

## **Lessons and Outcomes of Mobile Acute Care for Elders Consultation in a Veterans Affairs Medical Center**

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## **ABSTRACT**

**Objective:** Describe the implementation and effects of Mobile Acute Care for Elders (MACE) consultation at a Veterans Affairs Medical Center (VAMC).

**Design:** Retrospective cohort analysis.

**Intervention:** Veterans aged 65 or older who were admitted to the Medicine Service between October 1, 2012 and September 30, 2014 were screened for geriatric syndromes via review of medical records within 48 hours of admission. If the screen was positive, the MACE team offered the admitting team a same-day consultation involving comprehensive geriatric assessment and ongoing collaboration with the admitting team and supportive services to implement patient-centric recommendations for geriatric syndromes.

**Results:** Veterans seen by MACE (n=421) were compared to those with positive screens but without consultation (n=372). The two groups did not significantly differ in age, comorbidity, gender, or race. All outcomes (30-day readmission, 30-day mortality, readmission costs) were in the expected direction for patients receiving MACE but did not reach statistical significance. Patients receiving MACE had lower odds of 30-day readmission (11.9% vs. 14.8%, odds ratio (OR) = 0.82, 95% confidence interval (CI) = 0.54, 1.25, p = 0.360) and 30-day mortality (5.5% vs. 8.6%, OR = 0.64, CI = 0.36, 1.12, p = 0.115), and had lower 30-day readmission costs (MACE \$15,502, CI = \$12,242, \$19,631; Comparison \$18,335, CI = \$14,641, \$22,962, p = 0.316) than those who did not receive MACE after adjusting for age and Charlson Comorbidity Index.

**Conclusion:** Our MACE consultation model for older Veterans with geriatric syndromes leverages the limited supply of clinicians with geriatrics expertise. Though not

statistically significant in this study of 793 subjects, MACE patients had lower odds of 30-day readmission and mortality, and lower readmission costs.

Key words: frail elderly, geriatric assessment, Veteran

## INTRODUCTION

In 2011, approximately nine million US Veterans were over the age of 65 years.<sup>1</sup> Older Veterans who receive medical care in the US Department of Veterans Affairs (VA) often have high levels of multimorbidity and have higher rates of functional impairment and cognitive impairment than age-matched non-Veterans or age-matched Veterans who are not accessing the VA for care.<sup>2</sup> When older Veterans are hospitalized for acute illness, geriatric syndromes including depression, cognitive impairment, frailty, difficulty walking, polypharmacy, and poor social support are often not identified or addressed during the hospital stay.<sup>2</sup> Thus, this vulnerable population can experience geriatric complications such as delirium, falls, and functional decline when hospitalized, adverse events that can lead to prolonged hospitalizations, increased hospital costs, increased morbidity, increased risk of readmission and institutionalization, decreased quality of life, and increased mortality. Unfortunately, previous studies of inpatient geriatric consultation have shown inconsistent results depending on patient selection and outcomes measured (**Table 1**).

Acute Care for Elders (ACE) units are dedicated geriatric inpatient units that are designed to prevent geriatric complications and functional decline in older adults during acute illness.<sup>17</sup> The ACE unit model includes the following components: patient-centered care, frequent medical review, early rehabilitation, early discharge planning, and an environment specifically designed to be “geriatric-friendly.” Although associated with positive outcomes such as shorter length of stay, lower costs of care, fewer 30-day readmissions, and less functional decline and other geriatric complications,<sup>18,19</sup> ACE units have not been widely implemented in most hospital

systems, including the VA, likely because of barriers such as start-up costs for environmental modifications and staffing, challenges with patient flow through the unit when hospitals are often at capacity and have rapid patient turnover, and shortages in the geriatrics workforce.

