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Transitional Care Cut Hospital Readmissions For North Carolina Medicaid Patients With Complex Chronic Conditions

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ABSTRACT **Recurrent hospitalizations represent a substantial and often preventable human and financial burden in the United States. In 2008 North Carolina initiated a statewide population-based transitional care initiative to prevent recurrent hospitalizations among high-risk Medicaid recipients with complex chronic medical conditions. In a study of patients hospitalized during 2010–11, we found that those who received transitional care were 20 percent less likely to experience a readmission during the subsequent year, compared to clinically similar patients who received usual care. Benefits of the intervention were greatest among patients with the highest readmission risk. One readmission was averted for every six patients who received transitional care services and one for every three of the highest-risk patients. This study suggests that locally embedded, targeted care coordination interventions can effectively reduce hospitalizations for high-risk populations.**

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People with multiple chronic conditions represent a growing sector of the population, particularly among Medicare and Medicaid beneficiaries.[1–3] Among adults ages 45–64 with public insurance, 44.7 percent reported having two or three chronic conditions, and 16.9 percent reported having four or more, compared to 27.3 percent and 3.4 percent, respectively, for adults with private insurance.[2] Patients with multiple chronic conditions are known to receive fragmented care involving multiple clinicians, take multiple medications, have increased risk for hospital admissions, and contribute disproportionately to overall health care costs.[4–6] This is particularly true in Medicaid, where the 33 percent of disabled beneficiaries who have three or more chronic conditions account for almost 70 percent of total spending.[7]

Patients with multiple chronic conditions are particularly vulnerable to unsuccessful transitions home after being discharged from the hospital and to subsequent readmission to the hospital.[8] Fourteen percent of Medicare beneficiaries have six or more chronic conditions and account for 70 percent of all Medicare readmissions to the hospital.[9] Thirty-day hospital readmission rates for Medicaid beneficiaries also correlate directly with the number of chronic conditions these beneficiaries have, ranging from 13 percent for patients with a single chronic condition to 36 percent for those with ten or more.[10]

Evidence suggests that hospital discharge is a critical opportunity for care coordination interventions to prevent recurrent hospitalizations for patients with complex conditions. Single-site randomized controlled studies have demonstrated that readmission rates can be reduced through coordinated discharge planning, education of patients and families about how to manage chronic medical conditions, and close follow-up by a nurse after discharge.[11–13]

For the most part, however, these interventions have been implemented and tested in single hospitals or health care systems, under the

relatively controlled conditions of a study protocol. One notable exception is a recent Centers for Medicare and Medicaid Services demonstration project, implemented across communities in fourteen different states. This project reported reductions in admissions and readmissions per 1,000 beneficiaries as a result of locally defined, community-based quality improvement projects focused on care transitions for Medicare beneficiaries.[14] However, it remains unclear whether long-term benefits can be realized when a program is implemented across a large geographical area, with multiple and diverse provider entities, in routine practice settings. We sought to answer that question.

The site for our study may be the largest and most widespread transitional care program investigated to date. North Carolina initiated a statewide rollout of a population-based transitional care initiative in the fall of 2008 for Medicaid recipients enrolled in the Community Care of North Carolina enhanced primary care case management program. The initiative used a community-based infrastructure for allocating care management resources to facilitate safe transitions from the hospital to home, as well as coordinated linkage back to the primary care medical home.[15]

We aimed to evaluate the effectiveness of this large-scale program in reducing readmissions for patients with complex chronic conditions during the first year following hospital discharge. Specifically, we examined time to hospital readmission and one-year readmission rates for patients who received transitional care compared to usual care, and we assessed whether patients with differing degrees of risk and conditions of varying levels of severity responded differently. We further examined readmission rate trends among North Carolina Medicaid beneficiaries with chronic conditions during the five years since the start of the transitional care initiative.

