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**A LIVING LAB FACILITY ON SAFETY IN HOMES  
AMONG THE ELDERLY AND ELDERLY DISABLED: A  
Literature Review**

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**ABSTRACT**

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<p>The study aimed to improve safety in the home environment for the elderly to live independently. The focus was discussing the measures of safe environment that promoted health, safety and security of the elderly. The study described the constituents of a safe home environment and approaches that safe environment promoted health of the aging. The objective was to utilize the results to advance safety in homes and assist the development of a living laboratory in the Ostrobothnia region.</p> <p>There is evident urgency for preventive health care measures that reduce injuries. The major hindrance in reducing falls was the inadequacy of facilities in homes for safety. Housing designs were inconsiderate of the elderly population. As a result, majority of this population were enrolled into rehabilitation institutions prematurely.</p> <p>A literature review with content analysis was established. The databases included Ebrary, CINAHL, Ovid, SAGE Premier and Science Direct as well as reliable electronic publications. These included WHO and Statistics Finland.</p> <p>The elderly safety was improved through modification of simple measures (grab bars, adequate light and non-slippery floor) and introduction of emerging advanced technology. Emerging care technologies were designed to enhance and maintain the well-being and independence of the aged. Technologists were to acknowledge pre-existing practices by enhancing them rather than replacing them. The recommendations include data on statistics that evaluated the safeness of the technologies and their direct correlation to the nursing profession.</p>		
<b>Key words</b> Aging, gerontology, health promotion, home environment, safety.		

## **ABBREVIATIONS**

ADL	Activities of Daily Living
AT	Assistive Technology
CINAHL	Cumulative Index to Nursing and Allied Health Literature
Ebrary	Electronic Library
ECG	Electrocardiogram
Ovid	Database Guidelines
SPO2	Blood Saturation Oxygen
THL	The Finnish National Institute for Health and Welfare. In Finnish: Terveyden Ja Hyvinvoinnin Laitos
WHO	World Health Organization

## **ABSTRACT**

## **ABBREVIATIONS**

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# 1 INTRODUCTION

Aging was a fundamental concern in health care. The elderly population required appropriate attention in their aging needs. This was for the continuous of living independently and safely. The increase on individuality and independence was significantly due to society's migrations and relocation to urban centers. In addition, there was an increase in the number of elderly citizens (baby boomers) as well as life expectancy in general. These increased the number of individuals living alone, in a society that housing designs were inconsiderate of the elderly and disabled. As a result, majority of the disabled and elderly population were enrolled into rehabilitation institutions prematurely. (Daniel, Cason & Ferrell 2009; Mann 2008.)

Technology assisted health care providers and relatives in promoting safety and independency. These consisted of strategic plans for home modifications, home safety, fall recovery techniques, balance and muscle strengthening as well as education for quality lives. (Daniel et al. 2009, 386.) Advanced technology and environmental interventions showed increased development in monitoring old people at their homes and surrounding to support aging. Besides that, advanced technologies were characterized by their reliability, minimal obstructiveness, and reasonable cost. These technology devices improved safety and decreased injury cases to the elderly. (Hoof, Kort, Rutten & Duijnste 2011; Daniel et al. 2009, 385.)

The World Health Organization (WHO) (2011) indicated a global population of 600 million people aged 60 and above in the year 2000. Approximately 30% of the European population would be above 60 by 2020. According to Statistics Finland (2012), Finland represented the world's fastest growing aging population with 65 years and above. The aged were estimated to increase from 18% to 26% by 2030 and to 28% by 2060. These demographic changes would pose increased problems for health and social care systems.

The Finnish National Institute for Health and Welfare (THL) (2012) stated that the aged receiving home care increased by 11.9% for 75 year and above. Moreover, 56.5% entered regular home care directly from home while 26.7% from hospitals or health centers. Approximately 25.3% were admitted due to physical issues while 27.1% were due to neglect of personal care. Approximately 84.2% of the population received the appropriate care while 5.6% managed better at home alone. Furthermore, there was an increased institutional care by 29% at end of 2009, indicating that the aged receiving 24 hour assistances had ascended by 4.1%. (THL 2011.)

