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Enhanced Transitions of Care: Centralizing Discharge Phone Calls Improves Ability to Reach Patients and Reduces Hospital Readmissions

Kristin A. Schuller, Bita A. Kash, Larry D. Gamm

Introduction

In the U.S. healthcare system, hospital readmissions tend to be common and costly (Joynt and Jha, 2012; Kangovi and Grande, 2011), occurring in approximately 20% of discharged patients (Harrision et al., 2011; Misky et al., 2010), and can affect Medicare payment to hospitals. Hospital readmissions impose grave problems to the healthcare system and its care recipients including increased spending and cost of care, decreased quality of care, and added burden to patients and families (Johnson et al., 2013). As part of the Affordable Care Act, the Centers for Medicare & Medicaid Services (CMS) started publishing hospital readmission rates in 2009. As a result, hospitals have been subject to adjusted Medicare payment rates based on “excess” readmission rates (Axon and Williams, 2011).

According to CMS, a hospital readmission is defined and measured as a patient hospital admission that occurs within 30 days of a patient hospital discharge (Centers for Medicare & Medicaid Services, n.d.; Fontanarosa and McNutt, 2013). Payment reforms intended to reduce length of hospital stays may contribute to higher rates of hospital readmissions and operating costs for hospitals (Alper et al., 2015).

Hospital readmissions tend to be variable (Joynt and Jha, 2012; Kangovi and Grande, 2011). In 2003–2004, 19.5% of Medicare beneficiaries experienced a hospital readmission (Gruneir et al., 2011; Kassin et al., 2012; Sweeney, 2013), which was significantly higher than the readmissions among Medicaid and privately insured, 10.7% and 6.3%, respectively (Kripalani et al., 2014). Related to admission severity, medical patients had a higher percentage of hospital readmissions than surgical patients, 16.1% and 12.7%, respectively, and readmitted patients averaged 2.8 comorbidities compared with 2.1 comorbidities in nonreadmitted patients (Lawson et al., 2013).

There are several explanations for these observed variations in readmission rates; hospitalized patients are often discharged before they are fully recovered and prepared to go home (Forster et al.,

Background: The discharge phone call (DPC) is an important initiative aimed at improving transitions of care and reducing readmissions. It is of added importance as financial penalties will be imposed on hospitals with “excessive” Medicare readmissions. This study examines the impact of DPCs on percentages of patients reached through the DPCs and hospital readmission rates based on the centralized or noncentralized mode of DPCs.

Methods: The health system centralized the Studer Group Discharge Phone Call program into one central call center with the goals of reaching more discharged patients and to ultimately reduce hospital readmissions. The study analyzed hospital visits from 74,754 patient admissions that could result in an unplanned hospital readmission. Hospital discharge data were analyzed from August 2010 to January 2014. Primary outcomes included DPCs reaching discharged patients and effects on hospital readmission rates as a result of centralizing the DPC program.

Results: Centralized DPCs are significantly associated with increases in the percentage of patients reached by the DPC, which in turn reduces readmissions rates. Patients not reached were 1.32 times more likely to be readmitted than patients reached by centralized DPCs.

Conclusions: Centralizing the DPC program within a call center helps reach more patients and reduce readmission rates further compared with noncentralized DPCs.

Keywords: transitions of care, discharge phone call, hospital readmissions, quality of care

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2003; Takahasi et al., 2013), failure of the patient to understand the physicians’ orders, lack of follow-up care postdischarge, reoccurrence of illness (Costantino et al., 2013; Vinson et al., 1990), lack of social support after discharge (Joynt and Jha, 2012), failures in filling prescriptions and medication adherence (Melton et al., 2012), poor provider-to-patient communication and care coordination during discharge, and poor discharge planning (Alper et al., 2015; Harrison et al., 2011; Johnson et al., 2013; Takahasi et al., 2013; Vinson et al., 1990). One factor, lack of primary care provider follow-up, can result in 10 times higher risk of readmission (Takahasi et al., 2013).