Because of these barriers, in recent years, work has been emerging around Mobile ACE (MACE), either as a consultation in collaboration with the admitting service<sup>6, 20</sup> or with MACE as the admitting service<sup>4, 5</sup> for the older patient. MACE maintains the traditional ACE characteristics of interdisciplinary patient-centered care, medical review, early discharge planning, and early rehabilitation but forgoes the prepared environment of a physical unit. In these previous studies, MACE was associated with lower rates of geriatric complications, shorter inpatient length of stay, and lower hospital costs.<sup>3,4,5,6,20</sup>

In this article, we describe the lessons learned and outcomes observed during the implementation of MACE consultation at the Richard L. Roudebush Veterans Affairs Medical Center in Indianapolis, Indiana (“Indianapolis VAMC”). We hypothesized that implementation of a MACE consultation service in our high-risk VA population would result in shorter length of stay, lower hospital costs, lower 30-day readmission costs, and fewer 30-day readmissions.

## **METHODS**

### **Population**

The Indianapolis VAMC is a 135-bed facility that provides acute inpatient medical, surgical, psychiatric, neurological, and rehabilitation care, in addition to outpatient primary care and specialized services. It also serves as an important clinical training site for the Indiana University School of Medicine (IUSOM). In 2012, more than 18,300 Veterans age 65 or older accessed primary care at the Indianapolis VAMC and accounted for approximately 4,600 emergency department visits and over 5,000 hospital admissions. The inpatient medicine service has five admitting teams. Four of the teams are composed of an attending hospitalist, a medicine resident, two interns, and medical students. The fifth team is a non-teaching service staffed entirely by hospitalists and nurse practitioners. All five teams have embedded social work and pharmacy support. In 2012, geriatric clinical services at the Indianapolis VAMC were limited, consisting of two half-day sessions of a geriatric primary care clinic, one half-day of outpatient geriatric consultation, a home-based geriatric care management program that supported primary care,<sup>21</sup> and an outpatient older adult mental health clinic within the psychiatry department. Geriatrics had no inpatient presence prior to the start of MACE in 2012. Thus, the majority of older Veterans were receiving inpatient and outpatient care from VA-employed providers who had little formal geriatric training. Within the VAMC, all inpatient and outpatient care is documented using the VA's electronic medical record (Computerized Patient Record System, CPRS), including all progress notes, discharge summaries, medication and test orders, test results, appointments, and billing codes.

## **Implementation, Recruitment, and Important Components of MACE**

In 2012, the Indianapolis VAMC Chief of Medicine and the Hospitalist Section Chief were approached about starting MACE, and all agreed that geriatric input via consultation would be beneficial in the care of high-risk older Veterans on the medicine service. With this support, a MACE team consisting of a geriatrician and gerontological nurse practitioner was developed to work proactively in collaboration with the admitting team, rehabilitation therapies, nursing, social work, and pharmacy service to address geriatric syndromes. To identify Veterans who could benefit from MACE, a member of the MACE team (CCS or RP) conducted brief medical-record reviews of all Veterans age 65 years or older within 48 hours of admission to the medicine service (**Figure 1**). These reviews looked for evidence of geriatric syndromes as follows: 1) admission documentation including keywords such as “poor historian”, “seems confused”, “falls” or “problems walking”, weight loss, poor appetite, references to poor social support; 2) past medical history or problem list including geriatric diagnoses such as dementia, cognitive impairment, difficulty walking, falls, depression, incontinence, “noncompliance with medications;” 3) outpatient medication list including cholinesterase inhibitor, memantine, chronic benzodiazepines, or polypharmacy (at least nine chronic medications); 4) Veterans who had had frequent emergency-department visits or hospitalizations (at least two of either in the previous six months). When the review was positive, the MACE team would contact the admitting team and offer to consult; the admitting team could accept or decline. Additionally, the admitting team could request a MACE consultation at any time during the Veteran’s hospitalization. All MACE consultations were completed within 48 hours of admission or request, with the majority

of Veterans being seen on the same day as the initial consultation request. Exclusion criteria for offering MACE consultation were lack of evidence of underlying geriatric syndromes on review as above or Veteran being enrolled in hospice at the time of hospitalization. Veterans seen by MACE were considered the intervention group; those not seen by MACE during hospitalization but with a positive review (MACE-eligible) were the comparison group. Reasons for not being seen by MACE included the admitting team's declining the offer of consultation, MACE service was already busy and could not offer to consult, or no MACE provider was available.

