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Impact of the Registered Nurse Clinical Liaison Role in Ambulatory Care on Transitions of Care

A Retrospective Cohort Study

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ABSTRACT

Purpose of Study: To determine the relationship between engagement with the novel register nurse care liaison (RNCL) and enrollment in care management compared with usual care in hospitalized patients.

Primary Practice Setting: Patients in the hospital from January 1, 2019, to September 30, 2019, who would be eligible for care management.

Methodology and Sample: This was a retrospective cohort study. The authors compared a group of 419 patients who utilized the services of the RNCL at any time during their hospital stay with the RNCL to a propensity matched control group of 833 patients, which consisted of patients who were hospitalized during the same time as the RNCL intervention group. Our primary outcome was enrollment in care management programs. Our secondary outcome was 30-day readmissions, emergency department (ED) use, and office visits. The authors compared baseline characteristics and outcomes across groups using Wilcoxon–Mann–Whitney and χ^2 tests and performed an adjusted analysis using conditional logistic regression models controlling for patient education and previous health care utilization.

Results: The authors matched 419 patients who had engaged an RNCL to 833 patients in the usual care group; this comprised the analytic cohort for this study. The authors found 67.1% of patients enrolled in a care management program with RNCL compared with only 15.3% in usual care ($p < .0001$). The authors found higher rates of enrollment in all programs of care management. After the full adjustment, the odds ratio for enrollment in any program was 13.7 (95% confidence interval: 9.3, 20.2) for RNCL compared with usual care. There was no difference between groups with 30-day hospitalization or ED visit.

Conclusion: In this matched study of 419 patients with RNCL engagement, the authors found significantly higher enrollment in all care management programs.

Implications for Case Management Practice: These findings encourage further study of this care model. This could help enhance enrollment in care management programs, increase relationships between inpatient practice and ambulatory practice, as well as increase communication across the continuum of care.

Key words: *care transitions, discharge, liaison, primary care, registered nurse*

Patients experience multiple chronic conditions commonly in the Unites States, with over 25% of the population suffering two or more chronic conditions (Ward et al., 2014). Health systems can care for the highest risk patients using care management programs, which focus either on individual conditions like heart failure or through a comprehensive approach for multiple illnesses (Leppin et al., 2014). There are examples of care transition models in the literature. In the transitions coach model, a health coach helps patients who were recently discharged from the hospital and provides tools and support to encourage patients to be involved in their transition of care (Coleman et al., 2006). In a second model an advanced practice nurse evaluates high-risk elders in the home setting post-discharge, which has been shown to decrease rehospitalizations and health care costs (Naylor et al., 2004). Additionally, Holland et al. (2019) discuss the collaborative approach of a community care team, utilizing a nurse care coordinator and case manager to assist individuals in

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navigating the health care system. Further evidence discusses telephone follow-up by nursing, some including specific face-to-face meetings prior to discharge and subsequent call, that can reduce readmissions, but without accepted best practice, it is difficult to direct case management practices (Reese et al., 2019; Vergara et al., 2018; 2020).

Although the authors recognize the potential importance of these care management programs described, patients often face barriers to enrollment and, thus, do not always participate in these programs. Mayo Clinic Rochester has many primary care programs and resources outlined in a previous article (Flynn et al., 2021).

Due to the importance of these programs, hospitals often try to promote enrollment using various resources. The primary care social worker often assesses patients for behavioral or psychosocial needs, connects patients to community resources, and coordinates services (Lombardi et al., 2019). The hospital social worker has a similar job description, with the addition of discharge planning efforts (Grant & Toh, 2017). Mayo Clinic hospital case managers help with discharge planning as well and review medical necessity of interventions and hospital stay, based on insurance guidelines (Kelly et al., 2019). Mayo Clinic Rochester created a new role for a register nurse care liaison (RNCL). This registered nurse works to bridge both the hospital and the primary care clinic to help facilitate enrollment in specialized programs as needed (Flynn et al., 2021). The primary aim of this study was to determine the relationship between engagement with the RNCL and care management program enrollment compared with usual care in a propensity matched group of hospitalized adult patients. Propensity score matching of two treatment groups is a technique used to remove confounding bias in a nonrandomized study. As a secondary aim, the authors sought to determine the relationship between RNCL engagement and 30-day hospitalization or 30-day emergency department (ED) visits compared with usual care.