Study Data And Methods

SETTING Community Care of North Carolina is a statewide, community-based, physician-led program committed to establishing access to a primary care medical home for vulnerable populations and providing those medical homes with the multidisciplinary support needed to ensure comprehensive, coordinated, high-quality care. Enrolled members are linked to one of more than 1,500 participating primary care practices statewide, which in turn are affiliated with one of fourteen regional networks. Medicaid supports community-based care management and quality improvement initiatives through monthly per capita management payments to the regional networks, which are nonprofit entities that facilitate collaborative improvement activities among physician practices, hospitals, health departments, social service agencies, and other community organizations.[16,17]

TRANSITIONAL CARE INTERVENTION Community Care of North Carolina's transitional care model, which incorporates elements of other transitional care programs,[11–13] has been described elsewhere.[15] In brief, the core tenets of the model are comprehensive medication management, face-to-face self-management education for patients and families, and timely outpatient follow-up with a medical home that has been fully informed about the hospitalization and any clinical or social issues that complicate the patient's care.

When the program was launched in the fall of 2008, the regional networks were expected to develop relationships with their local hospitals. Each network established processes for the real-time identification of Medicaid patient admissions with each hospital in their region. All networks were expected to use the Community Care Informatics Center, which provides access to patient claims history and decision support, together with web-based applications for care management and clinical pharmacy management.

The transitional care initiative was not functioning at full capacity during the study period. As a result, networks were then expected to assess as many hospitalized enrollees as possible, with priority given to those eligible for Medicaid because of age, blindness, or disability, and to direct care management resources toward patients with multiple chronic conditions and indications of clinical or social instability. Care managers were expected to use professional discretion to determine the frequency and duration of their interventions according to individual patients' needs, so patients who appeared to have a higher risk of readmission were likely to receive longer and more intensive support following discharge.

DATA Data about patients' demographic characteristics and enrollment in Community Care of North Carolina came from the North Carolina Medicaid eligibility and enrollment files. Hospitalization service dates, diagnosis-related groups (DRGs), and discharge disposition information came from paid Medicaid claims. Care managers' assessments and interventions were documented in Community Care's care management information system.

Patients were categorized by disease burden using the categorical and hierarchical Clinical Risk Group methodology developed by 3M Health Information Services,[18] through a con-

tract with Treo Solutions. Based on paid claims for services rendered during the period July 2010–June 2011, each Community Care beneficiary was assigned to one of 1,075 groups whose members had similar disease burden and severity. Each beneficiary was then assigned a risk score that reflected average total costs of care within that group relative to the Community Care population as a whole. Clinical Risk Groups can be combined into forty-four Aggregated Clinical Risk Groups, which classify patients according to the number and severity of their acute and chronic conditions.

PARTICIPANTS AND COHORT ASSIGNMENT North Carolina Medicaid beneficiaries of any age were eligible for inclusion in our study if their aggregated risk classification indicated the presence of multiple or catastrophic chronic conditions. Patients were included if they were discharged alive from an in-state general hospital with a qualifying DRG code during the period July 2010–June 2011 and enrolled in a Community Care of North Carolina primary care medical home at the time of discharge or within thirty days of discharge. Thus, both transitional care and usual care patients were enrolled with a primary care medical home and were eligible for all services covered by Medicaid in North Carolina. One index hospitalization was identified for each patient, which was typically the first discharge during the study period. Hospitalizations with a DRG related to obstetrical, newborn, malignancy, burn, or trauma care did not qualify as an index admission or readmission, because such admissions are frequently planned or unavoidable. Patients who were also eligible for Medicare at any point during the study period were excluded from the analysis because complete claims data for them were not available.

Patients were assigned to the transitional care cohort if a program care manager completed any task for them from the date of hospital admission through the thirtieth day after discharge, or between the date of admission up to the date of readmission if they were readmitted within thirty days. Patients were included in the transitional care cohort even if the care manager was unable to contact the patient or decided that further care management was not necessary, or if the patient refused services. The "usual care" cohort consisted of patients who did not receive any screening, assessment, or intervention by a program care manager from the time they were admitted until their Medicaid eligibility or the study period ended. Patients who did not receive a care management task within thirty days of discharge but received care management during the subsequent twelve months were excluded from the study. The study was approved by the Institutional Review Board of the University of North Carolina at Chapel Hill.

