medication adherence and lower medication error rates.⁷³ The most recent study of hospital acquisitions found modestly worse patient experiences and no significant changes in readmission or mortality rates after acquisition.¹⁹ Others have also found mixed results,^{74,75} as described in the introduction.

Our paper has important limitations; the most prominent limitation is its cross-sectional nature, limiting causal inference. Second, for the most part we have a single informant from each respondent organization (though we gave the option for the appropriate person to fill out each relevant section) and are not able to verify or measure the degree of implementation for each of the practice care delivery processes. This may, in part, account for the lack of support for some of our hypotheses. While we have created weights to account for nonresponse and our sampling frame, the information on which to base the weighting scheme (organizational characteristics) is scarce. Our measures of integration may not adequately capture important functions or components of integration. While measuring financial integration is relatively straightforward, clinical integration required judgment and was constrained by the length of the survey. Alternative specifications of integration might have led to stronger findings. We should also acknowledge that claims-based measures of patient health-related outcomes may have limited sensitivity to differences in care delivery processes. Our measures included, however, a broad array of claims-based measures meaningful to patients and other health care stakeholders.

Our study is the first of which we are aware to measure the relationship between financial integration and clinical integration with beneficiary-level outcomes. Differentiating measurement between

financial integration and clinical integration is an important advance in the literature, as most studies have focused on financial integration or size alone. Clinical integration was associated with higher reported adoption of important care delivery processes, whereas financial integration was associated with lower reported process adoption. We also found that higher levels of clinical integration are possible without higher levels of financial integration.

The policy implications of these findings are important. Experience with new payment models has shown that financial integration is not a necessary condition for clinical integration, as ACOs have forged new partnerships across health care organizations without financial integration.⁷⁶ Further, research suggests that larger size and vertical integration of physician practices with hospitals appear to be neither a necessary nor a sufficient condition for reducing spending or improving quality in ACOs⁷⁷ or other practices.³⁵ In the ACO case, boundary spanner roles and health information exchanges can fill some of the gaps in coordination that impede fragmented local providers.⁷⁸ Our findings also suggest that the Federal Trade Commission, the Department of Justice, and others concerned with rising prices associated with increased consolidation may need to broaden the scope of review to examine other dimensions of such integration including clinical and other more informal methods of integration.

Our findings are relevant to future research. The inconsistent association between beneficiary-level health-related outcomes and our measures of integration could reflect the way we defined integration, the insensitivity of claims-based measures of quality to improvement in care delivery, or the cross-sectional (and thus correlational) nature of this study. Given overwhelming evidence that transitional care processes for complex patients reduce readmissions,^{46-50,79-82} and that clinical integration was a strong predictor of care processes for complex patients, the lack of association between care of complex, high-need patients, and readmissions is disappointing. However, our estimates were not a precise zero, but rather clinical integration was associated with lower rates of readmissions in the complex cohort, though with large confidence intervals. In other words, we cannot rule out meaningful clinical improvements associated with several forms of integration. Further work on both the challenge of measuring integration and measuring meaningful clinical outcomes will be important to improving our understanding of how changes in the organization and delivery of care influence patients' health outcomes.

In a rapidly changing health care landscape, in which the financial earthquake of the COVID-19 pandemic will likely accelerate vertical consolidation as physician practices seek financial shelter by aligning with larger health care organizations, our findings offer important evidence. First, they contribute to a growing body of evidence, suggesting that financial integration does not, by itself, bring the clinical integration health care organizations typically say they seek. Second, nonfinancial forms of integration (particularly clinical but potentially others as well) deserve attention, as clinically integrated organizations are much more likely to adopt care processes thought to improve the experience and outcomes of patients.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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