Abstract
Objectives:
Analysis of data from the World Health Organization over the past 50 years, has demonstrated a transition towards population ageing globally. This has a significant impact on acute care services as well as on the approach to patient care in the acute setting.

Methods:
A narrative review of the literature was undertaken using Medline, CINAHL and the Cochrane Database, supplemented by manual searches of the literature, and further guided by the reference lists of relevant papers identified in the electronic search. No restriction was placed on the type of paper to be included in the study.

Results:
The initial electronic search of the three databases included 239 papers, of which 87 were found to be relevant and included in this review. Among the papers included were those which described the unique challenges posed by the ageing population, proposed modifications to the delivery of health services and recommended adaptations in the approach to older patients in the acute care setting.

Conclusion:
Population ageing is a significant global phenomenon, affecting both developed and developing regions of the world. More work is needed, particularly in the developing world, to better understand the impact of ageing on our population.

Introduction
The world’s population is ageing rapidly, with potential implications for health and healthcare. While this phenomenon has traditionally been considered a first world issue, evidence collected by the World Health Organisation over the past 50 years clearly indicates that population ageing affects both developed and developing nations [1, 2].

Recent work from Trinidad and Tobago has confirmed the impact of ageing on medical and social support services, and highlighted the need for increased awareness among health and social care providers in the country. Moonesar et al., in 2016, demonstrated that older persons in Trinidad have high levels of social support from family members, but less from other sources [3]. Naraynsingh et al and Yogi et al found that older trauma patients at the San Fernando General Hospital, particularly those with falls, suffered more severe injuries and were significantly more likely to require hospital admission compared to their younger counterparts [4,5].

An ageing population has a significant impact on a country’s ability to provide adequate levels of healthcare for the population, and also affects the way in which these services are provided. Research from the United Kingdom, the United States, Australia and Hong Kong have all documented the changes in injury patterns, process measures and outcomes in trauma patients as this population ages with time [6–9]. Similar trends have been observed in other patient groups, including those with medical illnesses, and patients with mental health issues, such as dementia and depression [10,11].

This review focuses on the impact of the ageing population on health services, and suggests ways that these
services can respond to this epidemiological phenomenon, to ensure optimal care to this vulnerable section of the population.

**Methods**

A narrative literature review was undertaken to identify the evidence of the impact of ageing on healthcare utilisation. A research question was formulated using the ‘PEO’ format (population, exposure and outcome). The primary research question was:

“How does increasing age (exposure) affect the provision of acute health services and the approach to patient care (outcome) for older people utilising the health services for acute illnesses and injuries (population)?”

The objectives of this review were:
1. To describe the impact of an ageing population on acute health services
2. To discuss the changes required in the provision of these services to best meet the needs of the older population
3. To describe the differences in the approach to the older patient with acute healthcare needs, as compared to their younger counterparts.

An electronic database search was performed on Medline (via Pubmed), CINAHL (via EBSCO) and the Cochrane Database. This was supplemented by a manual search of the reference lists of relevant papers from the initial electronic search.

No restriction was placed on the type of paper to be included, provided these were pertinent to the aims and objectives of the review. However, the search was restricted to English Language publications and human studies.

**Results**

Of the 239 papers identified through the literature search, 87 were found to be relevant to this review. Of these, 69 papers specifically described the impact of ageing on acute health services, while 15 discussed the changes required to provide better care for older people with acute health needs. A further eight (8) papers described the approach to older patients with acute health needs. Five (5) papers dealt with more than one of the main topics mentioned above. The main issues identified in this review are summarised in Table 1.

**Principal Findings**

**Impact of the Ageing Population on Acute Health Services**

Older people incur an increased demand on health services as a consequence of both physiological and pathological changes associated with ageing. As described in greater detail in Part 1 of this review, older patients are subject to changes in their cardio-respiratory, neurological and musculoskeletal systems.
Physiological Changes with Ageing
Decreased physiological reserve can affect older patients’ interactions with the health services in a variety of ways. Some of these changes in health status increase the risk of illness and injury in older people.

For example, sarcopenia and osteopenia, which often accompanies age, increases not only the risk of falls, but also the probability of fractures. These consequently increase the need for emergency care and the likelihood of hospital admission.