Extensive research on this topic has concluded that a majority of observed hospital readmissions can be prevented and avoided (Axon and Williams, 2011; Harrison et al., 2011; Melton et al., 2012; Takahasi et al., 2013; Barth, 2001; Vinson et al., 1990). The BOOST study analyzed pre- and postimplementation of a set on tools (including “admission risk assessment,” discharge checklists, “teach back use,” “mandate regarding discharge summary completion,” and discharge phone calls [DPCs]) on readmissions (Hansen et al., 2013). The researchers found that the average readmission rate declined among patients in the intervention group (14.7% preintervention and 12.7% postintervention) compared with readmissions among patients in the control units (14.0% and 14.1%, respectively) (Hansen et al., 2013). Boston University’s Project Red used a three-pronged approach to analyzing readmissions; in that, readmissions are a result of problems within the system, clinical processes, and/or patients themselves (Greenwald and Jack, 2009). Project Red used a “discharge advocate” to coordinate care; an “after-hospital care plan” to document all of the patient’s medical, medication, and follow-up information; and finally, a DPC performed by a pharmacist within 3 days of discharge (Greenwald and Jack, 2009). The overall result of the project was a reduction in readmissions (Greenwald and Jack, 2009).

Similar to previous studies, this study analyzed the impact of a hospital-based tool, the DPC, on hospital readmission rates. The DPC is used to follow up with patients postdischarge, improve patient satisfaction, and improve clinical outcomes (Alper et al., 2015; Barth, 2001; Dudas et al., 2001; Schuller et al., 2013; Setia and Meade, 2009; Shupe, 2014). The DPC is intended to answer questions that the discharged patient may have, determine patient pain levels, clarify medication understanding and adherence, and ensure primary care provider follow-up (Coleman et al., 2006; Dudas et al., 2001; Greenwald and Jack, 2009; Schuller et al., 2013). DPCs may prove to be a key patient safety and quality-of-care initiative, especially now with the drive to discharge patients quicker than ever (Barnes, 2000), sometimes before they are prepared to leave the hospital (Forster et al., 2003). Patients who received a DPC reported being more satisfied with their care than patients who did not receive a phone call, 86% and 61% very satisfied, respectively (Dudas et al., 2001). Furthermore, patients who received a DPC were significantly less likely to be readmitted to the emergency room than patients who did not receive a DPC (Dudas et al., 2001). From the perspective of a system, a DPC provides the opportunity to assess the discharge process for problems or inefficiencies in order to make changes for optimal care and allows the patient to comment on the hospital and staff’s overall performance during the discharge process (Barnes, 2000). Effective design and implementation of DPC protocols within the hospital setting to further reduce readmission rates is of great interest for both research and practice.

One important decision pertaining to the DPC program is whether the program should be operated within a centralized unit or decentralized within each discharge unit. There are pros and cons to each approach. Decentralized DPCs allow the attending nurses to follow-up with their patients postdischarge, and patients may feel more comfortable discussing their postdischarge with a nurse whom they know. However, the difficulty of
fitting DPCs into the day-to-day activities of the unit nurse can make it more difficult for these nurses to reach patients. Finally, some unit nurses are reportedly more comfortable performing DPCs and more successful in completing DPCs than other unit nurses, which leads to consistency, training, and quality-of-care problems. Conversely, with centralized DPCs, only the select few callers need to be trained and held accountable, which improves consistency and quality of phone calls; however, these nurses did not provide direct care to patients and may not be as familiar with each patient’s specific situation or be able to gain the patient’s trust as easily. In the end, research shows that a centralized DPC program is more effective than a decentralized DPC program because all of the data collected from the DPCs is received and reviewed by one unit, which improves accountability and benchmark comparability (Shupe, 2014).

There is limited research, however, on the overall effectiveness of DPCs, particularly related to its efficacy in reaching patients and impact on reducing hospital readmissions. This study attempts to answer prominent questions pertaining to the DPC, including: what proportion of the targeted patients is reached through the DPC, does reaching these patients help reduce readmissions, does centralization of the DPC program help to reach more of the targeted patients, and is there a difference in readmissions among those reached by decentralized DPCs versus centralized DPCs.