The escalating figures were acknowledged in intellectual disabilities and psychiatric housing services. It was evident that the population of the aged living in residential homes significantly decreased compared to institutional care. Intensified urgency for health promotion was desired to improve safe environments and independence. This included secure foundation in supportive environment, access to information, life skills and health choices opportunities. (THL 2011.)

The literature review aimed to improve safe home environment for independent living of the elderly. The study focused on discussing factors that safe environment promoted health for the elderly. The research project was conducted in association with Honka- Project. The project was established to improve elderly homes by reducing and eradicating the challenges encountered by the elderly and elderly disabled. The project's goal was to create accessibility for the elderly and elderly disabled in their environment. These would be implemented through products and services that would improve the everyday functional capability for this group.

The project in co-operation with different companies and multi-professionals was established to launch a living lab facility in the Ostrobothnia region. The main aim of the living lab facility was to offer information, showcase products and services. Therefore, improve life quality and safety as well as reduce financial costs. The literature review was conducted to access an extensive search concerning the concept. Related information was obtained from reliable articles, journals and books from the library databases as well as official electronic sources. The study revealed the importance in integrating technology in the health care. Moreover, it discovered different applications that would enhance and maintain the well-being and independence of the elderly. Furthermore, significant reduction in the relocation of the aged to institutional care would be achieved.

## **2 THEORETICAL APPROACHES OF THE RESEARCH**

Living Labs was an established forum for research and innovation applied to the development of new products, services and processes. The product and service development model would open collaborative networks to technology improvements. It represented constant development in obtaining the desired targets for the user's population. The users accounted the opportunity to manipulate the product or service development in order to correspond the final product with the user's needs and desires. (Merenvainio 2009.)

Assisted living was a system of housing and limited care that was designed for senior citizens that required assistance with Activities of Daily Living (ADL). These included meals, personal assistance, housekeeping aid, monitoring of medications and nurses' visits. (Phillips, Ajrouch & Nallétamby 2010, 29.)

Disability was the condition of being disabled, inability to pursue an occupation due to physical or mental impairment. It was a physical or mental condition that limits a person's movements, senses or activities (WHO 2011.)

Safety was the condition or state of being safe or protected from cause of danger, risk or injury. These would include within or the outskirts of home environment (WHO 2011.)

Aging was the length of time that an individual lived or existed. It was a process whereby individual continued accumulating more years throughout their existence. Hence, aging was described as biological, social and psychological functioning changes in different phases of life (Phillips et al. 2010, 12.)

According to WHO (2003), health promotion is the process of enabling people to obtain control over their health. Health promotion was considered as an avenue of elevating the health status of an individual or community. Promotion in health context was defined as improving, advancing, supporting and inspiring health of an individual (Ewles & Simnett 2004.)

Health in this research implied to a relative state of an individual to function physically, mentally, socially and spiritually. However, it was not necessarily the absence of disease or other physical disabling condition. Therefore, it expressed the full range of one's unique potentialities within the living environment.

The state was not a static condition rather regarded as a constant change and adaptation to stress result in homeostasis (The ability or tendency of an organism or cell to maintain internal equilibrium by adjusting its physiological processes.). The states of health or disease were the expressions of the success or failure experienced by the organism in their efforts to respond adaptively to environmental challenges. (WHO 2011.)

Unintentional falls referred to inadvertently coming to rest on the ground, floor or other level. This was to exclude intentional change in position to rest in furniture, wall or any other objects without the influence of external elements. (WHO 2011.) The phrase “unintentional falls” would relate to falls that were as a result to the aging processes. These would include falls due to muscle strength weakness, initialization of illnesses such as stroke and accidental falls in the home environment. The research would exclude falls related to medication, drugs and alcohol subjected falls.

## 2.1 Safety devices

In the aging population protection from danger, risk or injury potentially amplified their life quality. Applied measures on safety have improved in the current society. Safety devices and technologies were the key environmental modifications that improved safety and lowered injury risk. Safety devices were categorized as described below. (Daniel et al. 2009.)

