

Development of an Emergency Department Case Management Case-Finding Tool

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ABSTRACT

Purpose of Study: Identifying emergency department (ED) patients who are at high risk for return visits is an important goal for case management to improve patient care. This quality improvement study describes the development and evaluation of the Emergency Department Case Management Priority Score (EDCMPS), an electronic medical record (EMR)-based “case-finding” system, and its ability to identify these high-risk patients. In addition, the authors present data about its acceptability among emergency department case managers (ED CMs).

Primary Practice Settings: Emergency departments with case management availability and staffing.

Methodology and Sample: A retrospective analysis at Duke University Hospital ED compared patient data pre- and postimplementation of the EDCMPS. The tool was developed using the LEAN and Plan–Do–Study–Act (PDSA) quality improvement methodologies, with ED CM participation. ED return and hospitalization rates within 7 and 30 days between both methods were compared, and a survey evaluated CM satisfaction with the EDCMPS.

Results: The 2-month preintervention period (July 1, 2022, to August 31, 2022) included 8,677 patients discharged from the ED, with 897 patients (10.3%) identified as at high risk for return based on the previous manual methodology. In the 3-month postintervention period (September 1, 2022, to November 30, 2022), there were 13,566 patients discharged, with 692 patients (5.1%) identified as at high risk for return using the EDCMPS. The EDCMPS outperformed the manual method, yielding a significantly higher odds ratio (OR) for 7- and 30-day ED return or hospitalization (e.g., 30-day any return OR = 4.21 vs. 1.69). The survey showed broad ED CM agreement on the tool’s superior performance, especially in organizing outpatient resources and referring to support programs. However, challenges in securing primary care follow-up, housing, and health insurance applications were identified. The tool’s collaborative development approach ensured its fit to ED CM needs, contributing to its success.

Implications for Case Management Practice: The EDCMPS showcases promise in enhancing ED CM efficiency, with strong frontline staff endorsement. It pinpoints areas needing focus for patient support and has the potential to reduce ED revisits and therefore health care utilization. Its methodology offers insights for similar future implementations in health care institutions.

Key words: case finding, case management, clinical decision support, emergency department, health care utilization

In modern health care settings, case managers (CMs) have become an integral part of emergency departments (EDs) in large hospitals, working collaboratively with ED and inpatient or outpatient pro-

viders to enhance patient care (“CM Experts,” 2012; “ED Case Managers Are Crucial,” 2011; “ED Case Managers Save \$4.5 million,” 2011; “In a Dynamic Health Care Environment,” 2013). They are integral

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in improving hospital throughput and reducing unnecessary hospital admissions and readmissions. By bridging the gap between inpatient and outpatient care, ED CMs help alleviate barriers and streamline care transitions along the continuum of patient care, which may lead to decreased future health care utilization. Current literature highlights the various interventions ED CMs employ to achieve their goals in assisting both patients and hospitals (Bodenmann et al., 2017; Di Mauro et al., 2019; Lee & Davenport, 2006; Soril et al., 2015). These interventions encompass utilization management to ensure appropriate admissions, arrangements for post-acute care such as skilled nursing facilities or assisted living, and coordination of outpatient resources such as meals, home health aides, and durable medical equipment. In addition, ED CMs facilitate medical care follow-up with primary care providers (PCPs), specialists, and social work, as well as referrals to support programs for substance abuse, victims of violence, and other related services. Their role also extends to counseling patients, reviewing ED discharge instructions, helping with insurance coverage, securing housing, and developing personalized care plans for patients with high health care utilization that involve coordination with multidisciplinary teams. Furthermore, they contribute to clinical documentation improvement efforts.

Numerous systematic reviews have evaluated the effectiveness of ED CMs in achieving their objectives of providing optimal patient care. Several of these reviews conclude that ED CMs are likely to be effective in reducing future ED utilization (Althaus et al., 2011; Di Mauro et al., 2019; Moe et al., 2017; Raven et al., 2016; Soril et al., 2015; Van den Heede & Van de Voorde, 2016) and costs (Althaus et al., 2011; Di Mauro et al., 2019; Raven et al., 2016; Soril et al., 2015). Many of the reviews remark on the heterogeneity and variability of studies, therefore with an inability to perform meta-analysis because of these limitations.