The purpose of this study was to determine if centralization of DPCs from the individual discharge units to a main call center would increase the percentage of patients reached by the DPC and further decrease the rate of 30-day hospital readmissions. The hypothesis is threefold: (1) patients are more likely to be reached through centralized versus decentralized DPCs, (2) the rate of hospital readmissions will be lower if the patient is reached by the DPC than if the patient is not being reached by the DPC, and (3) readmission rates will be lower after centralization than before centralization. The basis for these hypotheses is founded in previous research and discussions with the health system staff: (1) centralized DPCs are more effective at gathering patient information, better able than unit nurses to make repeated calls, and therefore should be able to reach more patients; (2) patients reached by a post-DPC have lower readmission rates; (3) if our results indicate that centralizing the DPC program truly reaches more patients, then fewer readmissions should occur after centralization.

**Methods**

This study analyzed hospital discharge data from a 700-bed academic medical center located in the southeastern United States that serves over 170,000 patients annually. The health system operates four inpatient facilities, as well as multiple centers and outpatient clinics.

**The Discharge Phone Call Program**

In 2006, the health system began implementation, in partnership with Studer Group, of a set of tools for improving quality, patient satisfaction, and nurse engagement. In 2008, the health system commenced the Studer Group-designed DPC program. The DPC asks discharged patients questions covering five major areas: (1) are you feeling better today than when you left the hospital; (2) questions about discharge instructions; (3) have you been able to fill your prescriptions; (4) did our staff review your follow-up appointments or the process for scheduling your follow-up; (5) any other questions? Within each of these five categories, there are categorical responses that the patient may provide. The health system commented that 70–80% of the completed DPCs require some form of action, including: reinforcing discharge instructions, providing advice and education related to the medical problem, clarifying discrepancies in medication dosage, clarifying miscommunications, and provider or pharmacy follow-up.
The Studer Group model for DPCs called for a decentralized approach to increase the likelihood that the patient might recognize the unit nurse caller and thus respond, and to rely on the unit nurse’s familiarity with the patient to gain fuller information from the discharged patient whom the nurse had cared for. When implemented, nurses within the care units from which the patients were discharged initially conducted the DPC and recorded the results. However, the difficulty of fitting DPCs into the day-to-day activities of the unit nurse reportedly made it difficult for these nurses to reach patients. Also, some managers within the health system reported that some unit nurses were more comfortable with doing the DPCs and more successful in completing DPCs than other unit nurses. Subsequently, the health system decided to centralize the DPC program into the hands of a special group of nurses encompassing discharged patients from all units. As a result of switching to centralized DPCs, the health system hired experienced registered nurses and ensured that they had expertise in the specific illnesses of the patients for whom they were responsible for calling. These centralized groups of nurses received individualized training with a preceptor for 3 months. Further training on patients with disease-specific conditions that tend to be susceptible to high readmissions (i.e., chronic obstructive pulmonary disease, diabetes, and stroke) was also provided. With centralized DPCs, formalized protocols were put into place, including: all calls are recorded; calls are monitored; documentation is reviewed; and feedback is provided to each nurse.

Centralized nurses called patients within 96 hours of discharge. Some DPCs occurred within 24 hours of discharge but most occurred between 48 and 72 hours of discharge. The nurses within the centralized DPC unit are required to call each patient three times. If the patient was reached on the first attempt, no further calls were made. If the patient was not reached after the third attempt, the nurse recorded in the DPC system that the patient was not reached, but may continue to try to reach the patient. Approximately 30% of DPCs are completed with informal caregivers rather than the patients themselves.

The DPC program centralization began in stages. Only departments that switched from decentralized DPCs to centralized DPCs were included in this analysis.

