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## LEADING BEST PRACTICE: ACUTE CARE FOR ELDERS UNITS (ACE) – EVIDENCE AND KEYS TO SUCCESSFUL OPERATION

### Abstract

Acute Care for Elders (ACE) Units promote improved outcomes for hospitalized older adults through specialized inter-professional care and environmental adaptations. ACE Units differ from Geriatric Assessment Units (GAU) and Geriatric Evaluation and Management Units (GEMU) in two ways. First, ACE Units provide care from the start of the hospital trajectory and at the beginning phase of the acute medical illness (hence most patients are admitted directly from the emergency department), whereas GAU and GEMU usually provide care for patients during the mid-to-late acute or post-acute phase of the illness. GAU and GEMU that admit patients at the beginning phase of the medical illness are functionally similar to ACE Units despite their nomenclature. Second, ACE Units provide the full spectrum of medical services (including diagnostic services and treatments) that are found in high acuity medical wards, whereas the GAU and GEMU may offer services short of the high acuity treatments (for instance, may not provide bi-level positive airway pressure or BIPAP for patients with hypercapneic respiratory failure). The evidence, when viewed cumulatively, supports the widespread uptake of ACE Units. Keys to implementing ACE Units successfully include adopting a sustainable staffing model, maintaining efficient patient flow and consistent education focused on reinforcement of ACE concepts to new and existing staff. In turn, successful ACE Units can result in favourable patient-centred and hospital-based outcomes, including reduced physical function loss, reduced accidental falls, reduced skin breakdown, reduced in-hospital delirium, reduced length of hospital stay, reduced in-hospital cost and increased likelihood of home discharge.

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## Key points

1. ACE Units incorporate early rehabilitation, function-based assessments and interventions targeted at vulnerable older adults to prevent functional decline (e.g. *hospital acquired disability*) during admissions for acute medical issues.
2. The evidence for ACE Units when pooled, points to fewer falls, less delirium, reduced functional decline, shorter lengths of stay and potential cost savings in hospital. The ACE model is also associated with fewer discharges to nursing home potentially contributing to further cost-savings from a system perspective.
3. Optimal implementation of ACE Units should focus on a sustainable, inter-professional staffing model, timely involvement of geriatric specialists and smooth patient flow.

## Introduction – the Acute Care for Elders (ACE) model and its rationale

While GAU and GEMU exist to provide comprehensive geriatric care in the mid-to-late acute or post-acute phase of illness (see [article on GAU](#))<sup>1</sup> there was a lack of a parallel to meet the specialized needs of older patients in the early acute phase. Older patients present with acute illnesses on the background of multiple comorbidities along with various levels of **frailty**, a syndrome defined as age-related cumulative decline in physiological reserve, leading to decreased ability to accommodate insults on physical and mental health. Fried and colleagues described five phenotypic features of frail patients: unintentional weight loss, self-reported exhaustion, low energy expenditure, slow gait speed and weak grip.<sup>2</sup> The end-result is that frail older patients admitted for acute reasons often experience more adverse outcomes, including lengthier hospital stays, functional decline and an elevated risk of discharge to a nursing home.<sup>2</sup>

An inter-professional care model called the ACE model was designed with the aim of improving overall outcomes for seniors admitted to hospital for acute medical reasons. The model is based on five components: patient-centred care, frequent medical review, early rehabilitation, early discharge planning and a prepared environment.<sup>3</sup> The composition of each component is described in Figure 1.

The nomenclature of hospital wards that employ the ACE model is varied and includes ACE Units and Acute Geriatric Units (AGU). ACE Units can be complementary to GAU and GEMU. Practically, ACE Units differ from GAU and GEMU in two ways. First, ACE Units differ from traditional GAUs and GEMUs in that ACE Units provide comprehensive care tailored to older patients from the onset of their presentation of acute illness, with most patients admitted directly from the emergency department, while GAUs and GEMUs focus on serving the needs of older patients in the mid-to-late acute or post-acute phases. This represents *up-streaming* of geriatrics in acute care.