STATISTICAL ANALYSIS The primary study outcome was time to readmission following an initial hospital discharge. *Readmission* was defined as the date of first admission following the initial discharge, excluding transfers or same-day readmissions. We followed patients up to twelve months after discharge, observing readmission claims through September 30, 2011, that had been paid as of January 1, 2012. All patients remained in the analysis until readmission or until excluded because of death or a gap in Medicaid eligibility that lasted longer than two months.

To test the effectiveness of transitional care for people with similar clinical severity profiles, we conducted stratified analyses using assignment to Aggregated Clinical Risk Groups. To ensure that we were sufficiently powered at the twelve-month point, following recommendations published elsewhere,[19] we combined severity levels within the aggregated risk groups until at least 5 percent of the original sample still remained at the end of the twelve-month period. This gave us eight strata of clinical severity. We then calculated twelve-month survival estimates for transitional care and usual care patients within each stratum and tested the significance of cohort differences with the Wilcoxon-Gehan statistic. Because transitional care's impact on first readmissions can also affect the trajectory of future admissions, we also analyzed times between the initial discharge and second and third readmissions.

We then used a Cox proportional hazards regression model to identify demographic, clinical, and hospital characteristics associated with a reduced likelihood of readmission and to estimate the effect of transitional care while controlling for these characteristics. All analyses were conducted using the statistical software SPSS, version 12.0.

FIVE-YEAR ADMISSION AND READMISSION TRENDS As a secondary analysis to corroborate evidence of the program's effectiveness, we evaluated the trajectory of overall hospital admissions during the time of transitional care implementation in Community Care of North Carolina. We followed the approach described by Jane Brock and coauthors[14] and examined 2008–12 trends in inpatient admission rates, all-cause thirty-day readmission rates, and all-cause ninety-day readmission rates among North Carolina Medicaid beneficiaries with multiple complex chronic conditions, as defined in the primary analysis.

LIMITATIONS This was an observational study rather than a controlled trial, and our results

might have been affected by selection bias and endogeneity issues. However, the care managers were instructed to target transitional care resources toward patients at greatest risk for readmission, which would very likely prevent transitional care from appearing better than usual care.

Our evaluation design took the most conservative approach possible by using an intent-to-treat model, limiting the analysis to recipients with access to a primary care medical home through enrollment in Community Care of North Carolina, stratifying participants by severity level to create more homogeneous groups for comparison, and controlling for multiple potential confounding variables in the Cox regression. We conducted several additional sensitivity analyses to test the robustness of our findings. For details about the sensitivity analyses, see Appendix Exhibit 1.[20]

EXHIBIT 1

Characteristics Of Patients And Their Initial Hospitalizations, Transitional Care And Usual Care Groups

	Transitional care (*n* = 13,476)	Usual care (*n* = 7,899)
PATIENT CHARACTERISTICS		
Female	8,140	4,824
Residents of county with population ≥100,000	8,516	4,477
Race or ethnicity		
African American	5,196	3,186
American Indian	411	151
Asian	59	58
Caucasian	6,979	4,076
Other or mixed	11	4
Unknown	820	424
Hispanic ethnicity	437	377
Primary language		
English	13,278	7,697
Spanish	171	180
Other	27	22
Other characteristics		
Mean age (years)	40.0	34.2
Mean CRG weight	7.69	7.14
INITIAL HOSPITALIZATION CHARACTERISTICS		
Psychiatric hospitalization	1,527	1,330
Number of beds in hospital		
<100	1,042	802
100–499	6,671	3,903
≥500	5,763	3,194
Discharged to:		
Home (self-care)	11,480	7,081
Home with home health services	1,203	468
Skilled nursing facility	267	117
Other	526	233

SOURCE Authors' analysis of Medicaid enrollment and claims data. **NOTES** We conducted *t* tests to analyze group differences for age and Clinical Risk Group (CRG) weight—a risk score that reflected average total costs of care within that group relative to the Community Care population as a whole—and chi-square tests for all other variables. All group differences, except sex, were significant ($p < 0.001$).