**Data Collection**

Institutional review board approval was granted by both the hospital and Texas A&M University, College Station, TX. Retrospective hospital discharge data were collected from the health system from July 2009 to December 2013. Readmissions were flagged in the patient medical record and were defined as a patient returning to the hospital within 30 days of discharge for a similar condition or complication (Centers for Medicare & Medicaid Services, n.d.; Health Policy Brief: Medicare Hospital Readmissions Reduction Program, 2013). Four data sets were obtained from the hospital, including data on readmissions, DPCs, patient diagnoses, and patient hospitalization \((n = 121,920)\). The data set contained pre- and post-centralization flags to identify the discharges and readmissions that occurred before and after centralization of the DPC program. Any discharge that was not coded with this pre- and postcentralization flag was removed from the analysis, most of which were from a pediatrics or psychiatry unit. Owing to the probability of higher readmissions and inability to answer DPCs, children younger than 18 years were excluded from the analysis. Any initial discharge recorded as a death was excluded from the analysis due to the inability of that patient to receive a DPC and incur a readmission. Any discharge that occurred in January 2014 was also removed as a result of needing 30 days postdischarge to measure readmissions. December 31, 2013 was the last month included in this analysis.

For the health systems’ readmission data, there were 12,180 all-cause readmissions in the initial data set. Several
categories of patients were removed due to their higher likelihood of having a scheduled readmission and as a result of their exclusion from Medicare’s financial penalty for excess readmissions including chemotherapy (1,263 discharges), dialysis (59 discharges), rehabilitation (0 discharges), psychiatry (768 discharges), delivery (344 discharges), and radiation (96 discharges). After these exclusions, there were 10,488 readmissions identified and coded in the data set. The readmissions data and patient discharge data were merged and used in this analysis to determine the impact of DPC centralization and reaching the patient with the DPC on hospital readmissions ($n = 74,754$).

The dependent variable is the hospital’s readmissions rate. The readmissions rate was measured as the total number of patients readmitted to the hospital within 30 days of discharge over the total number of discharges. As in previous studies, this study analyzed hospital readmission rates as percentages instead of as raw numbers (Dudas et al., 2001; Joynt and Jha, 2012; Philbin et al., 2001). The two main independent variables are reaching the patient with the DPC (yes and no) and centralization of the DPC program (before and after). The control variables pertain to the patient’s severity, including severity of illness (none, mild, moderate, and severe), age (18–40, 41–64, and 65+ years), and primary payer (Medicare, Medicaid, Private, self-pay, and other), and were controlled for because of their confounding nature and potential effect on the results of the study. Other patient variables of interest include sex (female and male), race (White, Black, Asian, and other), admission status (emergency, urgent, trauma, and other), and discharge location (home for routine care, home healthcare, another rehabilitation center, skilled nursing facility, cancer center or children’s hospital, other long-term care hospital, and unknown).

**Analysis**

Descriptive statistics were obtained to determine the population discharge characteristics of this health system for three periods: overall, before centralization, and after centralization. Bivariate analysis assessed the readmissions rate, readmissions rate by reaching the patient through the DPC, and impact of centralization on reaching the patient regardless of readmission.

Independent two-sample $t$-tests, analyzed the mean number of readmissions by centralization of the DPC program and whether the patient was reached by the DPC. Interaction variables were analyzed to determine if the readmissions rate was impacted by reaching the patient or not reaching the patient before and after centralization of the DPC.

Multivariate logistic regression analyzed the impact of reaching the patient through the DPC and centralization of the DPC program on hospital readmissions rate. The results were stratified by patient’s age, primary payer, and severity of illness in order to control for potential confounding.

**Results**

The data contained 74,754 hospital admissions that could result in an unplanned hospital readmission. Basic patient demographic information as collected and analyzed. The largest groups in the patient population were adults 41–64 years old, female, White, and whose primary payer was Medicare or private insurance (Table 1). For severity, the population of admissions had mild severity of illness, a length of stay less than 6 nights, were discharged to their homes for routine care, and were admitted for an emergency or elective. The patient DPC log reports which patients were reached with centralized DPCs than decentralized DPCs. When analyzing the percentage of patients reached by the DPC before and after centralization for all discharges including...
**Table 1. Population Demographics of Hospital Admissions That Could Result in an Unplanned Readmission, n = 75,754**