ED CMs generally identify high-risk patients using a manual chart review process or by provider request to determine whether hospital admissions are appropriate or whether an alternative disposition for the patient exists (Hudon et al., 2017). In a scoping review, Marcoux et al. (2017) describe some tools that are available to improve “case finding”; however, most of these tools involve manual processes of chart review and patient interviews, which can be time intensive. The tools identified looked for health care utilization history, medical conditions, emotional health issues, and socioeconomic variables, which could be obtained from the electronic medical record (EMR). This manual case-finding process was identified as being inefficient and an area of opportunity for ED CMs at our institution as well. In

reviewing the medical literature on ED CM screening tools, the authors found no studies on developing and implementing an EMR-based screening tool. This is a significant gap in the current literature with an opportunity for ED CMs and therefore this project focused on addressing that gap.

To address this gap in the literature and enhance the efficiency of case finding, the authors sought to develop an innovative solution—the Emergency Department Case Management Priority Score (EDCMPS)—with the active input of ED CMs. The objective was to utilize the EMR to integrate this tool within the standard work of ED CMs, streamlining their decision-making process.

This quality improvement initiative involves observational retrospective analysis to assess the performance of the EDCMPS and to evaluate the satisfaction of CMs with the tool. The authors hypothesized that the EDCMPS would outperform the traditional manual methodology of case finding, effectively identifying patients at high risk for return to the ED. In addition, the authors anticipated that ED CMs would readily embrace the EDCMPS as a valuable addition to their practice.

METHODS

This research study aimed to develop and implement the EDCMPS at Duke University Hospital (DUH) using the LEAN and Plan-Do-Study-Act (PDSA) quality improvement methodologies. The EDCMPS was designed as an EMR-based “case-finding” system to aid ED CMs in identifying and providing support to patients with a potential for future ED visits. DUH is an academic tertiary-level referral medical center with 1,048 inpatient beds, and DUH ED is a Level 1 trauma center that cared for 76,000 patients in fiscal year 2023. During the study period, there were nine regular DUH ED CMs.

Participants

The study involved patients at the DUH ED who were not admitted and were subsequently discharged from the ED. The authors did not have access to data from the two other hospital sites within Duke University Health System (DUHS); however, the tool was available to their CMs to use and give feedback on. The satisfaction of all DUHS ED CMs who used the EDCMPS after its implementation was assessed by a survey.

EDCMPS Tool Development

The development of the EDCMPS began with focus group meetings involving CMs and leaders to

determine the variables that should be included in the scoring system. The selected variables included the following:

1. ED provider order or request for CM consultation.
2. Index hospitalization discharge within the previous 30 days indicating readmission risk if a patient is admitted.
3. EMR flag identifying patients with behavioral issues or complex care plans.
4. Patients with active hospice status.
5. Patients with ED triage level (2-5) (Shelton, 2009) and meeting the following criteria (ED Triage Level 1 were highly complex trauma patients, critically ill, who were always admitted):
 - a. Discharged to a skilled nursing facility or home with home health in the last 30 days,
 - b. Two ED visits in the last 30 days or one ED visit in the last 72 hr,
 - c. Age greater than 80 years,

- d. Age greater than 70 years and a fall within the last 3 months,
- e. No stable housing,
- f. Arrival to the ED from a skilled nursing facility or assisted living facility, and
- g. No health insurance and no primary care provider.

The variables were primarily chosen on the basis of expert opinions from CMs and leadership to ensure broad acceptance and understanding of the tool among CMs. Once the variables were selected, a weighted scoring system was developed, with risk thresholds for high-risk, medium-risk, and low-risk patients. Four variables were weighted high enough to ensure that CMs always intervened: ED consult order for CMs, prior ED or hospital utilization, complex care/behavioral flags, and hospice enrolled. The scores were visibly integrated into the EMR to facilitate CMs' workflow, with high-risk patients appearing at the top of the list, color-coded in red (see Figure 1).