The MACE team performed a comprehensive geriatric assessment on the day of consultation and then collaborated throughout the hospitalization with the admitting medicine team, bedside nursing, social work, rehabilitation therapies, and pharmacy in the Veteran's care. In addition to a geriatric review of systems and focused physical examination to detect geriatric syndromes, MACE undertook thorough review of the Veteran's medical history, pre-admission and inpatient medications, and pre-admission social supports, to assess his or her baseline medical status and function. MACE then helped the admitting team implement a geriatric plan of care that aligned with treatment of the acute illness and would also help mitigate the risk of functional decline during the hospitalization.

The comparison group received usual care from the medicine service teams, which included as-needed access to social work, pharmacy, and rehabilitation therapies but no input from MACE.

## **Data and Statistical Analyses**



After approval from the academic affiliate's Institutional Review Board (also used by the VAMC) and the Indianapolis VAMC, data on comorbidity, length and costs of initial hospital stay, and 30-day readmissions, 30-day total readmission costs, and 30-day mortality were obtained retrospectively from VA Corporate Data Warehouse (CDW), Managerial Cost Accounting System, and VA Vital Status File (VA-VSF) for MACE and comparison Veterans who were admitted to the medicine service between October 1, 2012 and September 30, 2014. The CDW is a national repository comprising data from several VA clinical and administrative systems. CDW includes clinical, enrollment, financial, administrative, utilization, and benefits data. The CDW provided inpatient and outpatient data on admissions for both groups. The Managerial Cost Accounting System contains fiscal data and clinical information at the patient level and enabled calculation of the total cost of hospitalization via a sum of the provided direct and indirect costs. The VA-VSF contains demographics, including dates of death, for Veterans and was used to assess 30-day mortality after hospitalization.

Bivariate analyses were performed to compare patient characteristics (age, gender, race, Charlson Comorbidity Index,<sup>22</sup> number of conditions, number of outpatient visits in the 30-days following admission, initial admission length-of-stay, and initial admission total costs) and outcome measures at admission between the MACE consultation group and the comparison group. Continuous variables (age, Charlson Comorbidity Index, number of conditions, initial admission length of stay and costs, and 30-day readmission costs) were compared between groups using a Wilcoxon rank-sum test for non-normally distributed outcomes, or a t-test otherwise.

Categorical variables (30-day readmission and 30-day mortality) were compared between groups using Chi-square or Fisher's exact tests if counts were small.

Binary outcomes of 30-day readmission and 30-day mortality were analyzed with logistic regression, and 30-day total readmission costs were analyzed using a generalized linear model<sup>23</sup> with a gamma distribution and log link since costs are highly skewed. The main effect of interest in all models was the receipt of MACE. Adjusted models also included covariates of age and illness severity, as measured by the Charlson Comorbidity Index. Adequate power to detect a difference in the outcomes of interest required an estimated 2210 subjects per group for 30-day readmissions and 1070 subjects per group for 30-day mortality based on a two-sided Chi-square test with type I error set at 0.05. Analyses were performed using SAS v9.4 (SAS Institute, Cary, NC).

## RESULTS

### Veteran and Intervention Characteristics

The baseline characteristics of hospitalized Veterans who met inclusion criteria (N=793) are summarized in **Table 2**. For Veterans with more than one hospitalization during the study period, only the initial admission was included in the analysis to avoid potential contamination bias. Veterans who received MACE consultation were, on average, 1.4 years younger and had slightly lower Charlson Comorbidity Index scores and slightly fewer conditions, although these did not reach statistical significance. Veterans who received MACE consultation did not significantly differ from the comparison group on gender, race, number of 30-day post-hospital outpatient visits, or total length of stay or costs of the initial hospitalization.