For the GAUs and GEMUs that admit patients at the beginning phase of the medical illness, they are functionally similar to ACE Units despite their nomenclature. Second, ACE Units provide the full spectrum of medical services (including diagnostic services and treatments) that are found in high acuity medical wards, whereas the GAU and GEMU may offer services short of the high acuity treatments (for instance, may not provide bi-level positive airway pressure or BIPAP for patients with hypercapneic respiratory failure). In the last two decades, a more hospital-wide concept of delivering health care to seniors has emerged, called the Elder Friendly Hospital (EFH) or **Senior Friendly Hospital** (SFH). The EFH/SFH model applies certain concepts of the ACE model on a larger hospital-wide scale, in addition to other organizational changes focused at improving care to all senior patients and their families throughout the hospital.<sup>4,5</sup> These other acute geriatric models are beyond the scope of this article.

## The evidence demonstrating the clinical effectiveness and cost-effectiveness of the ACE model

The first positive clinical trial of an ACE Unit, published by Landefeld and colleagues in 1995, showed that admission to an ACE Unit compared to usual care in a general medical ward was associated with superior preservation of basic activities of daily living at discharge, and a lower risk of discharge to long-term care institutions (14 percent in the ACE group, as compared to 22 percent in the usual-care group).<sup>6</sup> Subsequent studies have also shown mostly positive results.

A meta-analysis of the collective evidence of ACE was published by Fox and colleagues in 2012 (see [article](#)), demonstrating clear results in favour of ACE Units for outcomes of falls (RR 0.51, 95 percent confidence interval, CI 0.29 to 0.88), delirium incidence (RR 0.73, 95 percent CI 0.61 to 0.88), functional decline at discharge from baseline two-week pre-hospital admission status (RR 0.87, 95 percent CI 0.78 to 0.97), length of hospital stay (weighted mean difference -0.61, 95 percent CI -1.16 to -0.05), lower hospital costs (weighted mean difference -\$245.80 USD standardized to year 2000, 95 percent CI -\$446.23 to -\$45.38), and fewer discharges to a nursing home (RR 0.82, 95 percent CI 0.68-0.99).<sup>3</sup>

Given that the overall evidence supports the use of the ACE model to improve multiple relevant outcomes with potential cost-savings, logically, this should propagate widespread uptake of the ACE model.<sup>7</sup> However, this has not been the case. In a survey of 82 hospitals in the U.S., only 16 sites reported that they had an ACE Unit.<sup>8</sup> Uptake in Canada has similarly been low.<sup>7</sup>

Several barriers may explain the yet-to-be-seen ubiquitous uptake of the ACE model. There are concerns over costs, scarcity of geriatricians and the fact that ACE Units only benefit patients physically located on the unit, and not older patients admitted elsewhere in the hospital.<sup>9</sup> Additionally, physical and organizational limitations within hospitals, such as the physical infrastructure changes required to create a prepared environment, may restrict the adoption of all five ACE components in their entirety.<sup>10</sup> Consequently, hospitals are missing out on the potential cost-savings and other positive outcomes (e.g. decreased length of stay, decreased discharge to nursing home) listed above.

### **Key factors to successful operation of the ACE model**

#### **Staffing model**

The optimal staffing model for ACE Units should be tailored to meet the unique needs of direct patient admissions from the emergency department. The exact staffing makeup is debatable, but there are some commonly accepted features. Most units include a complement of physicians (geriatricians may act as attending physicians or consultants), registered and licensed practical nurses with nursing aides, physiotherapists and occupational therapists.<sup>3</sup> Social workers in ACE Units may take on an enhanced role compared to non-ACE Units, given the intricate psychosocial situations inherent in caring for older adults. The routine service of a clinical pharmacist is often employed to review medication lists, conduct medication reconciliation<sup>11</sup> and ensure minimization of drug-related adverse events at multiple points during hospitalization and on discharge.<sup>12</sup>