ED Track Board (DUH ED)

Refresh

Arrival

Room

Registration

Dismiss

Admit

Tx Team

Open Chart

ED Manager

ED Map

Sign In

Edit Shifts

3

2A+ yellow; 2200 open to 10, 8200 open to 12. PEU open. D pod open to 11 • Please sign in to & carry your mobile phone at all times

All Patients (118)

Waiting Room (32)

To Be Admitted (22)

Ready for Discharge (10)

Consult to ED CM/CSW (1)

ED CM Worklist (56)

CM	Priorit	Bed	Bed Requ	TT	Complaint	A	Hosp Elig	30d	Duke We
1,505		B26	—	12:57	Shortness of Breath	3	0	IP - ED	—
1,005		D08	Ready...	07:13	Abdominal Pain	3	0	IP - IP	Y
1,004		WTNG	—	04:18	Shortness of Breath	3	0	OBS -...	—
1,001		8205-01	Ready...	16:18	Fever	2	5	IP - IP	—
1,000		A22	—	149:46	Psychiatric Evaluation	2	0	IP - ED	—
1,000		C34	—	05:25	Sickle Cell Pain Crisis; Chest Pain	2	0	IP - ED	Y
1,000		C41	—	12:43	Back Pain	3	0	—	Y
509		HALL G	—	02:47	Fall	3	0	IP - ED	Y
506		WTNG	—	02:59	Shoulder Pain	3	0	IP - ED	—
506		2210-01	—	30:05	Pain	4	0	IP - OBS	—
505		WTNG	—	00:56	Facial Swelling; Leg Injury	3	0	IP - ED	—
505		A53	—	22:39	Knee Pain	3	0	IP - ED	—
505		C36	—	02:18	Generalized Weakness	3	1	—	—
505		A23	—	04:33	Fall	2	0	IP - ED	Y
505		D04	—	45:38	Psychiatric Evaluation	2	0	—	—
505		D10	Assig...	07:11	Rectal Bleeding	2	0	IP - IP	Y
504		WTNG	—	05:31	Asthma	3	0	—	—
504		WTNG	—	04:16	Epistaxis	5	0	OBS -...	—
504		F13	—	16:31	Medication Refill	5	0	—	—
501		A51	—	01:01	Neurologic Problem	2	0	—	—
500		WTNG	—	00:01	abd pain	—	0	IP - ED	—
500		A19	—	00:11	Abdominal Pain	2	0	IP - ED	Y
500		OTF	—	31:21	Altered Mental Status; Hypotension	1	1	IP - ED	Y
9		A20	—	18:26	Fall	4	1	—	—
5		F12	—	06:58	Leg Swelling	3	0	—	—
5		D03	—	52:15	Shortness of Breath; Emesis	3	0	—	—
5		D01	Assig...	06:44	Fall	3	2	—	—

FIGURE 1

EDCMPS example screenshot. © 2023 Epic Systems Corporation. DUH = Duke University Hospital; ED = emergency department; EDCMPS = Emergency Department Case Management Priority Score.

To familiarize CMs with the EDCMPS, a rapid improvement event, regular meetings, frequent email reminders, and leadership rounding were conducted. Performance and results of the tool were made available on a Tableau-based website for performance management and feedback by CM leaders.

Study Variables

For the retrospective analysis of the EDCMPS, the independent variables were the manual case-finding methodology employed for the 2 months before the implementation of the EDCMPS (July 1, 2022, to August 30, 2022) and the EDCMPS for the 3 months after implementation (September 1, 2022, to November 30, 2022). Patients identified as at high risk for return pre-EDCMPS implementation were those with an ED CM note documented during their index ED encounters. The dependent variables included 7- and 30-day returns to the ED or hospitalization or both after their index ED encounter. Demographic variables, such as age, gender, race, ethnicity, financial class or payer, and ED triage acuity, were also compared between the two intervention groups.

Data Collection

Data from the electronic health record database were collected and stored in Tableau (Salesforce) by the DUHS performance services teams. The data were filtered on the basis of the study site, admission/discharge transfer class (ED), and specific dates mentioned earlier.

ED CM Survey

An electronic survey was developed and distributed via email invitation to CMs primarily working in the three EDs at DUHS (see Supplemental Material 1, available at: <http://links.lww.com/PCM/A17>). The survey consisted of seven questions using a Likert scale to gather their opinions on the tool's efficacy, ranging from "strongly disagree" to "strongly agree." In addition, one question asked whether the tool helped identify patients needing various interventions that CMs could provide.