Study Results

PARTICIPANT CHARACTERISTICS A total of 21,375 Medicaid recipients with complex chronic conditions and a hospital discharge in the period July 2010–June 2011 met the study's inclusion criteria (see Appendix Exhibit 2 for further details).[20] Of those, 13,476 received a transitional care assessment or intervention by a program care manager. Transitional care patients were discharged from 120 different hospitals, were enrolled with 1,325 primary care medical homes, and resided in ninety-nine of North Carolina's hundred counties.

Patients in the transitional care group were older than those in the usual care group and less likely to reside in a rural county (36.8 percent versus 43.3 percent; Exhibit 1). Transitional care patients had a higher overall risk profile than usual care patients. In addition, a greater proportion of patients in the transitional care group had chronic disease in three or more organ systems, compared to patients in the usual care group (25 percent versus 16 percent).

Initial hospitalization characteristics also differed between the two groups (Exhibit 1). Most notably, transitional care patients were less likely than usual care patients to have had a psychiatric hospitalization (11.3 percent versus 16.8 percent) and more likely to have been discharged with home health services arranged for their care (8.9 percent versus 5.9 percent).

TRANSITIONAL CARE ACTIVITIES The patients in the transitional care group received a wide range of transitional care services from the date of their initial admission to a hospital through the first thirty days after discharge (Exhibit 2). Sixty percent of them received interactions and supports of moderate intensity, such as a hospital bedside visit prior to discharge, service coordination, or medication reconciliation by a care manager focused on the identification and resolution of discrepancies between medication lists. Twenty-six percent also received high-intensity transitional care activity, such as a home visit by a care manager or a comprehensive medication review by a clinical pharmacist. The remaining 14 percent of patients in the transitional care group received only screening or other low-intensity transitional care activities such as assessment with deferral—that is, an assessment that determined that the patient did not require further intervention—and phone calls or correspondence without further intervention.

Transitional care activities also varied in duration. At one month after discharge, 66 percent of patients in this group still had some level of contact with a care manager. The proportions at three months and six months after discharge were 49 percent and 31 percent, respectively.

TIME TO READMISSION BY AGGREGATED CLINICAL RISK GROUP There were 8,612 first readmissions within a year of discharge after the initial hospitalization. In 27 percent of these readmissions, the patient was admitted to a different facility than the one used in the initial hospitalization.

Because patients whose conditions were more clinically severe were more likely than others to receive transitional care and more likely than others to be readmitted, we categorized our results according to eight strata of clinical severity (Exhibit 3). Within each stratum, compared to patients in the usual care group, transitional care patients experienced a significantly longer time between their initial discharge and their first readmission, expressed in terms of percentage readmitted at different points in time during the year following discharge. Additionally, in nearly all strata, transitional care patients were significantly less likely than others to have second and third readmissions.

Patients in higher-risk strata were readmitted sooner after their initial discharge than were patients in lower-risk strata, and they experienced greater benefit from transitional care. This is most clearly shown in the survival trajectories for each risk stratum, shown in Appendix Exhibit 3.[20] For example, 84 percent of transitional care patients in stratum 7 were not readmitted in the first thirty days after their initial discharge, compared to 75 percent of usual care patients in the same stratum (Exhibits 3 and 4). Twelve months after the first discharge, 37 percent of transitional care patients in that stratum, but only 25 percent of usual care patients, had not been readmitted. In contrast, among patients in the lowest stratum of clinical risk, 79 percent of transitional care patients and 78 percent of usual care patients remained free of readmission at twelve months (Exhibit 3 and Appendix Exhibit 3).[20]

Comparing all readmissions during the first twelve months after the first discharge, across the eight risk strata, transitional care patients had seven to thirty-two fewer readmissions per hundred initial discharges than usual care patients (Exhibit 3). Across all risk strata, the absolute risk reduction associated with transitional care compared to usual care was 17.4 fewer readmissions per hundred patients—equivalent to one readmission averted for every six patients who received transitional care.