Yogi et al, in a cohort of patients at San Fernando General Hospital demonstrated that, compared to their younger counterparts, older people were more likely to be admitted with falls and were at greater risk for sustaining more severe injuries [5,15]. The modified response to acute illness and injury may also lead to atypical presentations in older people, potentially delaying definitive diagnosis. For example, older people in shock tend to present with higher blood pressures than their younger counterparts, making the diagnosis more difficult in this age group [16]. Patients with significant intracranial mass lesions also tend to present with higher Glasgow coma scores than younger patients with similar lesions, making it more difficult to recognise these conditions in older people [17]. Finally, the reduced physiological reserve in older people means that they are less able to cope with physiological stressors associated with acute illness. For example, older patients with acute respiratory illnesses are more prone to respiratory failure and need more intensive early respiratory therapy than younger patients with similar conditions [18].

Multimorbidity and its impact on acute illness and injury
Since the 1980s, researchers have been investigating the link between multimorbidity and response to acute illness and injury. Charlson et al first attempted to quantify this by developing the Charlson comorbidity score in 1987 [19]. This weighted score was based on the comorbid conditions that were demonstrated to impact on in-hospital morbidity in acutely ill patients. While the score has not always been shown to predict mortality, patients with more comorbidities tend to need longer hospital stays and are more likely to die following acute illness and injury [20,21]. Certain comorbidities, such as chronic cardiac disease, respiratory insufficiency and altered mental status, increase the risk of a poor outcome in older patients, including an increased length of stay [22–24]. There is a similar relationship between ICU length of stay, age and comorbidities [25]. This relationship is seen not only in patients with acute physical illnesses and injuries, but also in patients with psychiatric illnesses and following major surgery [26,27]. The overall impact of these effects is that older patients, particularly those with multimorbidity, are likely to have longer in-hospital and ICU stays, once admitted [28]. This in turn increases the risk of iatrogenic complications such as bed sores, venous thrombosis and hospital acquired infections.

With regard to ICU admission, the benefits to older patients are difficult to prove. Studies by Aitken et al and Giannoudis et al both concluded that mortality rates for older trauma patients were worse if they were admitted to ICU, even after adjusting for age, injury severity, gender and physiology [29,30]. However, this paradoxical outcome should be interpreted with some caution as both studies were retrospective reviews of trauma registry data and may have overlooked other confounding factors such as injury pattern and
comorbid state of patients admitted to ICU compared to those who were not.

**Functional outcomes in older people**

Some clinicians express concerns that aggressive management of older people can lead to an increase in the numbers of these patients surviving with moderate to severe disability. Some authors have investigated the functional capacity of older people discharged from hospital after major trauma, for example, and found that most patients’ functional capacity declined significantly after acute illness or injury, and that this decline persisted for many months and years after the acute event [31-33]. In a systematic review of predictive factors for functional outcome in older hospitalised patients, McCusker et al found that age, admitting diagnosis and activities of daily living all contributed to the patient’s discharge status [31]. However, the 2017 Trauma Audit and Research Network report on trauma in older people found that, following serious injury, although older patients were more likely to die than younger people, there was no significant difference in functional capacity between older and younger patients who survived their initial injury [34]. These findings suggest that aggressive resuscitation of older people will not lead to large numbers of severely disabled survivors, as feared by some commentators.

**Polypharmacy and Ageing**

Polypharmacy is recognised as a significant factor that affects health outcomes in older acutely ill patients [13]. By virtue of the increased risk of multimorbidity, polypharmacy is much more common in this age group, and is significantly associated with drug-drug interactions [35]. Dookeeram et al investigated the prevalence of polypharmacy and drug-drug interactions in a cohort of patients presenting to the Emergency Department at Eric Williams Medical Sciences Complex, and found that 56% of patients 65 years and older were on 5 or more medications, compared to 24.1% of younger patients. In addition, 67.5% of older patients had potential drug-drug interactions, compared to 48.9% of younger people (p<0.001), and the risk of drug-drug interactions was significantly associated with polypharmacy [36].