Once the staffing model is solidified, it is essential to nurture and maintain staff competency surrounding concepts of ACE, through educational opportunities such as new staff orientations, patient conferences, interdisciplinary meetings and in-services.<sup>13</sup> Distribution of a pocket-sized ACE card that outlines major principles underlying the ACE model can serve as a reminder of important concepts of geriatric care to employees.<sup>9</sup>

The role of geriatricians in the ACE model is another factor that merits some discussion. Although positioning geriatricians as the attending physicians has potential advantages, the limited number of geriatricians may preclude this approach. An alternative model that offers sustainability in an environment of limited human resources is the integration of geriatricians (and geriatric psychiatrists) on a consultative basis, with practical referral guidelines for attending physicians to follow.<sup>13</sup> Still, a third approach is a hybrid model, whereby a geriatrician acts as attending for some patients, while being available on a consultative capacity for others. Regardless of model, it may be helpful to employ a geriatrician to assume a leadership role of ACE and oversee proper implementation of the appropriate referral criteria and standards of care. In the management of complex older patients where small details in lengthy consultative notes can be missed, it is important for consultants to establish a practice pattern of writing explicit physician orders if they are likely to impact patient care, as this results in a much higher execution rate than embedding suggestions in the consultation note.

At the Vancouver General Hospital, a tertiary-care centre that has implemented the ACE model since 2000, a standard 22-bed ACE Unit had the inter-professional staffing complement shown in Table 1.

**Table 1.** Staffing composition of a 22-bed Acute Care for Elders Unit<sup>14</sup>

Position	Capacity
Medical Manager or Medical Director	0.2 full-time equivalent (FTE) Geriatrician
Patient Service Manager	0.3 FTE
Patient Care Coordinator	1.0 FTE
Clinical Nurse Specialist	0.3 FTE
Registered Nurses	4.0 FTE days (1 RN to 5.5 patients) 3.0 FTE nights (1 RN to 7.4 patients)
Licensed Practical Nurses	1.0 FTE
Patient Care Aide	2.0 FTE
Physiotherapist	1.0 FTE
Occupational therapist	1.0 FTE
Rehabilitation Assistant	0.5 FTE
Social Worker	0.5 FTE
Dietician	0.7 FTE
Pharmacist	Rotational
Spiritual Care Staff	Rotational
Care Management Leader	1.0 FTE
Transitional Service Officer	Rotational

In addition to the usual staffing complement of a medical ward, this unit included a dedicated clinical pharmacist, part-time rehabilitation assistant to augment services of a full-time physiotherapist and rotational coverage of spiritual care.<sup>14</sup> This resulted in a successful implementation of the ACE model, leading to shorter hospital stays (average length of stay in ACE Unit was 7.6 days, vs. 12.4 days in other units), and a greater likelihood of returning patients to their original residence compared to usual care (adjusted odds ratio 1.75, 95 percent CI 1.04 to 2.96).<sup>15</sup>

### Patient flow

ACE Units can be effective in improving hospital patient flow, especially in decanting emergency departments, provided that ACE Units carry adequate number of beds (for inflow of patients) and adequate number of discharge venues (for outflow of patients). A discrete ACE Unit will inherently have a limited number of beds, which incentivizes development of admission criteria that are predictive of patients most likely to benefit. Examples include use of medical illness acuity scores, comorbidity or complexity scores, physical performance test scores and cognitive or depression screen scores.<sup>13</sup> However, this approach of utilizing stringent admission criteria is more time-consuming and may require special training of non-medical personnel to operationalize. In addition, it may result in difficulty obtaining buy-in from hospital administration if it appears that the unit is admitting only a small portion of patients that can potentially benefit. On the other hand, admitting on more straight forward criteria, such as based on age cut-off, while more efficient, may mean that many robust older patients who may not require enhanced services of ACE are admitted and occupy a bed in the unit. Interestingly, the [Cochrane review that evaluated benefits of the comprehensive geriatric assessment](#) showed that the greatest evidence was in geriatric wards that admitted patients on needs-related criteria (such as presence of geriatric syndromes, perceived risk of nursing home admission and functional or cognitive impairment), as opposed to wards that used age as the sole admitting criteria, although it is noteworthy that this analysis did not differentiate ACE Units from those that provide mid-to-late acute care or sub-acute geriatric care (GAU/GEMU).<sup>16</sup> We favour the adoption of pragmatic/efficient admission criteria that facilitate smooth and continuous patient flow, which includes using age-based criteria because most ACE Units that have been studied thus far are almost exclusively based on age alone.<sup>17</sup>

