Mobility dynamics of the elderly: Review of literatures

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Abstract. Mobility is key to maintaining independence, especially as people age. Sustainable development goals focused on providing access to safe, affordable, accessible and sustainable transportation for all by reducing number of global deaths and injuries from road traffic accidents. Providing transportation facilities for the elderly is an important part of sustainable transportation. This review assessed the mobility dynamics of the elderly with the aim of proffering sustainable solutions to the effective mobility of this unique set of individuals. Several literatures on mobility dynamics, travel behaviour and trip pattern of this unique set of people were assessed. The study showed that the use of public transport is influenced by distance in comparison with different modes of transport for the elderly. The review also established that distance is a function of the pendulum pattern. The mobility patterns of older people are influenced by various elements that depend on individual circumstances and state of health. Other factors that influenced mobility dynamics of the seniors as reviewed are age, gender, educational level, type of disability, income, residential area, availability of means of transport and built environment. The outcome of this review will aid transportation policy makers on the way-forward for effective and efficient mobility for the elderly now and in the foreseeable future towards a sustainable transportation system.

Keywords: Sustainable Transportation, Trip pattern, Accessibility, Aged, Transportation Planning

1.0 Motivation

By 2060 it is expected that the number of elderly people (65 and higher) will increase by two folds [1]. Increased life expectancy in recent years have been attributed to higher life expectancy and lower fertility rate among other factors. Natural aging process is linked to physical transformation and it has huge results on mobility. As a result, most countries now have an appreciable percentage of the seniors with transport needs. Gloomily, this set of people have been left out in the overall transportation planning policies which is an integral component of national growth and quality life [2-3]. Decline in mobility of the seniors have many unfavourable consequences. Inadequacy of public transport and public transportation infrastructure has limited the mobility of this unique set of people. Absence of data on mobility dynamics of the aged in most developing countries for quite some time now has been an issue for transportation planners. This review seeks to assess the factors affecting mobility and the mobility dynamics of the aged with view of proffering a sustainable solution for effective mobility now and in the foreseeable future.
1.1 Introduction

Mobility is one of the fundamental aspects of daily activities because without locomotion, it becomes difficult for an individual’s needs to be accomplished [4]. Transportation is one of the most important human activities in the world, it is an essential part of social, political and economic life in every society [4]. The expectation of older people around the world is increasing because of the improved expectations for daily comfort and health. As a result of the aging process and physiological changes, more aged individuals tend to make fewer trips than other age groups, altering the desired mode of transport. By 2060, it is expected that the number of elderly people (65 and higher) will increase by two folds [1]. Reduced flexibility, strength, visual perception, increased vulnerability to bone fracture, are some of the transformations that reduce the choice of active transportation for this individuals. Every elderly person, despite the fact that they participate in walking, cycling, driving or public transport, experience the negative consequences of more stressful and more powerful traffic [5]. Transportation mobility of older persons have been relatively neglected [6] and this is necessary for efficient transportation planning and hence the review.

2.0 Review of Literature

2.1 Travel behaviour of the Elderly

Due to the increase in age, older people tend to walk more, drive less and use more public transport [7]. According to the same author, the use of the car is constantly decreasing from the age of 55, while walking increases and public transport becomes a more used option for people aged 75 and older. It was also opined that there are different subgroups of obsolete individuals with different trip patterns and matching desires [8]. The mobility of elderly people can therefore be ambiguous and depend on the blueprint and the nature of the public transport services available to them. Elderly people in most developing and under developed nations are inclined to make fewer trips than the lower age groups. Research of [9] recommended that appropriate and meaningful transport workplaces for this age group is essential. According to the same author, access to open traffic can help mature people to enjoy good, administrative, businesslike and distinctive traffic. Public transport will make a significant contribution to maintaining its dynamic lifestyle, even when they cannot drive [10]. Public transport is therefore crucial for meeting the neighborhood of older people, their adaptability and flexibility. This has been adopted used globally [11-12].