COX PROPORTIONAL HAZARDS REGRESSION In the Cox proportional hazards regression model, certain characteristics—including being older or male, having a higher Clinical Risk Group weight, and having had a psychiatric hospitalization—were associated with a greater likelihood of readmission (Exhibit 5). Patients who had home health services arranged at the time of hospital discharge avoided being readmitted for a longer time than patients without home health services. When we controlled for these potential confounders, transitional care patients remained much less likely to be readmitted than usual care patients ($p < 0.001$).

Because having had a psychiatric hospitalization and having home health services were significantly associated with both the receipt of transitional care and readmission risk, we tested the sensitivity of the analysis to the inclusion of patients in these categories. Both when we removed patients with psychiatric hospitalizations from the analysis and when we removed those receiving home health services, the effect size of transitional care was unchanged (hazard ratio: 0.78:1; $p < 0.001$). Hazard ratios were not materially affected by several additional sensitivity analyses that are described in online Appendix Exhibit 1.[20]

FIVE-YEAR TRENDS In the period 2008–12 thirty-day readmissions among North Carolina Medicaid beneficiaries with multiple complex chronic conditions decreased from 123.3 to 110.7 per 1,000 recipients per year. Ninety-day readmissions decreased from 299.7 to 272.4 per 1,000 recipients per year, and overall admissions decreased from 579.4 to 518.5 per 1,000 recipients per year. Additional details are available in Appendix Exhibit 4.[20]

EXHIBIT 2

Types Of Transitional Care Received By Patients In The Transitional Care Group

Transitional care activity	Patients receiving care
HIGH-INTENSITY CARE	
Home visit by care manager	2,471
Medication review by clinical pharmacist	2,256
Tele-health management	143
Any high-intensity care	3,508
MODERATE-INTENSITY CARE	
Service coordination	7,737
Patient education	5,559
Medication reconciliation	4,332
Hospital visit	4,152
Face-to-face encounter between patient and care manager[a]	1,070
Ongoing follow-up or monitoring by care manager	10,022
Any moderate-intensity, but no high-intensity, care	8,054
LOW-INTENSITY CARE	
Screening or assessment	12,568
Correspondence	8,525
Phone call	8,517
Other	11,888
Any low-intensity, but no high- or moderate-intensity, care	1,914

SOURCE Authors' analysis of transitional care activities documented in Community Care of North Carolina's Care Management Information System. [a]In practice or community.

EXHIBIT 3

Patients' Readmissions Over Time By Risk Stratum, Transitional Care And Usual Care Groups

Type of care	Patients (*n*)	Percent of patients with: No readmission after: 30 days	90 days	6 months	12 months	No second readmission after 12 months	No third readmission after 12 months	Readmissions, 12 months after first discharge (per 100 discharges)	Averted readmissions (usual care–transitional care)
RISK STRATUM 1 (LOWEST RISK)									
Usual	1,236	93	88	83	78	92	97	33	7
Transitional	1,340	97	93	89	79****	96**	99**	26	—[a]
RISK STRATUM 2									
Usual	1,313	90	82	76	66	87	96	52	9
Transitional	1,600	95	87	82	71****	90**	97	42	—[a]
RISK STRATUM 3									
Usual	1,213	89	80	72	61	84	92	63	9
Transitional	1,709	93	85	77	67****	87	93	54	—[a]
RISK STRATUM 4									
Usual	1,220	83	71	60	48	74	88	91	18
Transitional	2,194	91	82	73	55****	81****	91****	73	—[a]
RISK STRATUM 5									
Usual	627	79	68	58	44	71	87	98	15
Transitional	1,581	91	79	67	51****	76**	90****	83	—[a]
RISK STRATUM 6									
Usual	670	70	54	38	30	55	65	150	19
Transitional	1,351	83	66	53	39****	60****	71**	131	—[a]
RISK STRATUM 7									
Usual	1,035	75	56	38	25	47	69	159	32
Transitional	1,966	84	69	54	37****	61****	76**	127	—[a]
RISK STRATUM 8 (HIGHEST RISK)									
Usual	585	61	41	23	12	32	55	201	26
Transitional	1,735	77	57	39	20****	43****	61**	176	—[a]