In future studies, it would be useful to explore if using other measures of frailty for admission criteria, such as the [clinical frailty index](#), translates to better outcomes.<sup>13</sup> Furthermore, use of technology may help automate some of the cumbersome aspects of predicting and targeting high yield patients, particularly those at high risk of functional decline. One such integration of technology is the ACE Tracker, an electronic tool used in Wisconsin that pulls information from admission data, nursing assessments, pharmacy data, social services and physician orders, to generate daily reports identifying older patients at high risk for functional decline and poor outcomes that may be admitted anywhere in the hospital.<sup>9</sup> This tool also allows for dissemination of the ACE model beyond the confines of a geographical unit.

Smooth patient flow is as dependent on an efficient admission process as it is on a streamlined discharge process from the ACE Unit. In the ACE Unit, the enhanced discharge planning involves constant review of patients' trajectories, frequent liaison with patients' families and careful consideration of the complex psychosocial background of each individual patient.<sup>13</sup> This process, where the professional skills of social workers and occupational therapists are central, will identify suitable discharge destinations (which may include home, assisted living or residential care facilities) with appropriate ancillary services, such as home care services or outpatient follow-up with family physicians or specialists (including geriatricians) to prevent avoidable readmissions. In the case of patients who require prolonged convalescence, consideration should be made for transfer to sub-acute or transitional units to free up resources of the ACE Unit.<sup>13</sup>

### **Strategic implementation of ACE components**

Early studies looking at the effect of partial implementation of the ACE model have largely been disappointing, suggesting that the multicomponent approach is imperative.<sup>17</sup> However, it may not be feasible to implement the full spectrum of the ACE model in all hospitals.

Given limited resources, administrators might wonder what permutation of the ACE components affords the greatest positive effect. This question was answered in a systematic descriptive review by Fox and colleagues, which reviewed the implementation details of the ACE Units, and quantified the effect size of each ACE component on successful outcomes.<sup>18</sup>

It is evident that different ACE Units employ anywhere from one to all five components of the ACE model, and that these components are delivered to varying degrees. The conclusion of the authors' analyses was that the three ACE components that contribute the largest mean effect sizes are patient-centred care, frequent medical review and early rehabilitation.<sup>18</sup>

Patient-centred care encompasses the use of protocolized procedures to screen for and treat issues of mobility, hydration/nutrition, cognition, self-care ability, continence and elimination and skin integrity.<sup>18</sup> Some examples of preventative measures to avert problems in these domains include encouraging patients to stand or ambulate at least three times per day, providing nutritious snacks, high-protein meals and four glasses of water per day, encouraging self-bathing and providing pressure-reducing mattresses.<sup>18</sup>

Frequent medical review involves holding at least weekly interdisciplinary rounds to review the patients in detail, with focus on reduction of high-risk medications, early removal of invasive intravenous/urinary catheters and physical restraints and treatment of nutrition or fluid deficits.<sup>18</sup> The goals of the rounds are to identify barriers to recovery and discharge, reduce potential for iatrogenic harm and foster a deeper understanding of the patients' medical status among all team members. Subsequently, the team can mobilize resources earlier to further the care plan of the patient. Patients appropriate for geriatric medicine or geriatric psychiatry referral are often identified through these rounds.

Early rehabilitation entails screening for baseline mobility and functional status, often beginning at admission. Many ACE Units use automatically triggered physiotherapy and occupational therapy referrals for all patients.<sup>12</sup> Akin to early rehabilitation concepts used to optimize patients' functional status prior to major surgery, the early rehabilitation process provides pre-emptive physical therapy to prevent decline around the stress of an acute medical admission, often before the mobility problems arise.<sup>10</sup> Mobility is encouraged via equipment provision, adaptive devices and targeted exercises.<sup>18</sup> The success of early mobilization parallels the success of the MOVE-On initiative in Ontario (see [article](#)).