Access to public transport helps older people to use goods and services, business activities and various activities [9]. To this end, public transport plays an important role in maintaining a dynamic lifestyle for older people who cannot drive [10]. Public transport is essential for the personal satisfaction of older people, their sense of flexibility and freedom [11-12].

2.2 Mobility Dynamics of the Aged

Human movements have been studied by observing people’s positions in a given space and time [13]. Based on the research, mobility is dependent on time and distance. The distance people travel and the durations of the trips are known as power law distributions [13]. Mobility is subject to cost and return and other incentives such as employment, health, desires among others. The mobility patterns of the elderly are caused by different elements based on individual circumstances as avowed by [14, 15, 8, 15, 16]. Apart from the ever-increasing physical or mental limitations, extraordinary events play a remarkable role in modifying mobility behaviours and desires. According to the same authors, retirement, sick leave of an accomplice, partner or close family members are common occurrences that affects mobility needs and alternatives. Other important events are separation, marriage, leaving children and the introduction of grandchildren.

Attitudes and lifestyles of the elderly have been identified as important factors in the trip pattern of these persons [17]. This was also buttressed by the theory of planned behavior, the theory of interpersonal behaviour and the standard activation model. Furthermore, the research of opined [17] stated that accessibility, mobility and external factors influence the decisions that these people take. It was in like manner demonstrated that there are different sub-groups of aged individuals with various
character patterns and matching desires [9,18]. The mobility of aged individuals hence can be unequivocally and rely based on blueprint and nature of public transportation services available to them. The modal split of the aged, showed that public transportation is a reliable means of transportation. To this end, access to public transportation helps the aged to have access to goods and services, business and other different activities. Consequently, public transportation plays a vital part in keeping up their dynamic way of life [19]. The author opined that public transportation is essential for personal satisfaction of the aged. This improve the feeling of flexibility and freedom. This has been affirmed in a broad overview nationally, around the world as well as in the World Health Organization's. However, some authors hold a different view on the mobility dynamics of this individual especially for rural elderly.

2.3 Trip Pattern of the Rural Elderly
One of the social functions of the transport system is to facilitate the movement and the needs of the population by integrating territories into the economic, social and recreational world. The research of Gina et al., 2006 has showed that the rural seniors are at disadvantage because they are less educated and have lower income. This was also buttressed by [20-21] that women, widows and most single parents [21-22] are at detriment. The low income of most seniors limit their accessibility to the basic necessity of life which include transportation. Additionally, lack of transportation alternatives is also a key factor restricting mobility in rural neighbourhood [23]. This to a large extent has affected accessibility to effective transportation of this set of individuals [24]

2.4 Factors affecting transportation pattern of the Aged
Changes in mobility patterns may be related to the declining ability of older people to overcome various obstacles. However, research of revealed that age is not really a strong factor affecting mobility as assumed for people lesser than 75 years. Interestingly, changes consist of physical and mental changes, financial barriers, reduced energy and sensory and reduced psychological capacities among other factors reduce the choice of active transportation by the elderly [1] Conversely, research of [15] contradicted this view. According to the author, age is indirectly proportional to driving, which reduces trip, trip time, and distance. Accordingly, older people are particularly struck by obstacles to their physical condition and inadequate facilities for public transport [25]. So many factors are responsible for the reduced mobility of the aged.

Sex or Gender
Men on the basis of gender can travel more easily than the female gender without help [15, 26]. Older women trip pattern showed that they are more escorted than men. This result is in line with the research of [15, 26] which revealed that older women use public transport more often than men, with women preferring the bus system

Income
The general recurrence of voyages is contingent on having a driver’s license as well as financial pay, among different elements. Aged individuals having little income as well as no driver’s permit will probably have shorter trip distance while those with higher incomes are most likely to trip more [27]. In general, trip costs turn out to be more vital than trip time as age increases; because aged individuals possess additional time along with regularly little or no cash there is a tendency of picking options that are less expensive however having longer trip time [28].