SOURCE Authors' analyses of readmission rates based on Medicaid claims data. **NOTES** Patients were categorized by disease burden according to the categorical and hierarchical Clinical Risk Group (CRG) methodology developed by 3M Health Information Services discussed in the text (see Note 18 in text). We merged eighteen of the forty-four Aggregated CRGs into the eight risk strata shown. We report the significance level of the Wilcoxon-Gehan statistics for each of the survival curve comparisons at twelve months. [a]Not applicable. **$p < 0.05$ ****$p < 0.001$

During this five-year period, North Carolina Medicaid expanded the enrollment of elderly and disabled beneficiaries into the Community Care of North Carolina primary care medical home managed care model. The proportion of Medicaid recipients with multiple complex chronic conditions enrolled in the program, and thus eligible for transitional care services, increased from 61 percent to 79 percent. Within the program, the reach of the transitional care initiative also increased over time: The proportion of beneficiaries with complex chronic conditions who received transitional care assessment or interventions rose from approximately 10 percent in 2008 to 80 percent in 2012.

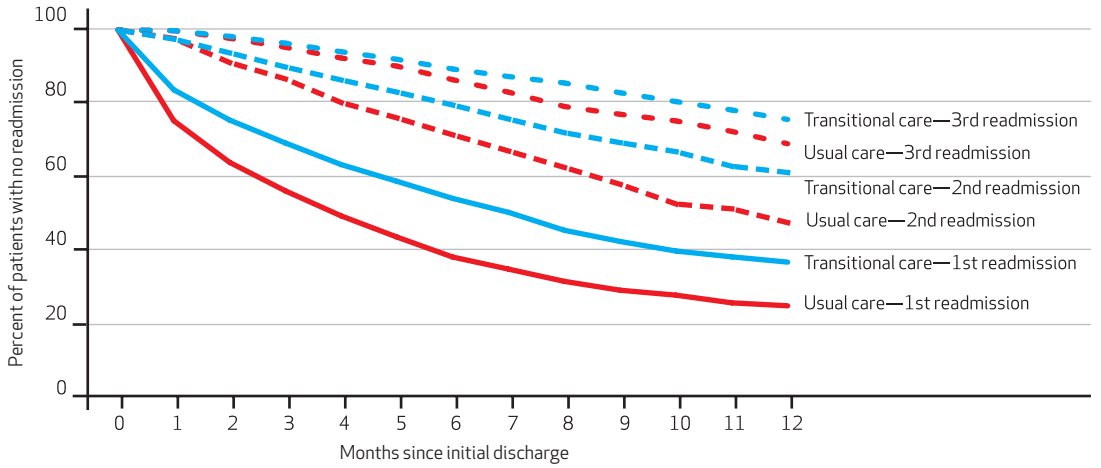
Discussion

This study demonstrated the success of a unique statewide community-based care management intervention—transitional care—in improving care transitions and reducing hospital readmissions for Medicaid patients with complex chronic conditions. Adjusted readmission rates were approximately 20 percent lower for Medicaid beneficiaries who received transitional care within thirty days of discharge than for clinically similar beneficiaries who received usual care. Twelve-month readmission rates were consistently lower for participants within each of the eight strata of clinical severity examined. In addition, the transitional care participants were less likely than others to experience multiple readmissions.

When these additional readmissions were taken into consideration, we found that for every six patients with complex chronic illnesses who received transitional care, one readmission was averted in the following year. The effects were greatest among patients with the highest levels

EXHIBIT 4

Time Before First And Subsequent Readmissions For Patients In Risk Stratum 7, Transitional Care And Usual Care Groups



SOURCE Authors' analyses of readmission rates based on Medicaid claims data. **NOTES** Patients were categorized by disease burden according to the categorical and hierarchical Clinical Risk Group methodology developed by 3M Health Information Services discussed in the text (see Note 18 in text). We merged eighteen of the forty-four Aggregated CRGs into eight risk strata, with stratum 1 the lowest-risk group and stratum 8 the highest-risk group. This figure shows patients in stratum 5 only, with 1,966 receiving transitional care and 1,035 receiving usual care.

of overall clinical risk, for whom the baseline risk of readmission within one year after an initial discharge under usual care exceeded 70 percent. Among these patients, one readmission was averted for every three patients who received transitional care.