The most common ICD-9 hospital discharge diagnoses for both groups are listed in **Table 3** along with the most common geriatric syndromes diagnosed or addressed during MACE consultation. Interventions that MACE frequently implemented included stopping medications that are potentially inappropriate per Beers Criteria,<sup>24</sup> reducing polypharmacy as much as medically possible while maintaining consistency with the Veteran's goals of care, recognizing delirium and using non-pharmacological management as much as possible, mobilizing early and often, involving rehabilitation services, and recognizing and treating depression, urinary retention, and constipation. MACE also facilitated early discharge planning to ensure a smooth transition of care at the time of hospital discharge. This included interventions such as anticipating when subacute rehabilitation or home health services might be needed, collaborating with social workers to start the referral

process early in the hospitalization, and facilitating post-hospital follow-up and other services to meet the Veteran's geriatric needs.

### **System Outcomes**

Patients receiving MACE exhibited a trend of lower odds of 30-day readmission and 30-day mortality and of lower 30-day total readmission costs than those who did not receive MACE; the difference, however, was not statistically significant for any of the outcomes ( $p > .05$ ; **Table 4**). MACE was not associated with change in length of stay or costs of the initial hospitalization. Results were similar after adjusting for covariates of age and Charlson Comorbidity Index.

### **Costs and Savings of the Program**

During the study, MACE consisted of 0.5 full-time equivalent (FTE) geriatrician and 1.0 FTE gerontological nurse practitioner. Including salary and benefits, continuing medical education, and miscellaneous equipment, the annual total cost of MACE consultation was \$222,155 in 2012. Outcome data reveal MACE is associated with trends of both reduction in the rate of 30-day readmission (11.9% vs 14.8%) and in the median total costs of the readmission (\$9,840 vs \$15,674). Thus, MACE Veterans avoided 13 readmissions that might have occurred under usual care, saving an estimated \$203,762 over the two years. In addition, for those readmissions that did occur in MACE Veterans during the study, we estimate the costs of care to be \$291,700 less than they might have been under usual care. Thus, MACE likely helped the VA avoid 30-day readmission costs of an estimated \$495,462 over the two years, saving the VAMC an estimated \$51,152 including the costs of the MACE program.

## **DISCUSSION**

VAMCs often provide inpatient care for older Veterans with high complexity and comorbidity. This study demonstrates that MACE consultation can be successfully implemented in a VAMC without increasing costs and, though results did not reach statistical significance, patients receiving MACE had fewer 30-day readmissions, lower readmission costs, and lower 30-day mortality, positive outcomes for both older Veterans and the VAMC.

To our knowledge, this is the first published description of ACE or MACE in a VAMC setting. MACE maintains most of the traditional components that make ACE units successful, such as interdisciplinary patient-centered care, medical review, and early rehabilitation and discharge planning. In addition, our consultative model maximizes the reach of the limited number of available providers with geriatric expertise more than having the geriatric provider as primary attending as in other MACE studies.<sup>4,5,8</sup>

Unlike in the work of Sennour *et al.*, our MACE consultation service surprisingly did not result in decreased length of stay or decreased costs for the initial hospitalization. The reasons for this will require further study, but potential contributors may be our smaller sample size (793 vs. 1358 in Sennour), shorter duration of our study (two years vs. four years), and differences in study population (age range 65-99 vs 56-103; female 2% vs 66%).

### **Lessons Learned: Factors for Success**

Factors that contributed to the success of MACE included early and ongoing engagement with facility leaders; providing frequent updates to leadership on progress

and specific Veteran “success stories” as the program was implemented; having an experienced gerontological nurse practitioner as part of the MACE team, to facilitate engagement and collaboration with both nurse leaders and those providing direct bedside care; proactive case finding allowing recognition and treatment of geriatric syndromes as early in the hospitalization as possible; ongoing interaction with trainees and attending hospitalists about the availability of MACE; and involving interdisciplinary members across all of the admitting medicine teams, which seemed to foster new levels of interest and empathy for older Veterans.

### **Lessons Learned: Barriers and Solutions**

MACE faced some challenges during implementation. Initially, some attending hospitalists did not understand what MACE could offer, and had the negative perception that geriatric consultation might prolong the hospitalization, making them reluctant to accept consultation. After experiencing MACE with some of their more challenging cases, however, most embraced the program. Another barrier was maintaining coverage of a busy consultation service with only 1.5 provider FTE; this was primarily overcome through teamwork and collaboration of the geriatrician and gerontological nurse practitioner. Finally, the hospitalist service had frequent changeover of personnel, making the timing of ongoing education important for continued success of the program.