Methods

Design and Setting

This was a retrospective cohort study of patients who engaged the services of the RNCL versus a propensity matched control group of patients who did not. This study was conducted within primary care in Rochester, Minnesota, and included patients who were discharged from the hospital from January 2019 to September 2019. The study was reviewed and approved by the Mayo Clinic Institutional Review Board. The study adhered to the principle of the Declaration of Helsinki.

Population

All patients who utilized the services of the RNCL at any time during their hospital stay were included in the RNCL intervention group. Inclusion criteria for RNCL services included patients who had a primary care provider at Rochester, Mayo Clinic primary care, living near Rochester, Minnesota, and being hospitalized at a Mayo Clinic hospital. Patients also must have had an Elder Risk Assessment (ERA) score over 16, which placed them at risk for hospitalization. The ERA accounts for comorbid health burden and previous hospital utilization and a score over 16 places an individual in the top 10% for risk of hospitalization (Crane, et al., 2010). Finally, patients were eligible if they had a LACE+ score (length of stay [L], acuity of admission [A], comorbidity [C], and emergency department utilization in the 6 months before admission [E]) greater than 59 and possessed a high risk for readmission, like chronic obstructive pulmonary disease (COPD), heart failure, and sepsis (Iyngkaran et al., 2018; Krumholz et al., 2016; van Walraven et al., 2012; Wallace et al., 2019). The exclusion criteria comprised refusal for medical record review, having a primary care provider outside of Mayo Clinic primary care, as well as obstetrical and psychiatric admissions.

The propensity matched control group included patients who were hospitalized during the same period as the RNCL intervention group. Eligible controls must have been 18 years or older at the time of hospital discharge, with a LACE+ score greater than 59, and admitted to the same hospital services and department units as those in the RNCL intervention group. Patients who did not consent to have their medical records used for research purposes were excluded from the pool of eligible controls. The control group was propensity matched at a ratio of 1:2 cases to controls based on age, sex, ethnicity, race, language, marital status, chronic health conditions (as measured by the Charlson comorbidity index) and LACE+ score, as well as the length of stay of the index hospitalization and the hospital service and department unit they were admitted to. Age, sex, ethnicity, race, language and marital status, LACE+ score, and the characteristics of the index hospitalization were electronically abstracted from the electronic medical record. Comorbid health conditions were determined using *International Classification of Diseases, Ninth Revision* and *Tenth Revision* (*ICD-9* and *ICD-10*) billing codes and the Deyo adaptation of the Charlson comorbidity index. The patients in the control group included those patients who met criteria for enrollment but were not enrolled. The main reason is that a single RNCL cannot meet the volume of hospitalized primary care patients.

Intervention

Referrals to care management programs in the study were done in two primary ways. A full methodology of the intervention has been previously reported. This includes a detailed description about the role, care management programs, and the RNCL process for reviewing, seeing, and referring patients to care management programs. "The RNCL model of care provides enhanced services and care for a vulnerable population at risk for future health decline. The ongoing goal is to ensure patients can enroll in ambulatory care management programs and receive appropriate care at the opportune time" (Flynn et al., 2021, pp. 130–131). As the first method of referral, the RNCL reviewed a list within the electronic medical record daily. The list included a cohort of all hospitalized primary care patients older than 18 years except patients who were hospitalized for obstetric or psychiatric reasons. The RNCL stratified patients based on the LACE+ score and the ERA to pinpoint the highest risk patients (Crane et al., 2010; van Walraven et al., 2012). Within the high-risk strata, the RNCL found patients with higher risk diagnoses including congestive heart failure, COPD, sepsis, or diabetes. The second way to receive referrals was from direct communication to the RNCL from either the hospital or ambulatory providers. This was usually done by a phone call or message sent via the electronic health record.

After identifying high-risk patients, the RNCL would determine patient qualifications for programs. The RNCL would then see the patient or family at the bedside to explain the options and offer enrollment to the primary care program. The RNCL was able to set up initial home visit consults for Mayo Clinic Care Transitions (MCCT) or get a specialty clinic visit scheduled prior to the patient leaving the hospital. Pertinent insight on discharge plans or primary care interventions were shared with both inpatient and primary care team members.