<table>
<thead>
<tr>
<th>Patient characteristics</th>
<th>Total (%)</th>
<th>Before centralization (%)</th>
<th>After centralization (%)</th>
<th>p-value$^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18–40</td>
<td>29.98</td>
<td>33.59</td>
<td>26.82</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>41–64</td>
<td>42.49</td>
<td>40.10</td>
<td>44.58</td>
<td></td>
</tr>
<tr>
<td>65–84</td>
<td>27.53</td>
<td>26.31</td>
<td>28.59</td>
<td></td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Female</td>
<td>57.67</td>
<td>61.21</td>
<td>54.58</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>42.33</td>
<td>38.79</td>
<td>45.42</td>
<td></td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
<td></td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>White</td>
<td>58.50</td>
<td>57.76</td>
<td>59.14</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>37.14</td>
<td>36.51</td>
<td>37.69</td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>0.63</td>
<td>0.70</td>
<td>0.57</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>3.74</td>
<td>5.03</td>
<td>2.61</td>
<td></td>
</tr>
<tr>
<td><strong>Primary payer</strong></td>
<td></td>
<td></td>
<td></td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Medicare</td>
<td>40.33</td>
<td>36.85</td>
<td>43.39</td>
<td></td>
</tr>
<tr>
<td>Medicaid</td>
<td>13.58</td>
<td>15.30</td>
<td>12.06</td>
<td></td>
</tr>
<tr>
<td>Private</td>
<td>32.37</td>
<td>33.80</td>
<td>31.12</td>
<td></td>
</tr>
<tr>
<td>Self-pay</td>
<td>9.11</td>
<td>9.66</td>
<td>8.64</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>4.61</td>
<td>4.39</td>
<td>4.80</td>
<td></td>
</tr>
<tr>
<td><strong>Severity of illness</strong></td>
<td></td>
<td></td>
<td></td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>None/unknown</td>
<td>23.02</td>
<td>26.41</td>
<td>20.06</td>
<td></td>
</tr>
<tr>
<td>Mild</td>
<td>37.47</td>
<td>38.70</td>
<td>36.39</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>30.84</td>
<td>28.21</td>
<td>33.14</td>
<td></td>
</tr>
<tr>
<td>Severe</td>
<td>8.66</td>
<td>6.67</td>
<td>10.41</td>
<td></td>
</tr>
<tr>
<td><strong>Length of stay</strong></td>
<td></td>
<td></td>
<td></td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>&lt;6 nights</td>
<td>73.17</td>
<td>75.39</td>
<td>71.23</td>
<td></td>
</tr>
<tr>
<td>&gt;6 nights</td>
<td>26.83</td>
<td>24.61</td>
<td>28.77</td>
<td></td>
</tr>
<tr>
<td><strong>Discharge location</strong></td>
<td></td>
<td></td>
<td></td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Home</td>
<td>64.24</td>
<td>70.41</td>
<td>58.84</td>
<td></td>
</tr>
<tr>
<td>Home health</td>
<td>24.42</td>
<td>20.01</td>
<td>28.29</td>
<td></td>
</tr>
<tr>
<td>Rehabilitation facility</td>
<td>4.49</td>
<td>3.90</td>
<td>5.01</td>
<td></td>
</tr>
<tr>
<td>Skilled nursing facility</td>
<td>2.46</td>
<td>2.02</td>
<td>2.85</td>
<td></td>
</tr>
<tr>
<td>Long-term care hospital</td>
<td>0.25</td>
<td>0.23</td>
<td>0.26</td>
<td></td>
</tr>
<tr>
<td>Other/unknown</td>
<td>4.13</td>
<td>3.43</td>
<td>4.75</td>
<td></td>
</tr>
<tr>
<td><strong>Admission status</strong></td>
<td></td>
<td></td>
<td></td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Emergency</td>
<td>38.80</td>
<td>34.65</td>
<td>42.43</td>
<td></td>
</tr>
<tr>
<td>Urgent</td>
<td>28.95</td>
<td>32.42</td>
<td>25.90</td>
<td></td>
</tr>
<tr>
<td>Trauma</td>
<td>1.84</td>
<td>1.01</td>
<td>2.57</td>
<td></td>
</tr>
<tr>
<td>Elective</td>
<td>30.41</td>
<td>31.92</td>
<td>29.10</td>
<td></td>
</tr>
</tbody>
</table>

$^a$p-value represents the significance associated with the population characteristics, pre- and postcentralization.