Area of residence
Extensive literature by [29-33] has discussed the links between the built environment and travel behavior. Factors such as density, street design, land use diversity, destination accessibility, distance to transit, and demographics, and travel behavior [34-38] affects the trip pattern of the elderly. The
residential area has a significant influence on the trip pattern and the choice of transport. A recent report showed that people aged 65 and above live in groups where the benefits of public transport are poor or do not exist. In addition, 60 percent of people above 50’s have no public transport within a 10-minute walk of their homes. Ownership of a vehicle can also be affected by residential areas, with 97% of rural and 92% of urban families owning a car and rural residents accounting for 91% of car journeys, compared to 86% of urban residents [39].

**Built Environment**

The research of [40-41] suggests that built environment characteristics from three domains (transportation systems, land use patterns, and urban design) can impact both functional limitations and disability in positive and negative directions. A majority of the existing literature is cross-sectional, making causal inferences impossible [41-44]. Housing density was associated with greater levels of walking according to [45] and with less disability among those with lower body functional limitations [46].

The results of the research showed that the mobility of older people still lags behind with young people. Recent studies are based on spatial differences in the trip behavior of the elderly. Several important elements of the built environment have a considerable impact on the drain profile, such as population density, mix of land use, distance to different facilities and transport regulations [46]. In general, residents of compact, compact mixed-use cities, together with adequate access to public transport and facilities, tend to participate in additional outdoor activities using more non-motorized transport [46-50]. Older people tend to react differently to build environments than other age groups because of the effects of retirement, changes in lifestyle and aging of the body.

### 3.0 Discussion

The review revealed that older people often seem less involved in movement and opt for shorter distances. It can be inferred that seniors engage in more intra city trips than inter-city trips. Based on the review, public transport is important for elderly because of their personal satisfaction, their sense of opportunity and freedom. Access to transport for these people can help them to use goods, services, work and different activities. Usually these people want to have available, moderate, accessible, acceptable, access and unlimited services with access to a significant number of goals over a long period. Additionally, the review showed that in general, trip costs turn out to be more vital than trip time as age increases. The residential area has a significant influence on the trip pattern and the choice of transport. As people aged 65 and above live in groups where the benefits of public transport are poor or do not exist. Furthermore, age is indirectly proportional to driving, which reduces trip, trip time, and distance. Accordingly, older people are particularly struck by obstacles to their physical condition and inadequate facilities for public transport as opined by [25].

The literature study showed a developing population of elderly whose needs are being maintained or observed in many national and international policies. The research of [40-41] suggests that built environment characteristics from three domains (transportation systems, land use patterns, and urban design) can impact both functional limitations and disability in positive and negative directions.

**Conclusion**

This research assessed the mobility dynamics of the elderly. This was done by the extensive review of relevant literature to assess the factors affecting the mobility of this unique set of individuals. This is because decline in mobility of the seniors have many unfavourable consequences. This review creates a way of bridging the gap that exist between this unique set of individuals and the rest of the world. Changes in mobility patterns may be related to the declining ability of older people to overcome various obstacles. The review assessed past research on travel behaviour and trip pattern of the seniors in a bid to proffer a sustainable solution to their transport need. The result of the review showed that:

a. Trip distance and time are very important factors in assessing the travel behavior and trip pattern of these individuals. We can infer that with increase in age the lower the use of private cars and mobility in general.

b. Due to increase in age, older individuals begin to walk more, drive less and use more public transport.
c. The rural seniors are at disadvantage because they are less educated and have lower income
d. According to the study car use diminishes continually as from 55 years, while walking increases and public transportation becomes a more used option for people 75 years and more.
e. Public transport is therefore crucial for meeting the neighborhood of older people, their adaptability and flexibility.
f. Men on the basis of gender can travel more easily than the female gender without help

3.1 Recommendations
i. Transport structures need to be created to promote non-motorized or public transport to nearby locations or residences for elderly.
ii. Walkways, railways, inland waterways and other modes of transport must be built, developed and promoted in order to reduce excessive reliance on the use of road transport over short and long distances.
iii. In addition, pedestrian paths must be linked to the structure of the general road network.
iv. For older people who cannot drive any more, a good and efficient public transport service should be provided.

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