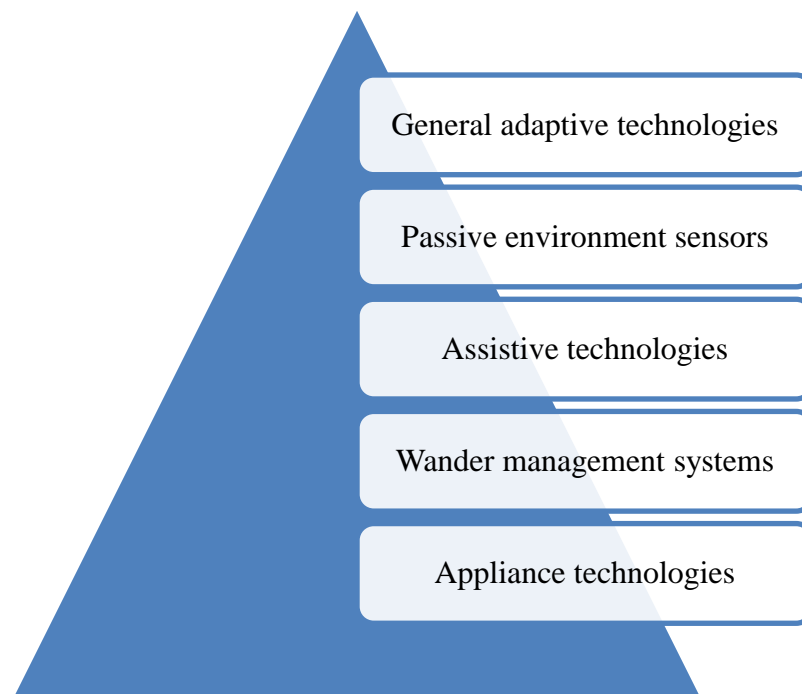


FIGURE 1. Safety devices (Daniel, Cason & Ferrell 2009)

**General Adaptive Technologies:** These general technology applications were to prolong independency in homes. Thus, avoiding expensive moves of these devices included level door



handles, amplifiers on door bells, telephones, grab rails and hand rails in appropriate locations. In addition, ramps, stair lifts, external lighting with passive infrared, as well as lowered light switches were included. Raised of electrical outlets, level thresholds, wider doors and corridors and electrical window and door openers were inclusive to this category. (Daniel et al. 2009.)

**Passive Environmental Sensors:** These monitoring devices were for the individual's and individual's homes. These included gas leaks monitors, carbon dioxide and other potential hazards. A telecom programme implemented in 2007 in United Kingdom, illustrated the usefulness of the passive environmental sensors in maintaining independency and safety among the elderly. According to the programme, the sensors at homes notified the elderly or the care giver for corrective action. (Daniel et al. 2009.)

Motion and pressure sensors were an additional illustration of the passive environments. These sensors protected and maintain security for the elderly at home. The devices were rendered useful to caregivers caring for cognitively impaired at their homes. Frequently, the devices were located under the flooring, mattress, passageways walls and windows as well as doors. The systems were designed to report and monitor events such as falls. Therefore, the systems were useful to people at high risk for falling. (Daniel et al. 2009.)

The sensors and the monitoring system detected movement or absence thereof once installed under the floor. Extensive absence of movement initiated the monitoring system to plan a consequential action. Pressure sensors were placed under mattresses. The sensors turned on bed-sides lights whenever the individual woke up from bed. Furthermore, it was programmed to activate the alarm in case of delay to return to bed after a period of time. Door sensors placed on entry-ways detected the elderly's movements. The sensors were combined with alerting systems that offered messages to relatives informing the elderly's location. (Daniel et al. 2009.)

**Passive Environmental Sensors and Monitoring Systems:** The combined systems were efficient to relatives residing in distant locations from the elderly's home. The systems were connected to the internet thus, alert the relatives. The system was beneficial to distance relatives. These allowed an interaction interface with the elderly's home; to turn on and off lights, turn off appliances and open and close blinds. The systems were fundamentally for monitoring home appliances while conserving energy use. Obstructiveness of the systems was reduced though cost should be extended. (Daniel et al. 2009.)

**Assistive Technologies Aid:** This technology assisted the elderly with physical disable to achieve ADL requirements. This included walkers, canes and telephones. Samsung brands for instance in the recently marketed a simplified phone that provided the elderly with desired enlarged numerical display and simplified operating procedure. Moreover, mobile phones were available in voice activation or command technologies thus, enable calls by voice command. An alternative voice activation technology required the elderly to wear a tie-clip microphone. (Daniel et al. 2009.)