All readmissions and non-readmissions (Hypothesis 1), there was a significantly higher percentage of patients reached by the DPC after centralization than reached by the DPC before centralization, 72.66% and 41.44%, respectively ($p < .0001$). The second hypothesis stated that the rate of readmissions will be lower among patients reached by the DPC. The results indicate that there were significantly higher readmission rates among patients not reached by the DPC than patients reached by...
the DPC, 15.44% and 13.23%, respectively (p < .0001). The overall trend indicates that a higher percentage of patients are being reached after centralization of the DPC program than before centralization.

Independent two-sample t-tests analyzed our third hypothesis that readmission rates would be lower after centralization. The results indicate that there was no significant difference in the percentage of readmissions before centralization by reaching the patient with the DPC or not reaching the patient with the DPC (p = .7224) (Table 3). By contrast, after centralization the readmissions rate among patients reached by the DPC was 13.40%, which is significantly lower than the readmission rate among patients not reached by the DPC after centralization, 20.66% (p < .0001). There was no significant difference when comparing across centralization (before and after) by reaching the patient (p = .1717); however, the readmission rate was significantly higher in patients not reached by the DPC after centralization (20.66%) than in patients not reached by the DPC before centralization (12.77%); p < .0001.

According to Table 2, centralized DPCs reach about twice as many of the discharged patients than that of those reached by decentralized DPCs. With this fact in mind, Table 3 suggests that centralized DPCs may reach more patients, some of whom remain noncompliant, but those discharged patients not reached by centralized DPCs are likely to include proportionately more of the most socially isolated or resistant to DPC contact or may be most noncompliant with post-discharge guidance. Thus, one would expect higher readmission rates among these more isolated or less compliant patients.

The multivariate logistic regression indicates that while controlling for patient severity characteristics (age, payer, and severity of illness) (Table 4), regardless of the DPCs being centralized or decentralized, patients not reached by the DPC after initial discharge from the hospital were 1.32 times more likely (odds ratio [OR]: 1.32; confidence interval [CI]: 1.261–1.385) to be readmitted than patients who were reached by the DPC. This finding supports our second hypothesis that patients reached will experience lower readmission rates.

### Table 2. Hospital Readmission Rates, Readmissions by Centralization, and Impact of Centralization on Reaching Patients for All Admissions

<table>
<thead>
<tr>
<th>Percentage</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-day all-cause readmission rate&lt;sup&gt;a&lt;/sup&gt;</td>
<td>14</td>
</tr>
<tr>
<td>Readmissions by DPC&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Reached by DPC</td>
<td>13</td>
</tr>
<tr>
<td>Not reached by DPC</td>
<td>15</td>
</tr>
<tr>
<td>Patients reached by the DPC before and after centralization&lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>DPC</td>
<td></td>
</tr>
<tr>
<td>Reached by DPC</td>
<td></td>
</tr>
<tr>
<td>Before centralization</td>
<td>41</td>
</tr>
<tr>
<td>After centralization</td>
<td>72.66</td>
</tr>
</tbody>
</table>

<sup>a</sup>Thirty-day all-cause hospital readmissions n = 10,831; no readmissions n = 64,743.

<sup>b</sup>Total discharges before centralization = 31,921. Total discharges after centralization = 35,049.

<sup>c</sup>Includes all hospital discharges (readmissions and non-readmissions). Percentages compare reached versus not reached by centralization.