### **Limitations**

This study had several limitations. The MACE and comparison groups may have had unmeasured differences that could have affected results. We were initially concerned about possible selection bias—that providers would accept the offer of

MACE consultation only for their sicker, frailer patients—but that does not appear to be the case, based on our assessment of age and comorbidity. Because we identified participants via medical-record review, ascertainment bias is also a possibility, since geriatric syndromes are often missed and thus not documented in the medical record. This, however, is unlikely to have affected our outcomes since the MACE and comparison groups received the same chart review and are similar in age and comorbidity. Unfortunately, resource and time constraints inhibited MACE from reaching the sample sizes needed per our power calculation to detect statistically significant differences in outcomes. Also, our sources included only VA data, so any non-VA hospitalizations and their costs are unknown, and our cost analysis is limited to the basic cost elements available in our VA databases. Finally, MACE was implemented in a VAMC located at an academic medical center in an urban area and in a predominately male Veteran population, so the results might not be generalizable to all VAMCs or all older Veterans.

## **Conclusion**

MACE consultation, an innovative but proven model of care associated with improved inpatient geriatric care, can be implemented in a VAMC successfully. Though not statistically significant, in this study, it was associated with a trend of reduced 30-day readmissions and other adverse outcomes for older Veterans with geriatric syndromes while also leveraging providers with geriatric expertise as efficiently and effectively as possible. MACE consultation has the potential to improve care of older Veterans while achieving cost savings to the health system.

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**Author Contributions:** Schubert and Parks: conception and implementation of Mobile ACE program, study design, analysis and interpretation of data, preparation of manuscript. Weiner, Coffing, Daggy, and Slaven: study design, analysis and interpretation of data, preparation of manuscript.

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**Table 1: Results of non-unit based geriatric consultation trials**

Trial	Intervention	Patient Criteria	Team Members	Outcome
Bernstein 2018 <sup>3</sup>	Consultation	≥70	G, PA	↓ mortality, ↓ daily cost, ↓ high-risk medicines, ↓ restraint
Hung 2013 <sup>4</sup>	MACE, Admitting	≥75, geriatric clinic patient	G, APN, SW	↓ LOS, ↑ home health referrals
Farber 2011 <sup>5</sup>	MACE, Admitting	>64, geriatric clinic patient	G, APN, SW	↓ LOS, ↓ total costs
Sennour 2009 <sup>6</sup>	MACE, Consultation	≥70, impaired function	G, APN	↓ LOS, ↓ costs
Reuben 1995 <sup>7</sup>	Consultation	≥65, geriatric condition	G, APN, SW	No significant change: function, mortality
Naughton 1994 <sup>8</sup>	MACE, Admitting	≥70	G, SW	↓ LOS, ↓ total, lab and pharmacy costs
Winograd 1993 <sup>9</sup>	Consultation	≥65, functionally impaired, frail	G, APN, SW	No significant change: function, cognition, utilization, institutionalization
Thomas 1993 <sup>10</sup>	Consultation	≥70	G, APN, RN, SW, D, P, PT	↑ function, ↓ LOS, ↓ readmissions, ↓ mortality
Hogan 1990 <sup>11</sup>	Consultation	≥75, functionally impaired	G, RN, SW, PT, OT, D, C	↑ survival, ↑ function, ↓ readmissions, ↓ institutionalization
McVey 1989 <sup>12</sup>	Consultation	≥75	G, APN, SW	↑ function
Saltz 1988 <sup>13</sup>	Consultation	≥75	G, APN, SW	No significant change: readmissions, institutionalization
Gayton 1987 <sup>14</sup>	Consultation	≥70	G, APN, SW, PT, OT	↓ mortality. No significant change: LOS, function, disposition
Becker 1987 <sup>15</sup>	Consultation	≥75	G, APN, SW	No significant change: hospital-acquired complications
Hogan 1987 <sup>16</sup>	Consultation	≥75, geriatric condition	G, RN, PT	↓ 1-year mortality, ↑ mental status, ↓ polypharmacy
Present Model	MACE, Consultation	≥65, geriatric condition	G, APN	↓ 30-day readmissions, ↓ costs, ↓ 30-day mortality