The observed reduction in readmission risk achieved through Community Care of North Carolina's transitional care intervention is similar to that reported in smaller controlled trials that served as models for the program.[11–13] In contrast to previously published reports, this study focused on a Medicaid population, focused on the twelve months following an initial discharge rather than the first thirty days in the postdischarge period, and evaluated the effectiveness of a widely dispersed and sustained intervention that spanned an entire state and multiple health systems. This study adds to a growing body of literature suggesting that locally embedded, targeted care coordination interventions can effectively reduce hospitalizations for high-risk populations.[11–13]

The North Carolina program focused on a Medicaid population, but the study further substantiates lessons learned from the eleven Medicare Coordinated Care Demonstration programs. Similar to the North Carolina program, the four of those programs that reduced hospitalizations for high-risk patients featured timely, comprehensive transitional care after hospitalization, person-to-person contact between patients and care managers, substantial interaction between care managers and physicians, strong medication management, and patient education with an emphasis on patient self-care.[21]

As a study of a large-scale implementation, our study also has some similarities to a recent evaluation of fourteen communitywide initiatives—facilitated by Quality Improvement Organizations—to improve care transitions for Medicare beneficiaries.[14] Brock and coauthors reported declines in overall readmission and admission rates in the target population, despite no change in the rate of all-cause thirty-day readmissions as a percentage of hospital discharges.[14] Our study offers further evidence that coordination of care transition resources in a community can affect overall admission and readmission rates. And the study adds to the existing literature by demonstrating the effects of transitional care beyond the first thirty days after hospital discharge and the effectiveness of such care across a wide geographic area, particularly for the sickest patients.

Any number of factors might have contributed to the success of Community Care of North Carolina's transitional care program. By providing an intermediary, accountable structure between the financing agency (Medicaid) and health care providers, the program is able to distribute resources for care coordination among unaffiliated health care providers, according to the needs of the patient and in the local context. This shared care coordination infrastructure may be essential for reaching patients with complex care needs. A majority of North Carolina Medicaid recipients receive pri-

EXHIBIT 5

Estimated Impact Of Transitional Care On Readmission Rates In Cox Proportional Hazards Regression Model, Controlling For Patient And Initial Hospitalization Characteristics

Variables in the model	Beta	Wald	Significance	Hazard ratio
PATIENT CHARACTERISTICS				
Female	−0.065	8.616	0.003	0.937
Residence in county with population at least 100,000	0.063	7.205	0.007	1.065
Race or ethnicity[a]	—[b]	7.523	0.185	—[b]
African American	0.051	4.890	0.027	1.052
American Indian	0.076	1.323	0.250	1.079
Asian	−0.030	0.040	0.842	0.970
Other or mixed	−0.754	1.701	0.192	0.470
Unknown	0.030	0.375	0.540	1.031
Hispanic ethnicity	−0.018	0.058	0.810	0.982
Primary language[c]	—[b]	2.200	0.333	—[b]
Spanish	0.017	0.023	0.879	1.017
Other	−0.407	2.169	0.141	0.666
Other characteristics				
Age (years)	0.011	318.407	0.000	1.012
CRG weight	0.056	2,952.022	0.000	1.058
INITIAL HOSPITALIZATION CHARACTERISTICS				
Psychiatric hospitalization	0.095	8.463	0.004	1.099
Number of beds in hospital[d]	—[b]	1.877	0.391	—[b]
100–499	−0.055	1.867	0.172	0.946
≥500	−0.051	1.437	0.231	0.950
Discharged to:[e]	—[b]	285.659	0.000	—[b]
Home with home health services	−0.752	232.625	0.000	0.472
Skilled nursing facility	0.000	0.000	0.998	1.000
Other	−0.540	64.049	0.000	0.583
INTERVENTION VARIABLE				
Transitional care	−0.251	121.508	0.000	0.778