Polypharmacy in older people may impact on health service provision in several ways. Older people on multiple medications are more likely to suffer adverse drug-drug interactions, the latter may independently precipitate hospital admission. For example, Ruiter et al found a four-fold increase in the risk of drug-drug interactions in patients aged 75 and older, compared to those aged 55 - 74 years [37]. The authors noted that the majority of these older patients were on multiple medications. Polypharmacy has also been independently associated with worse outcomes in patients admitted with a variety of acute illnesses and injuries [38,39]. Finally, older patients with certain conditions such as cognitive impairment may have difficulty complying with medications, inadvertently leading to a higher risk of polypharmacy and drug-drug interactions [40,41].

**The impact of psychosocial factors on acute illness in older people**

Psychosocial factors also play a part in the development and progression of acute illnesses in older people. Several authors have identified socioeconomic status, social isolation and dependency as factors affecting this age group [3,42,43]. Moonesar et al assessed social support in older people presenting to the Emergency Department at San Fernando General Hospital, and found that most patients received most of their support from family members and very little from formal social services. However, the authors also noted that the extended family unit in Trinidad is being replaced by a more nuclear family structure, leaving older people at risk of social isolation. This trend was also noted by Rawlins et al in their survey of social isolation and loneliness in older people in Trinidad [44]. There is good evidence that social isolation
and dependency contribute to poorer outcomes in hospitalised patients [45,46]. McCusker et al systematically reviewed the literature to determine factors affecting Emergency Department visits in older people and identified lack of social support and having no regular source of care at home as two significant problems that lead to an increased frequency of Emergency Department visits [46]. In addition, low socioeconomic status has been documented to lead to higher mortality and longer hospital stays in older people suffering from a variety of illnesses including heart disease, stroke diabetes and trauma [47–49].

**Mental status changes in older people and its influence on acute hospital care**

The incidence of depression and cognitive impairment are higher in older people, and are often underdiagnosed in the Emergency Department. For example, as early as 1997 Meldon et al studied the incidence of depression in older people presenting to the Emergency Department, and found that 27% of their cohort of patients were depressed, but the Emergency Physicians looking after them did not diagnose depression in any of these patients [50]. The same authors also found that Emergency Physicians had difficulty recognising cognitive impairment and delirium; of the 78 patients diagnosed with either cognitive impairment or delirium by the research team, only 22 (28%) were identified as having mental status impairment by the Emergency Physicians looking after them [10]. In addition, of the 34 patients with mental status impairment who were discharged home, only 6 had a documented management plan for their mental status [10].

This low level of recognition of cognitive impairment in older people can have significant adverse effects on patients’ physical state and their outcome. Cooper et al studied hospital usage in older patients with chronic medical conditions, comparing those with and without a diagnosis of depression. The authors found that patients with depression were, on average, twice more likely to attend the Emergency Department and utilise hospital inpatient services for their medical conditions than those without depression [51]. Larsen et al also found that patients with cognitive impairment had a high risk of polypharmacy and drug-drug interactions [52]. Older Emergency Department patients with cognitive impairment are also more likely to reattend following discharge than those with normal mental status. For example, cognitive impairment is a recognised risk factor for falls in older people, and patients with cognitive impairment presenting with a fall to the Emergency Department are significantly more likely to return with further falls once they are discharged [53].

**Frailty – a major factor affecting recovery in older patients**

The presence of frailty in older patients has important implications for their care and outcomes [54,55]. Frailty has been defined as:

“...a distinctive health state related to the ageing process in which multiple body systems gradually lose their in-built reserves” *(Fit for Frailty - British Geriatric Society)*

The phenomenon has been described in Part 1 of this review [56]. Cawthon et al investigated the relationship between frailty and death in older men. They found that older men with frailty were more likely to die than those who were not frail [54]. The same authors also looked at the association between frailty and falls in older women, and concluded that frail older women were at a greater risk of falls, and once they had fallen were more likely to suffer serious injuries, require hospital admission and die of their injuries [55]. Bagshaw et al found that the adjusted odds of death in frail patients admitted with critical illness in Canada were almost twice that of non-frail patients [57].

Acute illness and admission to hospital often heralds a decline in functional status in older people, and this is
more marked in frail patients. Sands et al found that more than half of all frail patients with cognitive impairment suffered a decline in their activities of daily living after admission to hospital and this functional decline was still evident one year after the acute admission [58]. Overall, frailty is a major factor in determining the level of care required by acutely ill or injured older people, as well as predicting their outcomes.