Statistics

Baseline characteristics were reported as mean \pm standard deviation for continuous variables and as number and percentage for categorical variables. The performance of the EDCMPS in finding high-risk patients was described in terms of return number, return percent rate, and odds ratio with a 95%

confidence interval. The statistical analysis was conducted using JMP Pro 16.

Ethics

This study was approved by the institutional review board of Duke University as exempt without the need for informed consent.

RESULTS

The study evaluated the potential impact of the EDCMPS on reducing ED utilization at DUH. The 2-month preintervention period (July 1, 2022, to August 31, 2022) included 8,677 patients discharged from the ED, with 897 patients (10.3%) identified as at high risk for return based on the previous manual methodology. In the 3-month postintervention period (September 1, 2022, to November 30, 2022), there were 13,566 patients discharged, with 692 patients (5.1%) identified as at high risk for return using the EDCMPS.

Baseline characteristics of the two periods and systems were comparable, as shown in Table 1, indicating that any observed differences in outcomes are less likely to be influenced by demographic factors.

Table 2 presents the rates of return to the ED within 7 and 30 days for both groups, along with the odds ratios for both prediction systems. Notably, the odds ratio for any return to the ED or hospitalization was significantly higher for the EDCMPS than for the manual method for both 7- and 30-day periods. Specifically, the odds ratio for any 30-day return (ED or hospitalization) using the EDCMPS in September–November was 4.21 (95% CI [3.59, 4.95]) compared with 1.69 (95% CI [1.42, 2.02]) for manual case finding in July and August.

Figure 2 depicts the results of the DUHS emergency medicine CM survey, which sought feedback on their experience with the EDCMPS tool. The survey results showed broad agreement among CMs that the EDCMPS tool outperformed the manual methodology across the seven questions assessed.

Figure 3 shows the survey results that focused on whether the EDCMPS helped CMs identify patients who required various interventions. The data revealed that the EDCMPS was particularly helpful in assisting CMs with organizing outpatient resources for patients upon discharge to home, such as meals, home health services, and durable medical equipment. In addition, the tool proved effective in reminding CMs to refer patients to support programs, including those related to substance abuse, victims of violence, and psychiatric care. However, the EDCMPS was reported to be less helpful in alerting CMs to secure insurance and housing and ensure medical care follow-up.

TABLE 1
Baseline Characteristics

Characteristic	Preintervention (MCF) ^a (N = 8,677)	Postintervention (EDCMPS) ^b (N = 13,566)
Age, mean ± SD, years	38.83 ± 24.3	35.73 ± 24.4
Female gender, n (%)	4,556 (52.5%)	7,095 (52.3%)
Race, n (%)		
Black	3,693 (42.6%)	5,804 (42.8%)
White	3,267 (37.6%)	4,910 (36.2%)
Other/Not specified	1,717 (19.8%)	2,852 (21.0%)
Ethnicity, n (%)		
Hispanic	1,084 (12.5%)	1,839 (13.6%)
Non-Hispanic	7,081 (81.6%)	10,937 (80.6%)
Not reported/Declined	512 (5.9%)	790 (5.8%)
Financial class, n (%)		
Medicare	2,005 (23.1%)	2,673 (19.7%)
Medicaid	2,354 (27.1%)	4,108 (30.3%)
Commercial/Other	2,819 (32.5%)	4,678 (34.5%)
Self-pay/None	1,499 (17.3%)	2,107 (15.5%)
Triage acuity, mean ± SD	3.02 ± 0.78	3.07 ± 0.73

Note. EDCMPS = Emergency Department Case Management Priority Score; MCF = manual case finding.

^aPreintervention (July–August 2022).

^bPostintervention (September–November 2022).

Discussion

The development and implementation of the EDCMPS aimed to improve ED CMs' efficiency in identifying patients at high risk for future ED utilization. The results of this study demonstrate promising outcomes, indicating the potential effectiveness of the EDCMPS in achieving these objectives.

The EDCMPS was designed as an EMR-based “case-finding” system, guided by the LEAN and Plan–Do–Study–Act (PDSA) quality improvement methodologies. By involving ED CMs in the design process through focus group meetings, the selected variables for the scoring system were carefully chosen on the basis of expert opinions from both ED CM staff and leadership. This participatory approach ensured that the EDCMPS was well tailored to the specific needs and workflows of the ED CMs, leading to better acceptance and understanding of the tool.