**Smart Technologies:** The technologies were available for energy conservation by foregoing frequent trips to the mailbox or main door. The smart mailbox consisted of an audio system that notified the elderly of mail deliveries and visitations. The smart front door was activated by the doorbell equipped with a camera. The camera projected the visitors' image onto the screens once the doorbell rang. This provided the elderly an option of opening the door either manually or via voice activation. (Daniel et al. 2009.)

**Wander Management Systems:** These systems were first developed for nursing homes and assisted living facilities. Their function was to offer security to impaired elderly individuals that wandered outside of confined safe environment. This was for individuals that vanished from their own home communities. The system was supportive especially at night in aiding uninterrupted sleep. The system consisted of a day and night-time mode. The alarm alerted the caregiver in the occurrence that the patient was awake from bed in the night-time. Nevertheless, in the daytime mode the alarm notified the caregiver absences of the elderly from the house. The research showed that the participants were contented with the device. (Daniel et al. 2009.)

**Appliance Technology:** These appliances included the microwave that used smart wave technology. The smart wave's capability was to recognize the type of food product selected. It displayed the steps for preparation by an instructional video based on selection. Moreover, the smart wave was capable of self-programming for appropriate cooking time. There were notification alerts once completion by audio and video announcing and cautioning the user's handling the food. (Daniel et al. 2009.)

## **2.2 Aging population**

Aging was a fundamentally event-dependent, rather than a time- dependent process. Aging was considered as a natural development peculiar to an individual's experiences hence, deterioration in

physical activities that initiate illnesses. There was a subsequent anxiety that aging was linked to illnesses and physical anguish. The aging are individuals that offer certain implications to the general public health. For instance, healthier aging population equated to higher independent rate of living in the community. (WHO 2011; Leung 2010.)

This study utilized various terms in reference to aging. Preferences on the terms aging or elderly were used interchangeably and of equivalent meaning. The medical study of the aging process was termed as gerontology. Geriatrics was the study of diseases affecting the elderly. Senescence or biological aging was indicated as reference to changes in the biology of an organism as it ages after maturity. These were the changes affecting cells and their functions on the organism. (Mann 2008.)

According to WHO (2011), there were a global population of 600 million people who were aged 60 and above in the year 2000. The statistics indicated that by the year 2025 an increase by 1.2 million would be attained. The figure in 2050 was approximated to extent 2 billion people above this age. According to Mann (2008), global population growth was impacted by the increasing percentage of the elderly living longer. Apparently, the world was facing the challenge of healthcare service initiatives. (Mann 2008.)

Falls were ranked as the second leading reason for accidental or unintended injury deaths in the world. Approximately 424 000 people died from falls with 80% in low and middle income countries. There was an average population of 28-35% of falls each year of the people aged 65 and above. Besides that, there were approximately 32-42% of those above 70 years of age. WHO (2007) stated that increased falls occurred in nursing homes compared to the community. The statistics indicate approximately 30-50% of people in nursing homes fell yearly with a reoccurrence of a fall being at 40%. (WHO 2007.)

The number of injuries causing mild to severe complications falls have 20-30% representation. Injuries caused by falling range from hip fracture, severe brain and spine complications to limb injuries. The significant figures averaging than 50% were of the ages of 60 and above. There was a higher hospitalization stay on falls than any other form of injuries by four to 15 days. Falls severe for hospitalization of medical attention were approximately 37.3 million yearly. (WHO 2007.)

Approximately 30% of the European population would be above 60 by 2020. These demographic changes would decrease cases of increased health problems and social care systems. The main challenge was to amend the sort of care provision for increasing population if the aged such as discharging from hospital beds, to decrease overall costs. Delivering services to individuals in their own home enabled people to maintain their independence. The successful service delivery was

likely to be most cost-effective nonetheless it conveyed new challenges. (Mann 2008.) The individuals and the health administrators were facing problems with the worldwide trend of increased age and the 'elderly boom'. This expanding condition of the elderly population consumes on the health economy. (Leung 2010.)

Health promotions and advanced disease prevention measures in the population contributed to the increased life spans. The level of science to manage chronic illnesses was well established. The intention was for individual to living longer and healthier though this measures. Development of disease associated disabilities was a major negative consequence in the pursuit for the quality of life of the aging. This was resulting to enormous challenges for the population. These challenges included strains on aging's pension and social security systems. There were increased demands on medical health care and institutionalization. There was necessity for health-trained professional workforce in gerontology. (WHO 2011.)