The impact of ageing on health, as described above, affects the pattern of health service usage in older people. Acute illness is more likely to require health services intervention in the older population, leading to higher rates of usage of pre-hospital emergency services, higher rates of attendance at Emergency Departments and higher hospital admission rates [59,60]. The illnesses experienced by older people are more likely to be complex and involve multiple pathologies, thus requiring more integrated multidisciplinary care [61–63]. Once admitted, older patients stay longer in hospital, and are less likely to be functionally independent on discharge [24,64]. In addition, they are more likely to require social service input once admitted, particularly to effect a safe discharge home [65].

How should services be changed to better serve the ageing population?
As described above, the ageing population has specific healthcare needs, and the health service should be designed to meet these needs. This would include acknowledging and catering for the complexity of these patients’ health status, focusing on care within the community, providing early multidisciplinary care and emphasising quality of life as a priority outcome, rather than simply survival [66–68].

Admitting older people to hospital is not without its risks, and (as mentioned earlier), patients admitted to hospital with acute illnesses suffer a decline in their functional capacity, which can persist for some time after discharge [69]. Several authors have recommended more robust and comprehensive community-based care as a viable alternative to hospitalisation of older people. In their meta-analysis of studies investigating the ‘hospital in the home’ concept, Caplan et al found that they were associated with reductions in mortality, readmission rates and cost, and increases in patient and career satisfaction [70]. A literature review by Johansson et al explored multidisciplinary teamworking with older people in the community, and found that there were benefits to this approach. The authors suggested that team organisation, team intervention and outcome, and factors that influence teamwork were all important in ensuring the effectiveness of the team [71].

The importance of early multidisciplinary care within the hospital setting has also been emphasised by researchers in the field. Bouman et al demonstrated that a fast track rehabilitation service for older patients admitted to hospital after major trauma hastened their return to baseline functioning [72]. A recent review by Tanaka et al emphasised that a multidisciplinary approach to the care of older people provided support to patients and their families and helped them adapt to their illness [61]. Atwal et al investigated if multidisciplinary team working increased interprofessional collaboration. They observed teams working with older patients with hip fractures in the National Health Service in the United Kingdom. The authors found that multidisciplinary teams improved care processes for these patients, though there was little evidence of an increase in collaboration across professions [73].

Emphasis on quality of life is important in older patients and goals of treatment should be carefully considered, in consultation with patients and their families. Several authors have used quality of life measures to assess outcomes in older patients following hospitalisation. Inaba et al found that a large percentage of older people admitted for major trauma had a significant loss of independence and a decline in their quality of life (as measured by the SF-36) one year after their injury [67]. Other authors have pointed to the difficulty in
agreeing what constitutes a good quality of life. A review of the literature by Farquhar et al revealed a range of parameters identified by older people and their carers as pertinent to quality of life. The authors made the point that quality of life was defined by older people as more than simply quality of health, but included social interactions, social support and other societally based issues that impacted on patients. In addition, the authors noted that interpretations of quality of life were also influenced by individual patients’ socio-demographic characteristics, including age, social status and geographical location [74].

End of life decision making is becoming more common in all settings in which care is provided to an ageing population. Healthcare providers need to be able to enter into these difficult conversations with patients. Several authors have highlighted the need for more open conversations with older people regarding end of life decisions. As early as 1996, Bruce-Jones suggested that decisions to resuscitate older people should be made in close collaboration with them, but that a lack of public awareness and a reluctance on the part of physicians to engage in such conversations meant that these decisions were more often made by healthcare staff as a surrogate for patient autonomy [75]. In addition, there has been reluctance on the part of physicians to withhold or withdraw resuscitation from patients. Mahabir et al, surveying physicians in Trinidad and Tobago, found that 41.2% of respondents admitted to continuing cardiopulmonary resuscitation on patients despite perceived futility, and that 65.6% cited a fear of litigation as a factor in their decision making [76]. These results were similar to those in a survey of North American physicians conducted by Marco et al in 2007 [77]. Despite the reluctance of physicians to enter into these difficult discussions with patients, most commentators agree that they are necessary in older people, and welcomed by patients of this age group [78,79]. Involvement of the family in these decisions has also been shown to influence patient care and ultimately to help the grieving process for bereaved relatives [76,80].

Catering for the ageing population requires the health service to be more responsive to the needs of this population of patients. This would include providing more robust care in the community; a coordinated multidisciplinary approach to care; an emphasis on quality of life and a recognition of the importance of end of life care, where appropriate.