MACE=mobile Acute Care for Elders, G=Geriatrician, PA=Physician Assistant, APN=Advanced Practice Nurse, RN=Registered Nurse, SW=Social Worker,

PT=Physical Therapist, OT=Occupational Therapist, D=Dietician, C=Chaplain,  
P=Pharmacist, LOS=length of stay

**Table 2: Bivariate analyses of Mobile Acute Care for Elders vs. Comparison Group**

	<b>Mobile ACE</b> N = 421	<b>Comparison</b> N = 372	p-value
<b>Patient characteristics</b>			
Age ± SD, range	82.4 ± 7.2, 65-97	83.8 ± 6.5, 66-99	0.003
Male	409 (98%)	364 (98%)	0.947
Race			0.670*
Black	70 (17%)	57 (15%)	
White	345 (83%)	311 (84%)	
Other	1 (<1%)	2 (<1%)	
Charlson Comorbidity Index	3 (0-13)	3 (0-16)	0.016
Number of Conditions	2 (0-7)	2 (0-9)	0.045
30-day post-hospital outpatient visits	1 (0-12)	1 (0-12)	0.195
Number of 30-day post-hospital outpatient visits			0.241
0	181 (43%)	141 (38%)	
1	98 (23%)	90 (24%)	
2	54 (13%)	65 (18%)	
3+	88 (21%)	76 (20%)	
Initial admission LOS, (days)	5 (1-52)	5 (1-111)	0.567
Initial admission total costs (dollars)	14,400 (2,213-125,163)	13,097 (1,975-200,428)	0.135
<b>Unadjusted Outcomes</b>			
30-day readmission	50 (12%)	55 (15%)	0.228
30-day readmission total costs (dollars),	9,840 (1,886-111,031)	15,674 (1,078-102,307)	0.156
30-day mortality	23 (5.5%)	32 (8.6%)	0.083

Values are median (range) for continuous variables (unless otherwise noted) and frequencies (percent) for categorical variables. P-values obtained from Wilcoxon rank-sum test (except age is from t-test) for continuous variables and Chi-Square tests for categorical. Some percentages might not add to 100% due to rounding. \*Fisher's exact test. SD = standard deviation; LOS = length of stay

**Table 3: Most common geriatric diagnoses for MACE Veterans and most common medical diagnoses at hospital discharge for both MACE and Comparison Veterans**

<b>Mobile ACE Geriatric Diagnoses</b>
Cognitive Impairment or Dementia
Gait Instability
Delirium
Frailty or Debility
Malnutrition or Weight loss
Depression
Incontinence and/or Constipation
Hearing, Vision Loss
Nonadherence or Poor Social Support
<b>Medical Diagnoses at Discharge</b>
Hypertension
Acute Kidney Failure
Hyperlipidemia
Heart Failure
Urinary Tract Infection
Atrial Fibrillation
Coronary Atherosclerosis
Chronic Kidney Disease
Gastroesophageal Reflux Disease



**Table 4: Association of Mobile Acute Care for Elders with 30-day readmission, mortality, and 30-day readmission costs**

	Unadjusted Model		Adjusted Model	
	OR (95% CI)	p-value	OR (95% CI)	p-value
30-day readmission	0.78 (0.51, 1.17)	0.229	0.82 (0.54, 1.25)	0.360
30-day mortality	0.61 (0.35, 1.07)	0.085	0.64 (0.36, 1.12)	0.115
30-day readmission costs (dollars)	Mean (95% CI)		Mean (95% CI)	
Mobile ACE	15,719 (12,390, 19,943)	0.330	15,502 (12,242, 19,631)	0.316
Comparison	18,510 (14,752, 23,226)		18,335 (14,641, 22,962)	

OR=odds ratio, CI=confidence interval

Adjusted model includes age and Charlson Comorbidity Index.