### **2.3 Accident prevention in the elderly**

Fear of falling was pervasive among older adults. This was an independent risk factor for decreased mobility and loss of quality of life. Besides that, older adults in good health and living independently in the community were report as being fearful of falling. This highlighted the seriousness of fear of falls as a potential health risk factor in the healthy elderly. (Marquez, Bustamante, Blissmer, & Prohaska 2009; WHO 2011.) The definition of falls was debatable due to implications of the state of fall. This was due the description of the fall. The aged regarded it as a loss of balance while health professional observe it as any event leading to an injury and ill health. (WHO 2007.) These were accounted by both elderly that experienced and did not experience falls. (Quigley, Campbell, Bulat, Olney, Buerhaus & Needleman 2011.)

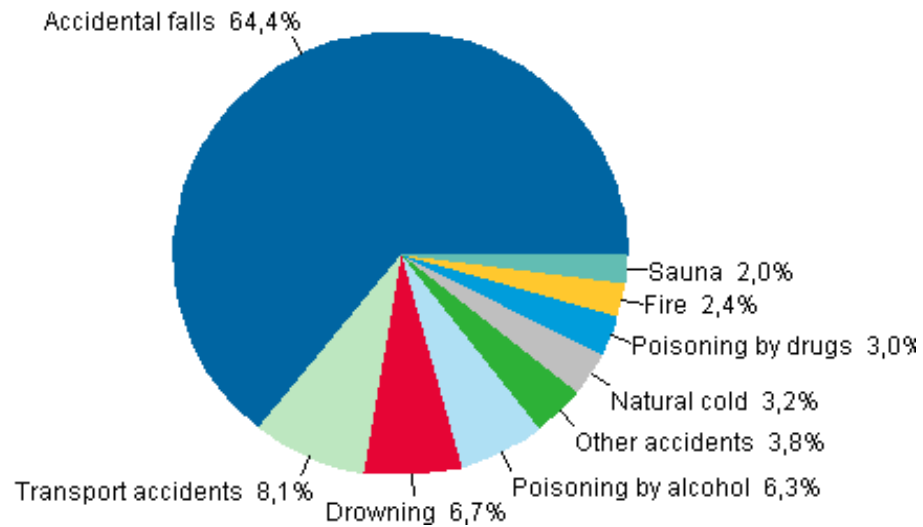


FIGURE 2. Fatal accidents among men aged 65 or above in 2009 (Statistics Finland 2009.)

The figure illustrates that major fatal accidents among men aged 65 and over was accidental falls with 64, 4%. 6, 7% of men died due to drowning and 6, 3% died from poisoning by alcohol. The number of elderly people with accidents relating to falls was on the increase and remained the main leading cause of fatal accidents. The least causes of death were other accidents, natural cold, poisoning by drugs, fire and sauna, respectively. The reasons for accidental falls among elderly was due to environmental hazards, balance disorder, dizziness, visual problem, postural hypotension as well as medication and so on. The accidental falls remained fatal due to their influence on accelerated death to already ill or ailing elderly people. In addition to that, elderly had low immunity or were unfit for surgery due to health conditions such as heart disease, diabetes, blood pressure and so on that lead to early death.