The comparison of return rates to the ED within 7 and 30 days between the two groups revealed intriguing insights. Our findings demonstrate the odds ratio for any return to the ED or hospitalization was substantially higher for the EDCMPS group than for the manual case-finding method. This indicates a significant improvement in risk stratification and identification of patients who may benefit from targeted case management interventions. The EDCMPS was therefore more effective in accurately identifying patients who genuinely needed CM support and follow-up care after discharge. The EDCMPS is an automated tool within the electronic health record and therefore does not require any manual process or chart searching for cases by CMs. This efficiency allows ED CMs more time to be at the bedside with patients and families and spend less time searching for cases.

The positive feedback received from the DUHS ED CM survey further supports the effectiveness of the

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TABLE 2

Return Rates and Odds Ratios for Manual Case Finding (Preintervention) Versus the EDCMPS (Postintervention)^a

Group	7 day			30 day		
	Hospitalization	Return to ED	Any Return	Hospitalization	Return to ED	Any Return
Manual case finding (preintervention) ^b						
n (%)	36 (4.0%)	62 (6.9%)	98 (10.9%)	54 (6.0%)	124 (13.8%)	178 (19.8%)
OR [95% CI]	2.76 [1.89, 4.04]	1.28 [0.97, 1.69]	1.64 [1.31, 2.06]	2.43 [1.78, 3.31]	1.41 [1.15, 1.73]	1.69 [1.42, 2.02]
EDCMPS—high score (postintervention) ^c						
n (%)	30 (4.3%)	110 (15.9%)	140 (20.2%)	57 (8.2%)	216 (31.2%)	273 (39.5%)
OR [95% CI]	2.95 [1.99, 4.36]	3.05 [2.46, 3.79]	3.20 [2.63, 3.90]	3.50 [2.61, 4.69]	3.71 [3.13, 4.40]	4.21 [3.59, 4.95]

Note. CF = case finding; CM = case manager; ED = emergency department; EDCMPS = Case Management Priority Score; OR = odds ratio. Bold values indicate the odds ratios are significant and therefore added to improve visibility.

^aBold values indicate the odds ratios are significant.

^bPreintervention (July–August 2022). Total patients: N = 8,677. Manual CF with CM notes: N = 897.

^cPostintervention (September–November 2022). Total patients: N = 13,566; EDCMPS high score: N = 692.

EDCMPS. The survey demonstrated broad agreement among ED CMs that the EDCMPS tool outperformed the manual methodology across various dimensions including efficiency and accuracy of identifying high-risk patients. This positive response reflects ED CM endorsement of the tool's efficacy, ease of use, and overall satisfaction with its performance. Also, in the survey of the EDCMPS usage, it was found to be particularly helpful in organizing outpatient resources for patients upon discharge to home, including meals, home health services, and durable medical equipment. It facilitated

CMs in referring patients to critical support programs such as those related to substance abuse, victims of violence, and psychiatric care. These findings highlight the valuable role that the EDCMPS plays in streamlining ED CM processes and ensuring appropriate follow-up care for high-risk patients. It is of interest that our ED CMs did not find the tool useful in identifying patients who needed support in obtaining local primary care follow-up, obtaining housing, and applying for health insurance. Interventions based on these identifications could be key efforts in preventing return visits.