Outcomes

The primary outcome was coordination of services following hospital dismissal. These services included the following: enrollment in MCCT, enrollment in Adult Care Coordination (ACC), enrollment in palliative care homebound program, enrollment in primary care house calls program, and referral to integrated community specialists (ICSs) (specialty care). For secondary outcomes and for hypothesis generation, the authors also evaluated 30-day hospital readmissions and ED visits, both overall did not lead to hospitalization. The authors further assessed whether patients were evaluated in the outpatient setting in the month following hospital dismissal.

Predictors

In addition to the propensity matched predictors, the authors included measures of prior utilization as a potential covariate for adjustment in outcome models. These utilization measures included the number of hospitalizations and the number of ED visits that occurred in the 12 months prior to the index hospitalization. These measures were obtained using the electronic medical record. The authors also included educational level as an adjustment factor, which was obtained from the most recent patient-provided information form on file.

Analysis

The authors described both the entire cohort and the characteristics of the matched cohort. The authors compared these characteristics between RNCL intervention and control groups using the Wilcoxon–Mann–Whitney test for continuous variables and the χ^2 test for categorical measures. Crude rates of the primary and secondary outcomes were compared among the matched cohort using χ^2 tests. A p value less than .05 was deemed to be statistically significant. The authors performed an adjusted analysis of primary and secondary outcomes using multivariable conditional logistic regression models controlling for prior hospital utilization, prior ED utilization, and educational level. Data management and statistical analyses were carried out using SAS 9.4 (Cary, North Carolina).

Results

A total of 539 patients were identified who had initial engagement with the RNCL intervention during the defined study period. Of this number, 101 patients were excluded based on study inclusion and exclusion criteria, leaving 438 patients in the RNCL intervention arm to be matched. A pool of 7,311 control subjects was identified that met study inclusion criteria. A total of 419 patients from the RNCL intervention group were able to be propensity matched to a total of 833 control subjects. The characteristics of the full study population, as well as the matched cohort, are described in Table 1.

In comparing the full study population of patients who interacted with the RNCL to the pool of control subjects, the authors found significant differences in baseline characteristics prior to propensity matching. The intervention group was older with an average age of 73.8 years (*SD*: 16.2). They were more likely to be female, 90% were White and 54.8% were unmarried, and more likely to be unmarried. They also were more likely to suffer history of myocardial infarction, congestive heart failure, peripheral vascular disease, stroke, dementia, COPD, diabetes,