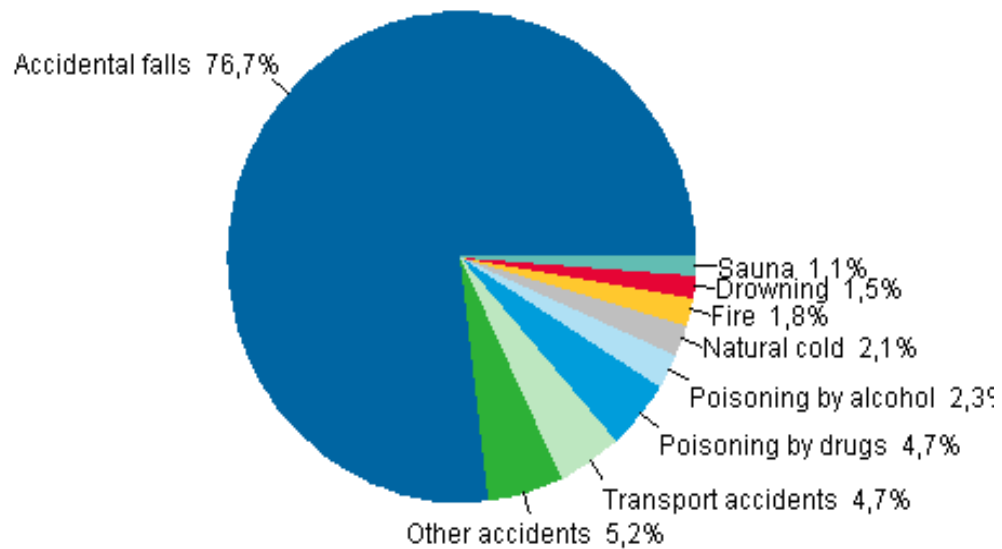


FIGURE 3. Fatal accidents among women aged 65 or over in 2009 (Statistics Finland 2009.)

The above figure reveals that accidental falls were the most common accidents leading to death in elderly women. It showed 76, 7% of women aged 65 or above died from accidental falls while 5, 2% died from other accidents. The least causes of death were from natural cold, fire, drowning and sauna respectively. The reasons for fall was due to poor balance caused by aging process, poor sights, insomnia, physical disabilities, medications, compromised co-ordination and so on.

According to Statistics Finland (2009), approximately 6% of deaths were caused by accidents. It was indicated that in 2,903 deaths 1,986 were men and 917 were women. Falls were ranked as the second leading reason for accidental or unintended injury deaths in the world. In addition, the statistics indicated that major cases of falls occurred at nursing homes compared to community. These were due to advanced age, multiple co morbidities for instance dementia, osteoporosis and multiple prescription medications negatively affecting gait and balance and bone strength.

Falls among Nursing Home residents' occurred frequently and repeatedly. The number of injuries causing mild to severe complications falls showed a 20-30% representation. Injuries caused by falling ranged from hip fracture, severe brain and spine complications to limb injuries. The figure showed that there was a 50% greater occurrence in ages 60 and above. There was a higher hospitalization stay on falls in relation to other form of injuries by four to 15 days. Falls severe for hospitalization of medical attention were estimated at 37.3 million yearly. (WHO 2007; Quigley et al. 2011.)

Decline in cognitive function and physical function are also associated with falls in elderly. Other factors that increase falls are a greater number of prescription medications, low levels of social support, and a greater need for assistance with instrumental activities of daily living. The predictors of nursing home placement includes advanced age, female gender, race, lower education level, low socioeconomic status, unavailability of informal care, living alone, dependencies in ADL, cognitive impairment, prior nursing home placement and hospitalization. (Spoelstra, Given, You & Given 2011.)

### **2.3 Home environment**

The term home environment would offer reference to shelter and the environs that were inclusive of the surroundings within and out of the shelter. Housing was universally designed for the average person with the average physical abilities. Designers ignored to accommodate designs that catered for the present resident as well as changes to occur in the future. The present resident was destined to change in the course of their life time. These unpredictable changes ought to be accommodated. These would offer designs that offered sensitive, excitement and were non-exclusive. A universal design is usable by all without remodification as a result of changes. (Mann 2008, 3.)

The worlds' leading aging society was Japan with quarter of the population above 65 by 2014. Measures were established to reduce the difficulties that the aging were encountering. The environment in there surrounding was on restructuring to improve safety and accessibility. The designers referred to it as 'design for all ages'. This was to implicate that the designs in housing and environmental changes in the surrounding were for all ages. The concept was to encourage residence to dwell in a place for childhood to old-aged. The housing units incorporated components for different ages, while in consideration of disabilities especially age-related. There was various design concepts created for longevity of enhanced housing experience such as the universal design, lifespan design. (Mann 2008, 19.)

The concept of the living labs was radically on the rise due to an increased innovation in housing facilities. This was an open innovation were companies, public organizations including councils; welfare and health organizations in unison produce prototypes of innovated new products, technologies and services in real environments for the market place. The objectives were to identify and realize the different anticipated desired products for the aged or users. Furthermore, it offered technology, solutions and pilot products that the clients obtained an opportunity to experience prior to purchasing for home use. (Mann 2008, 105.)