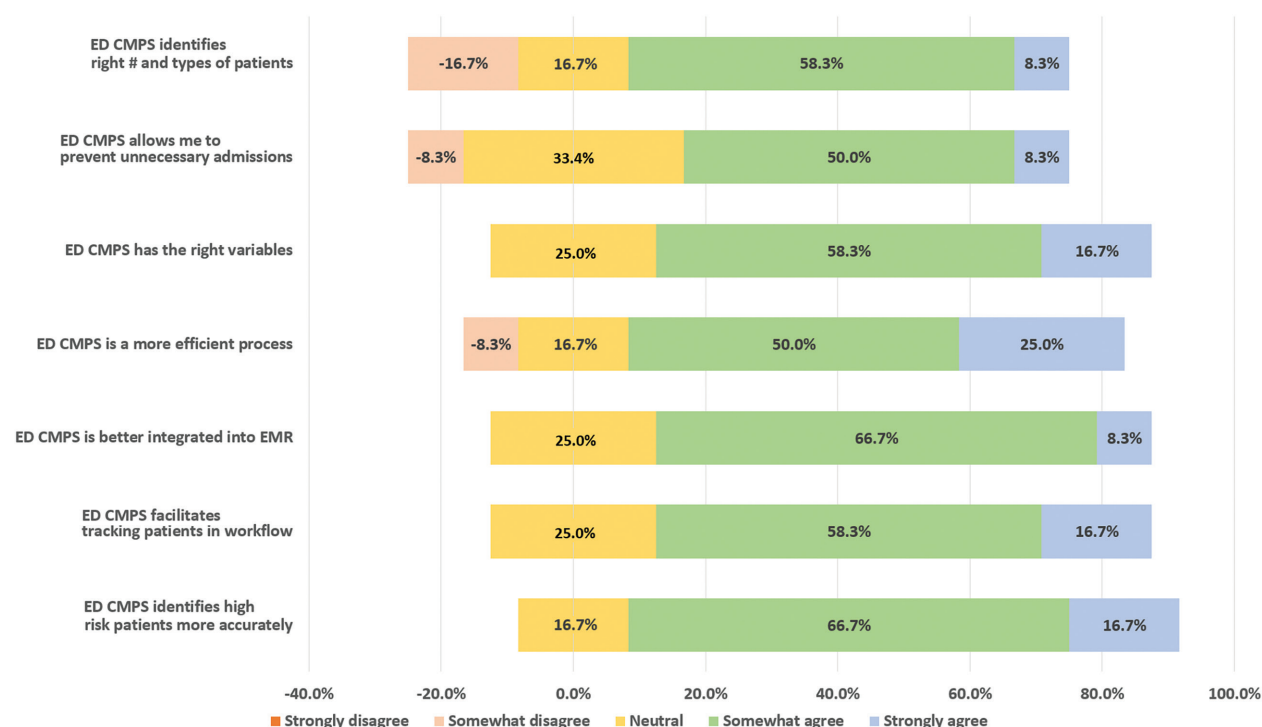


FIGURE 2

EDCMPS survey results: How did the EDCMPS perform compared with prior manual method of case finding. EDCMPS = Emergency Department Case Management Priority Score; EMR = electronic medical record.