TABLE 1
Cohort Characteristics

	Full Cohort			Matched Cohort		
Characteristic	**Cases (*n* = 438)**	**Control (*n* = 7,311)**	***p* Value**	**Cases (*n* = 419)**	**Control (*n* = 833)**	***p* Value**
Age, *M* (*SD*)	73.8 (16.2)	70.3 (15.6)	<.0001	73.5 (16.3)	73 (15.1)	.2954
Sex			.0009			.5634
Female	225 (51.4)	3,162 (43.2)		217 (51.8)	417 (50.1)	
Male	213 (48.6)	4,149 (56.8)		202 (48.2)	416 (49.9)	
Race			.0295			.9600
White	394 (90)	6,750 (92.3)		376 (89.7)	749 (89.9)	
African	12 (2.7)	145 (2)		12 (2.9)	26 (3.1)	
Asian	12 (2.7)	88 (1.2)		12 (2.9)	25 (3)	
Other/unknown	20 (4.6)	328 (4.5)		19 (4.5)	33 (4)	
Ethnicity			.6694			.9529
Hispanic	11 (2.5)	162 (2.2)		11 (2.6)	24 (2.9)	
Not Hispanic	419 (95.7)	6,971 (95.3)		401 (95.7)	794 (95.3)	
Unknown	8 (1.8)	178 (2.4)		7 (1.7)	15 (1.8)	
Language			.1116			.9292*
English	416 (95)	7,078 (96.8)		397 (94.7)	787 (94.5)	
Other	20 (4.6)	213 (2.9)		20 (4.8)	43 (5.2)	
Unknown	2 (0.5)	20 (0.3)		2 (0.5)	3 (0.4)	
Marital Status			<.0001			.6563*
Married	195 (44.5)	4,179 (57.2)		187 (44.6)	375 (45)	
Unknown	3 (0.7)	132 (1.8)		3 (0.7)	3 (0.4)	
Unmarried	240 (54.8)	3,000 (41)		229 (54.7)	455 (54.6)	
History of MI	73 (16.7)	788 (10.8)	.0001	71 (16.9)	129 (15.5)	.5061
History of CHF	180 (41.1)	2,088 (28.6)	<.0001	174 (41.5)	332 (39.9)	.5695
History of peripheral vascular disease	195 (44.5)	2,223 (30.4)	<.0001	181 (43.2)	379 (45.5)	.4399
History of cerebrovascular disease	120 (27.4)	1,066 (14.6)	<.0001	114 (27.2)	245 (29.4)	.4158
History of dementia	59 (13.5)	418 (5.7)	<.0001	57 (13.6)	119 (14.3)	.7432
History of COPD	163 (37.2)	1820 (24.9)	<.0001	155 (37)	299 (35.9)	.7028
History of ulcer	17 (3.9)	209 (2.9)	.2167	17 (4.1)	36 (4.3)	.8264
History of mild liver disease	41 (9.4)	682 (9.3)	.9820	36 (8.6)	78 (9.4)	.6542
History of diabetes	157 (35.8)	2,037 (27.9)	.0003	151 (36)	293 (35.2)	.7630
History of diabetes with organ damage	122 (27.9)	1236 (16.9)	<.0001	118 (28.2)	229 (27.5)	.8023
History of hemiplegia	22 (5)	153 (2.1)	<.0001	22 (5.3)	47 (5.6)	.7744
History of moderate/severe renal disease	173 (39.5)	2,031 (27.8)	<.0001	165 (39.4)	315 (37.8)	.5911
History of moderate/severe liver disease	13 (3)	233 (3.2)	.7996	12 (2.9)	28 (3.4)	.6368
History of metastatic solid tumor	19 (4.3)	424 (5.8)	.2006	17 (4.1)	33 (4)	.9350
History of aids	1 (0.2)	12 (0.2)	.7499	1 (0.2)	3 (0.4)	.7193
History of rheumatologic disease	52 (11.9)	525 (7.2)	.0003	52 (12.4)	93 (11.2)	.5156
History of other cancer	84 (19.2)	1,377 (18.8)	.8583	73 (17.4)	147 (17.6)	.9215
Index length of stay, *M* (*SD*)	6.5 (9.8)	5.9 (6.8)	.1208	6.6 (9.9)	6.9 (10)	.2910
Index LACE score, *M* (*SD*)	72.9 (9.5)	72.3 (9.4)	.0102	73 (9.5)	73.2 (8.5)	.3006

Note. CHF = congestive heart failure; COPD = chronic obstructive pulmonary disease; MI = myocardial infarction.
*Denotes use of Fisher's exact test.

hemiplegia, severe renal disease, and rheumatologic disease (see Table 1). After the propensity match, there were no significant differences in demographic factors or comorbid medical conditions (see Table 1 and Figure 1). Within the matched cohort, cases were 73.5 years (*SD*: 16.3) of age on average, with 51.8%

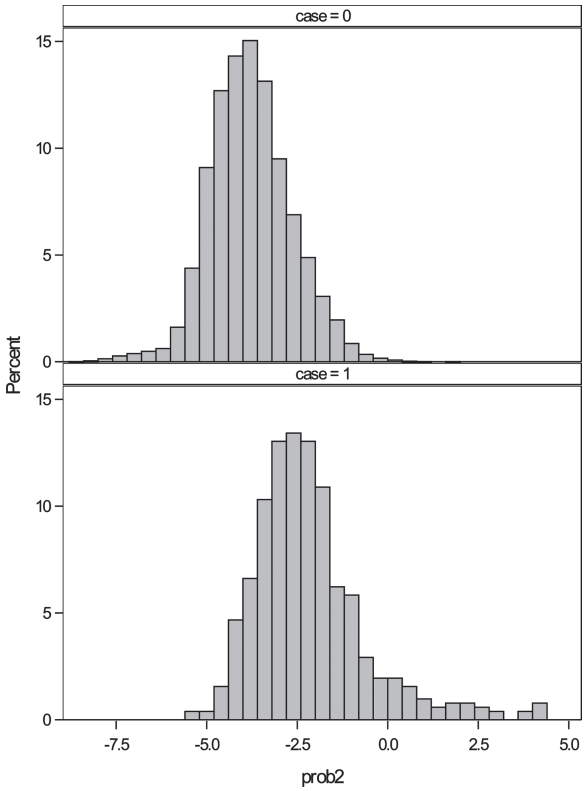

FIGURE 1
Propensity matching.