The recent past in technology represented an improved perspective in maintaining safety in the home environment. This was due to the increased consequences and complications from falls within the home environment. Wallmann (2009) stated that falls and fall-related injuries were among the primary reasons the aged were admitted to nursing homes. In addition, approximately 30% of healthy elderly aged 75 years and above fell once. A fourth of the 30% elderly ended up with serious injuries, while a 25% of the seriously injured showed restricted activities due to fears of falling. There was a sensitivity inclination to change the perceptions due to their deteriorating health status. (Wallmann 2009.)

The perception on people with disability of was ignored. The disabled have been sideline from the society. This was clearly illustrated by the view on disability. People viewed it as a negative issue and never to be associated with. Regardless of the person(s) with disability experiencing no pain, the perception was of pain. In an article Williams argues that

The reality of life for most disabled people is not the heroic overcoming of dramatic obstacles, but the daily struggle with the mundane activities through which identity is expressed and confirmed. (Luptona & Seymourb 2000.)

A research done on people with disability and their use of technology revealed there was an increased advancement. This simplified the disabled lives thus offering independence. (Luptona et al. 2000.)

There were soaring views to tackle and manage the rising challenges of the present and future society. The challenges included the safety and support of the elderly. There were concepts such as “age in place” that was of an assisted living concept. In a research on the challenges for nursing practice in assisted living, the concept avoided early long term care initialization. The assisted living facilities association of America offered an appropriate definition for this kind of care as:

A special combination of housing and personalized health care designed to respond to the individual needs of those who need help with activities of daily living. Care is provided in a way that promotes maximum independence and dignity for each resident and involves the resident's family, neighbors and friends. (Just, Deyoung & Van Dyk 2001.)

A research conducted on promoting basic accessibility in the home indicated that the basic house units were nonexistence of crucial design features. These features were vital for accommodating individuals with disability. The numerous barriers encountered by maneuvering in search pathways, support in their own homes as well as visitations in the community were unprecedented. (Just et al. 2001.)



A concept referred to as “Visitability” was an initiative advocated by the disabled community in America. It referred to attaining accessibility features for the disabled to have access in homes. It opened vital feature to be established in housing such as zero steps on home entrances, wide interior doors, accessible route inside homes, reinforced bathrooms walls and accessible light switches and controls. An American survey revealed at least 38% of homes with permanently physically limited individual modify their homes. (Just et al. 2001.)

In a survey for housing completed in 2000 Conventional homes with accessibility features, grab bars, shower seats comprised of 23%. Adjustments on wheelchair wide pathways constituted of 9%, special railings 8% and ramps at street level 5% were finalized. (Nishita, Liebig, Pynoos, Perelman & Spegal 2007.) In the year 1990 an act for architectural guideline for access to common areas such as meeting and laundry rooms, bathrooms parking facilities and recreation areas was enacted. This was from a straggle begun as a grassroots movement in 1986 by Eleanor smith. Smith was an advocate and a wheelchair user from Atlanta, Georgia. In the study, the researches stressed out that there were still difficulties in embracing and supporting this concept. (Nishita et al, 2007.)

## **2.4 Health promotion**

Health as a basic human right was a vital for social and economic development. Progressively, health promotion was obtaining recognition as an essential element of health development. The progress was to enable people to increase control and to improve their health. There was a significant reduction of inequities in health thus increasing health expectancy. Demographic trends such as an increased number of the aged pose new problems in all countries. Trans-national factors impacted on health through global economy, financial markets and trade. Furthermore, it widened access to media and communication technology as well as environmental degradation has steered to irresponsible use of resources. (Naidoo & Wills 1998)

Health promotion strategies had the ability to develop and change lifestyles. This impacted the social, economic and environmental conditions. The mortality rate for accidents was significantly for 65 years and above. Injury and disabilities on this age group was a considerable burden on the expenses of the government’s economy. Falls were reoccurring burdening factor in the aged group. Health promotion offered to reduce or eradicate identified factors that increase chances of continuous reoccurrence of the accidents. There were preventive programmes that could be considered. (Naidoo et al. 1998.)

The three E's of accident prevention were a conventional accident programme that categorizes preventable activities into engineering, enforcement and education. Engineering revolved on technical measures that were considered in developing safety environments. This included safety pedestrian crossings, staircases, smoke alarms in housings. Enforcement included legislations, regulations and standards that were put in place to reduce accidents and control injury. These included safety belts, helmets, product testing for standards and so on. (Naidoo et al. 1998.)