DPC, discharge phone call.
When analyzing the impact of centralization versus decentralization on readmissions, regardless of whether the patient was reached or not reached by the DPC, (Hypothesis 3), patients were less likely to be readmitted before centralization than after centralization (OR: 0.820; CI: 0.782–0.860). For patient severity characteristics, patients aged 41–65 years were 1.35 times more likely to be readmitted than patients 65 years and older (OR: 1.35; CI: 1.259–1.436). No significant difference in readmissions was found in patients aged 18–40 years compared with patients 65 years and older (p = .4127). Patients with Medicare as their primary payer were significantly more likely to be readmitted to the hospital than the other primary payers, except Medicaid, in which there was no significant difference. Patients with the most severe illnesses were more likely to be readmitted than their counterparts with less severe conditions.

The final logistic regression (Table 5) analyzes the readmissions rate by the interaction between centralization and reaching the patient with the DPC, controlling for patient severity variables. The results indicate that before centralization, there was no significant difference in the likelihood of a patient being readmitted whether they were reached or not reached with the DPC (p = .6452). Conversely, after centralization of the DPC program, patients not reached by the DPC were 1.64 times more likely to be readmitted than patients reached by the DPC after centralization (OR: 1.64; CI: 1.544–1.748). This finding combines all three of our hypotheses into one by stating that patients not reached by the DPC after centralization were 1.64 times more likely to be readmitted than patients reached by the DPC after centralization.

**Discussion**

The results of this analysis support our hypotheses: (1) centralization of the DPCs to a central call center was more effective in reaching patients than DPCs being performed independently by unit nurses within the individual discharge units, (2) reaching patients will lower the hospital’s readmissions rate, and (3) readmission rate will be lower after centralization. Furthermore, not only were more patients

<table>
<thead>
<tr>
<th>Effect</th>
<th>Point estimate</th>
<th>95% Wald confidence limits</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did not reach patient with DPC</td>
<td>1.322</td>
<td>1.261–1.385</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Reached patient reference</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before centralization</td>
<td>0.820</td>
<td>0.782–0.860</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>After centralization reference</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient age (years)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18–40</td>
<td>0.968</td>
<td>0.896–1.046</td>
<td>.4127</td>
</tr>
<tr>
<td>41–64</td>
<td>1.345</td>
<td>1.259–1.436</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>65+ references</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary payer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>0.639</td>
<td>0.564–0.724</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Self-pay</td>
<td>0.589</td>
<td>0.535–0.648</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Private insurance</td>
<td>0.797</td>
<td>0.749–0.849</td>
<td>&lt;.0001</td>
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<tr>
<td>Medicaid</td>
<td>0.956</td>
<td>0.884–1.033</td>
<td>.2557</td>
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<tr>
<td>Medicare reference</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Severity of illness</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None/unknown</td>
<td>0.290</td>
<td>0.266–0.317</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Mild</td>
<td>0.445</td>
<td>0.412–0.481</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Moderate</td>
<td>0.723</td>
<td>0.670–0.780</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Severe reference</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

**Table 3. Independent Two-Sample t-Test of Readmission Rates by Centralization Depending on Whether the Patient Was Reached and Not Reached by the Discharge Phone Call (DPC)**

<table>
<thead>
<tr>
<th></th>
<th>Before centralization</th>
<th>After centralization</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reached by DPC (%)</td>
<td>13</td>
<td>13</td>
<td>0.1717</td>
</tr>
<tr>
<td>Not Reached by DPC (%)</td>
<td>13</td>
<td>21</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>p-value</td>
<td>0.7224</td>
<td>&lt;.0001</td>
<td></td>
</tr>
</tbody>
</table>
being reached after centralization, more patients with severe conditions that warrant higher readmissions were being reached (i.e., patients 65 years and older, on Medicare, and with moderate to severe conditions). The DPC is a valuable tool used to enhance patient quality of care after discharge, improve continuity of care, and reduce preventable readmissions.

The findings on this study contribute to the current readmissions and DPC literature by analyzing the concept and impact of DPC centralization. Centralization is a key aspect of DPCs and has a link to readmissions. By centralizing DPCs, more patients are reached by the DPC and fewer patients are readmitted. These results also contribute to the practice of quality improvement within hospitals. By creating a centralized DPC program, hospitals can reduce their readmissions and, as a result, suffer fewer financial penalties. Future research is needed to assess the actual phone conversation for appropriateness and effectiveness, as well as, other community-based practices to ensure continuity of high-quality care postdischarge.