SOURCE Authors' analyses of predictors of readmission based on Medicaid claims data. **NOTES** Beta is the coefficient of each variable in the regression model, denoting both the direction and the magnitude of the effect. Wald is the statistic used to test the significance of the beta coefficients. Significance is the significance level of the Wald statistic, reporting the probability of obtaining each beta coefficient and Wald statistic by chance alone. Hazard ratio is the relative likelihood of being readmitted for patients who have that characteristic compared to those who do not (a hazard ratio of less than 1.0 represents a lower likelihood of readmission, and a ratio of more than 1.0 represents a higher likelihood of readmission). For example, patients receiving transitional care are 22.2 percent less likely than patients receiving usual care to be readmitted (hazard ratio: 0.778 to 1). Clinical Risk Group (CRG) weight is a risk score that reflects average total costs of care within that group relative to the Community Care of North Carolina population as a whole. [a]Reference is Caucasian. [b]Cox proportional hazards regression models do not provide beta or hazard ratios for the reference groups. [c]Reference is English. [d]Reference is <100. [e]Reference is home (self-care).

mary care in small practices that lack internal resources to support fully integrated, multidisciplinary medical home care coordination activities, as is true for Medicare beneficiaries nationwide; and patients from any given primary care medical home use multiple hospital systems. Cross-hospital traffic is also common: In our study population, 27 percent of the hospital readmissions occurred at a facility other than the one where the patient was first admitted. Although protocol driven, the Community Care of North Carolina model encourages local care managers to be flexible and accommodate patients' needs by providing individualized transitional care plans, while simultaneously leveraging existing relationships and adapting to the interventional capacities of the communities in which patients live.

Although the impact of transitional care was measurable at thirty days after patients' initial discharge, the effects were most pronounced beyond the initial thirty-day period and changed the trajectory of future readmissions. For every 100 patients receiving transitional care, 8.7 readmissions were avoided within the first thirty days, but 17.4 readmissions were avoided within the first year. This finding should perhaps be expected for a population of patients with complex chronic care needs. Issues identified and addressed during the transitional care process—for example, gaps in patients' knowledge about the progression of chronic diseases and signs of acute exacerbation, as well as the identification of errors or omissions in outpatients' medication regimen—can increase the long-term risk of adverse clinical outcomes.

Benefits of transitional care would be grossly underestimated by performance metrics that focused solely on the first thirty days after discharge. Indeed, efforts by the Centers for Medicare and Medicaid Services to incentivize hospital-based efforts to reduce thirty-day readmission rates through the public reporting of readmission statistics and the phasing in of financial penalties for hospitals[22] could divert attention from the potential of improved care transitions to yield longer-term benefits. To the extent that such incentives motivate hospitals to engage in collaborative efforts to coordinate the safe return of patients to their communities and primary care providers, as was likely the case in North Carolina, their benefits may be much greater and more sustained.

Notably, the Community Care of North Carolina transitional care program has continued to expand since the conclusion of this study and is now providing transitional care support to more than 2,000 patients with complex chronic illness every month. Efficiencies have been achieved through improvements in staffing and workflow, refined processes for identifying and prioritizing the patients most likely to benefit from transitional care, and increasing the use of electronic data exchange. Fifty-seven hospitals, which are responsible for more than two-thirds of North Carolina Medicaid discharges, are currently participating in the exchange of admission, discharge, and transfer data with Community Care of North Carolina to produce real-time care team notification.

Future research is needed to evaluate the factors that may be associated with successful implementations of such interventions. These

factors may include variations in community, hospital, and practice characteristics related to program implementation, as well as variations in network staffing and processes. In addition, it will be important to better understand which specific components of an intervention are critical for which patients, and the effects of transitional care support for patients who have only one chronic or acute condition.

Conclusion

North Carolina has successfully developed a robust, effective, statewide transitional care program for Medicaid recipients. Care management that is locally coordinated between the hospital and home and focuses on the patient's reengagement with his or her primary care medical home can greatly reduce long-term readmission rates, particularly for patients with the greatest illness burden. ■

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