Modifying the Approach to Older Patients in the Acute Setting

The different physical, psychological and social needs of older patients lead to a more complex illness experience, with multiple factors influencing any single illness episode. The approach to the assessment and management of the acutely ill or injured older person must therefore be modified to account for this. While the diagnostic approach in the younger person is essentially reductive (looking for one diagnosis that explains all of the patient’s complaints), the approach in older people is more inclusive (accepting that multiple pathologies and diverse explanations for the patient’s presentation are the rule rather than the exception in this age group) [81]. Melady and Perry provide an instructive insight into the approach to the older patient in the Emergency Department in their article “Ten Best Practices for the Older Patient in the Emergency Department” (Table 2).
These practices focus on key characteristics of older patients and the skills needed to manage them effectively. They include acknowledging the complexity of presentation of older patients; providing early and integrated interdisciplinary care; anticipating the likelihood of atypical presentations in this age group; identifying cognitive impairment and recognising its impact on the patient’s overall health status; identifying and addressing psychosocial issues that impact on the patient’s presentation and disease progression; understanding the role of medication (particularly polypharmacy) in the genesis of acute illness in older people; accepting the variability in presentation and health status within the older age group; providing geriatric-specific healthcare environment in which to treat these patients; providing appropriate clinician education on the needs of older people and the approach to this age group and finally actively advocating for and promoting high quality end-of-life care where appropriate [81].

Department [83,86]. Hustey et al found that the majority of patients with cognitive impairment presenting to the ED went undiagnosed, but that screening for this problem did not significantly change the management plans for these patients [84]. Several studies have highlighted the impact of medical reconciliation on identifying potential inappropriate medications (PIMs) and drug-drug interactions in Emergency Department patients. However, a systematic review by Mueller et al found no evidence that medical reconciliation had an impact on patient outcomes such as adverse events or hospital length of stay [87]. It is likely that these approaches to the problems encountered by older patients in the Emergency Department have some positive impact, but the complexity of acute illness in older people makes such an impact difficult to prove. In particular, it is possible that medical reconciliation has a positive influence on quality of life and functional independence in older patients, but again, this has been difficult to prove conclusively.

The physical environment is important to the effective assessment and treatment of older people and care should be taken to provide an environment that is comfortable and welcoming. Barnes et al suggested 13 domains that could be assessed when evaluating the appropriateness of the built hospital environment for acutely ill or injured older people (Table 3).

This would include:

- dignity and personal care, such as easy access to washing and toilet facilities; privacy (for example bathing facilities that do not open directly onto public corridor or room);
- security;
- safety and hygiene, including a clean environment for infection control and slip-resistant flooring to prevent falls;
- awareness of the outside environment provided by windows with views and access to outdoor seating areas;
- comfort and control, including control of lighting through windows, shading, access to heating control and ventilation;
- wayfinding, as evidenced by signage and corridor layout;
- accessibility through wheelchair access, wide doorways, smooth thresholds, and the provision of ramps or lifts where necessary and appropriate;
- physical support to older people, utilising handrails along corridors, seating placed at intervals along corridors for resting and other supportive infrastructure;
- sensory support for individuals with increased visual and hearing needs (e.g., larger lettering on signage, use of acoustic materials to lessen reverberation);
- dementia/cognitive support for people with cognitive impairment (e.g., easily understood access in and
around the building, and a layout that enhances natural wayfinding and does not work counterintuitively);
- enhancement of staff roles as carers through thoughtfully built infrastructure
- accommodation of visitors and caregivers within the environment, by provision of food and rest areas for them [88].

Conclusion
This paper has highlighted the impact of the ageing population on acute health services and provided some suggestions on how the service can be modified to meet the needs of this sector of the population. Physicians and nurses working in the acute setting can modify their approach to individual patients to accommodate for the unique challenges faced by older people. In addition, hospitals can upgrade their infrastructure, paying particular attention to modifications that would enhance the experience of their older patients.

Ageing is a phenomenon whose impact has not been fully appreciated in the developing world, and more research is needed to better understand the effects of the ageing population in this setting.

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The global challenge of ageing population – Part II: the impact on health services, and the optimum healthcare strategy for older patients

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