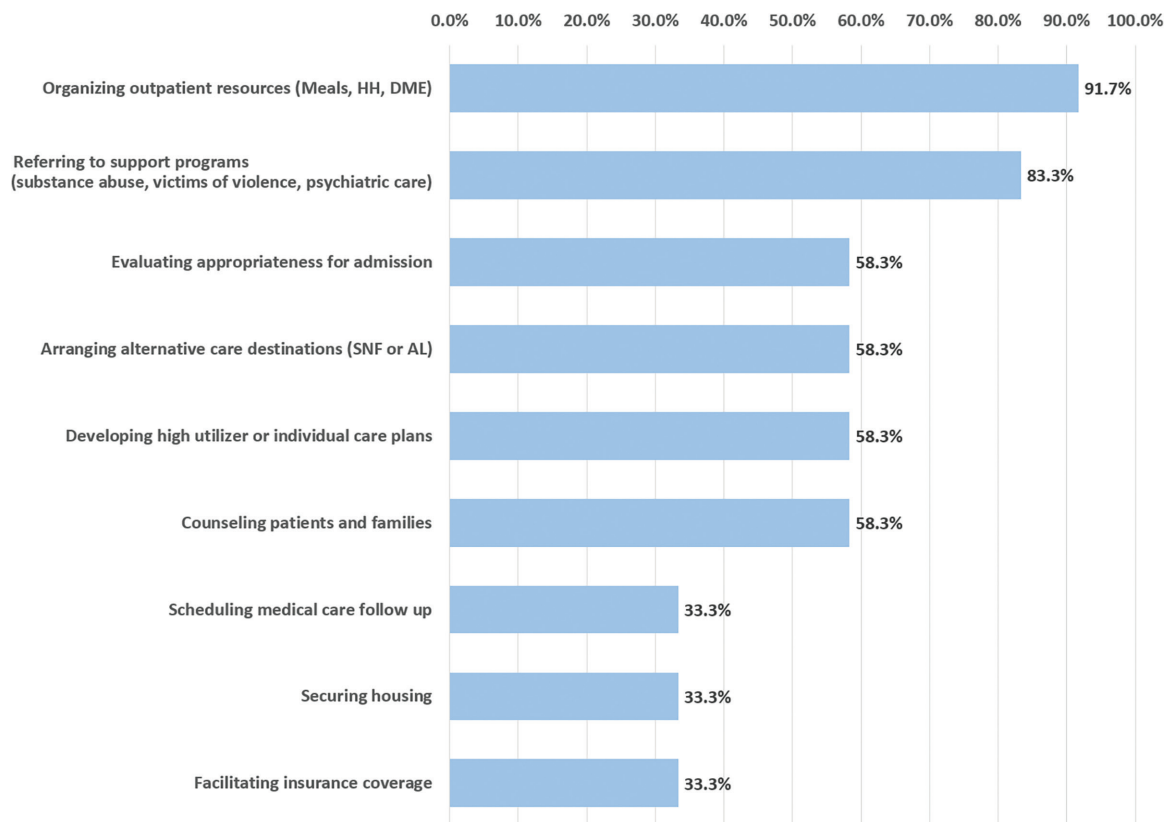


FIGURE 3

Survey results: Percent CMs answering “Yes” to whether the EDCMPS helped identify specific needs for high-risk patients that CMs could help with. AL = assisted living; CM = case manager; DME = durable medical equipment; EDCMPS = Emergency Department Case Management Priority Score; HH = home health; SNF = skilled nursing facility.

Challenges in PCP access may have negatively affected their expectations in this specific intervention. Housing resources have similarly been problematic. In addition, this study occurred in a state where, at the time of the study, Medicaid expansion had not occurred, which may have negatively affected perceptions of success in pursuing health insurance for these patients.

Overall, the results of this study indicate that the EDCMPS has shown promise in improving ED CM efficiency and accuracy in identifying high-utilization patients needing support and potentially reducing ED utilization. The combination of rigorous quality improvement methodology, development with frontline staff’s subject matter expertise, and real-world implementation contributed to the successful development and acceptance of the EDCMPS among ED CMs. The study’s findings warrant further investigation and refinement of the EDCMPS to continue enhancing patient care and optimizing ED CM processes. Moreover, the study’s methodology and findings offer valuable insights for other health care institutions seeking to implement similar EMR-based case-finding systems to improve patient outcomes, reduce resource utilization, and improve ED CM efficiency.

LIMITATIONS

This study has several limitations that need to be acknowledged. The EDCMPS variables were chosen on the basis of expert opinion rather than a regression analysis of all potential variables available in the EMR. If the study had started with regression analysis, it may have resulted in a model that was even more accurate. However, it was hoped that a new EDCMPS model and change in ED CM workflow would have the highest adoption if it was developed collaboratively with input from frontline ED CMs, as recommended by LEAN methodology. The model did result in overall fewer patients being identified as at “high risk” (10.3% in the manual method and 5.1% in the EDCMPS), which means for CMs to maintain the same levels of productivity they also need to see patients in medium-risk category (color coded orange in the score). Future iterations could also adjust the threshold level defining “high risk” to accommodate this same goal. This study was also limited to a single large academic medical center for data acquisition, so there are limitations to the generalizability of these findings to other facilities.

The integration of advanced automated tools within EMRs holds significant potential for enhancing the efficiency of case management, especially in hospital settings faced with resource limitations. Streamlining processes, such as eliminating the need for manual case identification, allows CMs to allocate more time to high-risk patients, potentially reducing recurrent ED visits.

IMPLICATIONS FOR CASE MANAGEMENT

The integration of advanced automated tools within EMRs holds significant potential for enhancing the efficiency of case management, especially in hospital settings faced with resource limitations. Streamlining processes, such as eliminating the need for manual case identification, allows CMs to allocate more time to high-risk patients, potentially reducing recurrent ED visits. Implementing scoring mechanisms, such as the EDCMPS, offers a systematic and superior alternative to traditional patient identification methods. When seamlessly incorporated into EMRs, these tools provide CMs in the ED with accurate, real-time data to inform their decision-making. Consequently, their adoption can lead to optimized workflows, fostering a more proactive and effective approach to patient care within the ED.

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