Our findings support prior research that the DPC is a valuable tool in transitional care. Researchers found that patients were 1.3 times more likely to be readmitted if they were not reached by the follow-up phone call than patients who were reached (Harrison et al., 2014). Patients reached by the DPC had lower readmissions (15%) than patients not reached by the DPC (25%) (Dudas et al., 2001). Similarly, patients reached by the DPC were significantly less likely to be readmitted than patients not reached by the DPC and those who were not called altogether with readmissions at 5.8%, 8.6%, and 8.3%, respectively (Harrison et al., 2014). Finally, patients enrolled in a DPC program had a readmission rate around 1% compared with the 6% overall hospital readmission rate (Kerns, 2012).

<table>
<thead>
<tr>
<th>Table 5. Logistic Regression of Readmissions by the Interaction of Centralization and Reaching the Patient With the Discharge Phone Call (DPC) Controlling for the Patient Severity Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effect</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>Odds ratio estimates before centralization × reach through DPC</td>
</tr>
<tr>
<td>Not reached by DPC</td>
</tr>
<tr>
<td>Reached reference</td>
</tr>
<tr>
<td>Age (years)</td>
</tr>
<tr>
<td>Primary payer</td>
</tr>
<tr>
<td>Severity of illness</td>
</tr>
<tr>
<td>Odds ratio estimates after centralization × reach through DPC</td>
</tr>
<tr>
<td>Not reached by DPC</td>
</tr>
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<td>Age (years)</td>
</tr>
<tr>
<td>Primary payer</td>
</tr>
<tr>
<td>Severity of illness</td>
</tr>
</tbody>
</table>
older, on Medicare, with moderate to severe conditions. One might anticipate that the approximately 30% not reached by centralized DPCs might also include high-risk patients, but those who are more isolated or otherwise less responsive to efforts to reach out to them. Thus, this group appears most likely to be readmitted. In 2014, 2,592 hospitals were penalized for excessive readmissions, costing around $420 million (Rau, 2015). Quality-of-care interventions need to be successfully implemented to reduce preventable readmissions and avoid financial penalties.

There are several limitations in this study. One is the lack of external community-based data that could offer an explanation for rising readmission rates. There could be several external variables that impact patient readmissions, including access to a primary care provider, family support at home to aid in recovery, access to a pharmacy for medications, disease severity, or patient demographics. For example, readmissions for heart failure have been associated with lower income neighborhoods (Philbin et al., 2001). Without this external data, researchers cannot offer alternative insights into the root cause of the reported hospital readmissions.

Another limitation pertains to the retrospective nature of the study. We were unable to obtain further information if we found gaps in the medical record data. The data did not contain information on the phone call discussion between the patient and the discharge phone caller. This information could inform researchers if the call identified unresolved patient issues or new symptoms, determine if the patient sought primary care postdischarge or had problems with the discharge or medication instructions. Further qualitative research on this limitation is needed to more comprehensively grasp the impact of DPCs on hospital readmissions.

The patient population may also pose as a limitation. This study may have been impacted by changing patient characteristics over the study period including payer mix, socioeconomic status, health status, healthcare-related behaviors, and healthcare system utilization habits. Furthermore, readmissions may be a result of disease severity and not necessarily patient responsiveness to the DPC.

Finally, other studies have found that coinciding quality improvement interventions may have impacted the results of the DPC (Bahr et al., 2014). In this case, there were no other quality improvement interventions underway during the time of the DPC program.

Conclusion
This study demonstrates that the centralization of a DPC program can significantly increase the proportion of discharge patients reached by DPCs over that of a decentralized program and further reduce hospital readmissions. The study also supports the notion that policies seeking reduction in hospital readmissions should give added support for researching the complexities of postdischarge strategies and processes that can bring about relatively greater reductions in readmissions.

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The authors declare no conflicts of interest.

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