being female. Most patients in the matched cohort were White at 89.7%. For the illness burden, 41.5% had congestive heart failure and 28.2% had diabetes with organ damage. The mean LACE+ score was 73 (*SD*: 9.5).

For our primary outcome of any program enrollment following hospitalization, the authors found that 67.1% of patients enrolled in any of the care management programs of interest following RNCL engagement versus 15.3% in a group without RNCL interaction ($p < .0001$). For individual program enrollment outcomes, patients who interacted with RNCL had 60.9% enrollment in the MCCT program compared with 13.9% in the patients without engagement ($p < .0001$). The authors found similar significantly higher enrollment for the other programs of ACC, palliative care homebound program, and ICS referrals (see Table 2).

TABLE 2
Unadjusted Outcomes in Patients With RNCL Engagement and Referent Group

Outcome	Case (%)	Referent (%)	*p* Value
Any program enrollment	67.1	15.3	<.0001
Mayo Clinic Care Transitions enrollment	60.9	13.9	<.0001
Adult Care Coordination enrollment	15.3	1.6	<.0001
Palliative care homebound	2.1	0.1	.0001
Integrated community specialist visit	10.5	3.4	<.0001
Hospitalization	17.2	14.9	.2911
Emergency department visit	21.0	19.3	.4836
Emergency department visit (no hospitalization)	7.4	9.6	.1952
Office visits	66.8	54.6	<.0001

Conditional logistic regression models controlling for patient education and prior health care utilization similarly showed significant associations between RNCL engagement and future enrollment in care management programs. Those who engaged with the RNCL were 13.7 times more likely (odds ratio [OR]: 13.7, 95% confidence interval [CI]: 9.2, 20.2, $p < .0001$) to have subsequent enrollment in a care management program of any kind compared with those who did not engage with the RNCL. Similarly, the OR of care transitions program enrollment in the intervention group compared with the control group was 11.8 (95% CI: 8.1, 17.3, $p < .0001$). The RNCL intervention group also had significantly higher odds of ACC enrollment and ICS care visits. In examining secondary outcomes of interest, the authors found that the RNCL intervention group was more likely to have office visits in the 30 days following their index hospitalization compared with those in the control group (OR: 1.6, 95% CI: 1.3, 2.1, $p < .0001$). There were no differences between the two groups when evaluating 30-day hospital readmissions or ED visits (see Table 3).

For our primary outcome of any program enrollment following hospitalization, the authors found that 67.1% of patients enrolled in any of the care management programs of interest following RNCL engagement versus 15.3% in a group without RNCL interaction. For individual program enrollment outcomes, patients who interacted with RNCL had 60.9% enrollment in the MCCT program compared with 13.9% in the patients without engagement. We found similar significantly higher enrollment for the other programs of ACC, palliative care homebound program and ICS referrals.

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Strengths and Limitations

Our study had strengths and some limitations. In this novel study, an RNCL engaged 539 patients over a 9-months period, 419 of which were included in the study. This is an encouraging level of interaction for a new program and a new role. The study had over 7300 patients from whom to match, which reflects a large volume of hospital patients who could benefit from this RNCL role. There is a substantially large effect size, which also reinforces the value of establishing this role in the hospital and primary care practices.

Recognizing these strengths, there were also limitations. For our primary outcome of care management enrollment, it is possible that patients were enrolled in care management outside of our primary care network. This possibility is unlikely given the infrastructure required and it would not likely favor one group over another. The authors attempted to mitigate this limitation by limiting our study to those patients empaneled to a Mayo Clinic primary care provider. A second concern is the possibility of residual bias due to unmeasured confounding. The study matched and adjusted for known predictors for illness severity. These included age, sex, comorbid health conditions, and previous utilization; however, there are potentially other predictors which are not accounted for. By implementing propensity score matching with a limit on distance allowed between matches, the authors were able to demonstrate adequate balance in measured covariates between the two groups and are confident that residual bias is limited. The authors can generalize the population to the upper Midwest of the United States; however, the findings cannot be generalized beyond this population with certainty (St. Sauver et al., 2012).