These measures prevent *hospital-acquired deconditioning* leading to *hospital-acquired disability*. Screening for dysphagia as indicated is also essential to prevent nutritional decline and reduce aspiration risk.<sup>12</sup> The remaining components (early discharge planning and prepared environment) have smaller, but significant effect sizes.<sup>18</sup> They are described, along with the other components, in Figure 1.

### Challenges to implementation

Some earlier studies of ACE Units did not show positive outcomes, owing in part to the heterogeneity seen in implementation of specific ACE components, as well as partial implementation of the five components.<sup>19-21</sup> There are also inter-study methodological differences in predefined outcomes and follow-up periods. As discussed above, many hospitals will face restricted resources or infrastructure. The systematic descriptive review by Fox and colleagues provides evidence-based guidance on prioritizing implementation of ACE components.<sup>18</sup> The success of ACE Units in decreasing length of stay (thereby saving cost and bed days while improving patient flow) and in decreasing long-term care placement (thereby saving the system money) should be considered by hospitals facing restricted resources – ACE Units may be the investment they need to make to ultimately deal with the escalation in the numbers of complex seniors being admitted to hospital.

### Evolving concepts using the ACE model

There have been several innovative adaptations to the implementation of ACE and variations on the target patient population. These ideas may be helpful to overcome certain barriers of implementation and advance the concept of ACE into other areas of medicine that traditionally have been excluded.

For instance, when structural or organizational constraints preclude the possibility of creating a geographically discrete ACE Unit, a **Mobile ACE (MACE) service** can be deployed to any patient located anywhere in the hospital, and has shown positive effects.<sup>22</sup> MACE is a round-the-clock service that is provided to medical patients who are already known to the outpatient geriatrics clinic at the hospital.

Its value proposition is about ensuring the continuity of geriatric specialty care of older patients as they transition from the outpatient to inpatient setting, regardless of the patients' hospital location. The MACE service differs from other geriatric consultation teams in the fact that MACE does not extend into non-medical wards (such as surgical wards or critical care units) and the MACE geriatrician is usually the physician-on-record during their patients' hospital admission. The MACE staffing model can be inter-professional, although the extent of the team is often of a smaller scale when compared to ACE. In contrast, geriatric consultation teams normally serve all locations (medical and surgical) within the hospital on a consultative basis, regardless of the patients' pre-admission outpatient affiliation. Some of the geriatric consultation teams may not incorporate all of the ACE components, despite often having inter-professional support. Success has also been seen in ACE models of orthogeriatric units,<sup>23,24</sup> sub-intensive care units for the elderly,<sup>25</sup> emergency departments,<sup>26</sup> stroke units<sup>27</sup> and in **oncologic care**.<sup>28</sup>

### Conclusion

The concept of Acute Care for Elders (ACE) is a multicomponent system of delivering best practices in hospital medicine to older patients. The implementation of ACE is not mutually exclusive of other well-established care model such as geriatric consultation teams or GAUs/GEMUs. The collective evidence shows ACE is associated with multiple positive patient-centred and hospital-based outcomes, including fewer falls, less delirium, reduced functional decline, shorter length of stay, potential cost savings in hospital and reduced discharges to nursing home. Several barriers (especially space and/or staffing capacity limitation) may hamper full ACE implementation, but the advent of innovative ideas, such as Mobile ACE service, provides paths to overcome these limitations. Learning from past experiences of ACE Units, the most important components include patient-centred care, frequent medical review and early rehabilitation. Keys to successful implementation include maintenance of smooth patient flow through adoption of efficient admission and discharge processes, building a sustainable inter-professional staffing model and providing initial and ongoing education on ACE principles to staff. The ACE model is a leading best practice that has significant impact on the improving care of older people in Canada and beyond.

**Figure 1.** Components of the ACE model<sup>6,12,18</sup>



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