In examining secondary outcomes of interest, the authors found that the RNCL intervention group was more likely to have office visits in the 30 days following their index hospitalization compared with those in the control group.

TABLE 3
Adjusted Conditional Logistic Regression Results

Outcome	Odds Ratio for Group Effect (Control Group as Referent) [95% CI]	*p* Value
Any program enrollment	13.7 [9.3, 20.2]	<.0001
Mayo Clinic Care Transitions program enrollment	11.8 [8.1, 17.3]	<.0001
Adult Care Coordination enrollment	13.1 [6.2, 27.9]	<.0001
Palliative care homebound	13.7 [0.7, 290.2]	.0922
Integrated community specialist visit	3.3 [1.9, 5.6]	<.0001
Hospitalization	1.2 [0.9, 1.7]	.2687
Emergency department visit	1.2 [0.8, 1.6]	.3783
Emergency department visits (that did not results in hospitalization)	0.7 [0.4, 1.2]	.2498
Office visits	1.6 [1.3, 2.1]	<.0001

Note. Multivariate models were adjusted with the following covariates: number of prior hospitalizations in the previous 12 months, number of emergency department visit in the previous 12 months, and education. CI = confidence interval.

Implications for Case Management Practice

These findings validate the importance of the RNCL role within the hospital. Similar to findings by Karam et al. (2021) that "efforts must be directed towards enabling the primary healthcare level of effectively play its substantial role in care coordination," our study facilitates multidisciplinary teamwork to delivery care (Karam et al., 2021, p. 16). The RNCL role could help enhance enrollment in care management programs. The authors learned that this role helps to facilitate communication between the hospital and the ambulatory clinic. The study may require further validation in other settings and other groups. However, we believe these findings may facilitate further models to improve enrollment in care management programs following hospital stay.

Conclusion

In this study of 419 propensity matched patients, the authors found a significant association between engagement in RNCL and enrollment in care management programs after controlling for prior health care utilization and patient education. The authors found that over two-thirds of patients who interacted with the RNCL enrolled in some type of care

The authors found that over two-thirds of patients who interacted with the RNCL enrolled in some type of care management program compared to only one in nine in usual care.

management program compared with only one in nine in usual care. In examining individual program enrollment, the authors further found substantially higher odds of enrollment across all programs for those who engaged with the RNCL compared with those who did not. The primary objective of this new clinical program was to increase enrollment in care management programs (Flynn et al., 2021). Showing this improvement was encouraging.

Although this role has some similarities when comparing to hospital and primary care social work roles, the RNCL is a unique individual who has a role in both the hospital and ambulatory practice. The hospital providers who help facilitate enrollment in ambulatory programs involve social workers and discharge planners, and their roles were previously described in this article. The communication between both settings is often through a discharge summary (Mitchell et al., 2017). The RNCL serves in both hospital and ambulatory settings with a single primary role, which may have helped facilitate these findings. The multifaceted nature of this position allows for more efficient coordination of care management services post-discharge, which likely contributed to the substantial effects that were seen among the intervention group compared with usual care.

The authors did not find significant differences in hospitalizations or ED visits in the 30 days following discharge between patients interacting with the RNCL compared with usual care. Additional research could be conducted to further this study to understand the impact on 30-day readmissions and/or ED admissions. The RNCL role does provide direct care to patients and serves as a facilitator between the ambulatory care management and the patient during the hospital stay. However, as demonstrated by our study, not all patients enroll in care management post-discharge and, thus, may not benefit from reductions in risk of readmissions. The authors found that many subjects enrolled in the MCCT program, which has been shown to reduce hospitalization; however, not all care transitions programs have shown reduction in hospitalization (Leppin et al., 2014). Other programs have a different focus, such as referrals to specialists in the ICS practice (Elrashidi et al., 2018). These programs do not have a specific focus on reducing hospital readmissions. This variation in enrollment and program focus may explain why our findings for our secondary outcomes were not significantly different across groups.

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