Education was the fundamental strategic tool in eradicating a problematic health hazard from the public in public health promotion. Education aimed to offer knowledge and understanding; enabling the clients to make and act upon well informed decisions. It set to identify causes and effects of health demoting factors in case of neglect. It offered an explanation of values and attitudes to developing required skills for healthy living. It proposed information that a client could obtain free choice on implementation of the knowledge received. Education included mass media campaigns, traditional methods of impacting advice and information, leaflets, posters and safety counseling. (Naidoo et al. 1998.)

## **2.5 Gerontology**

Gerontology was a branch of science that [dealt](#) with aging and the problems of aged person(s). The aspects of gerontology were explored for over 5000 years. Ageing was a natural, inevitable biological phenomenon. Geriatrics focused on the disease condition and disabilities of elderly persons. However, gerontology was studies on effects of time on human development and optional functioning throughout life. (Gilje, Lacey and Moore 2007; Mulley 2012.)

The study of the physical and psychological changes were incident to old age were under Gerontology. There were various aspects to gerontology. The care of aged was referred to as clinical Gerontology or Geriatrics. Social Gerontology was an aspect of Gerontology that was created to deal with the instincts of humanitarian and social attitudes and problems set by the increasing number of old people. (Gilje et al. 2007; Mulley 2012.)

Gerontologists view aging in terms of four distinct processes, chronological aging, biological aging, psychological aging, and social aging. Despite the growth in the field of Gerontological research for the past 50 years, no consensus emerged neither the definition of *gerontology* nor the scope and boundaries. This confusion was rooted historically in developments involving the geneses and acceptance of the terminology. These included the divergent agendas and world views of particular disciplines and gerontological institutions. Furthermore, there were significant conflicts on ideology and turf among major gerontologists. (Franklin & Tate 2008; Gilje et al. 2007.)

There arises numerous problems in old age with respect to health and other issue, therefore gerontology is sometime measured in terms of success. The concept of successful aging is used widely in the field of gerontology; there is no agreed-on standard or common underlying definition for measuring success in aging. As health care professionals adapt to the changing demographic composition of society, it should be of interest to understand successful aging might mean to the elderly to whom they are attending. (Dillaway & Byrnes 2009; Franklin et al. 2008.)

The elderly were involved with numerous health issues for instance heart disease, neurological alignment, cancer, osteoporosis, and dementia and so on. Majority of the elderly globally were obtaining inadequate health care due to governments and the society indecision. There was an approximated 1200 million people aged 65 years by 2025 (UN estimates 2012). Therefore, old age problems ought not to be in disregard. Although the aged over 65 year consumed hefty portion of health care services, yet the majority of nurses were unequipped with adequate knowledge about gerontology. Elderly's unique health problems were higher than normal adults due to their rapid grow. Thus, there was desire to preparing nurses proficiently in older adult issues and their health care (Gilje et al. 2007).

The five domains of activity for elders that were supported by technology were health and self-esteem. In addition, housing, daily living, mobility and transport, communication, governance and work as well as leisure were inclusive. According to the International Society for Gerontechnology, gerontechnology was "designing technology and environment for independent living and social participation of older persons in good health, comfort and safety." Gerontechnology is defined as "the design and development of techniques, products and services to support not only the physiological and medical aspects of aging but also the psychological and social issues faced by and aging population". (Skiba 2012)

### **3 RESEARCH PROBLEMS**

The study was to describe if proper housing facilities would enable safety from falls in the aged and the elderly disabled. In addition, it set to find out the deficiency of these safety facilities endangers the lives of the aged and the elderly disabled. The intended goal was to use the results to improve safety in homes and assist in developments in living laboratories. The purpose was that results would be used to improve the living environment among the elderly at their homes thus improving their sense of safety and security. The research questions included:

1. What constitute a safe home environment for the aging?
2. How safe environment promotes health of the aging?

#### **3.1 Research purpose**

The purpose of the research was to evaluate measures that encouraged home living. This was as a result of ensuring other preventive factors were in place. There was an increased level of individuality and independence in the society with the numbers of elderly citizens and life expectancies on the rise. It was important to prepare measures to reduce injuries in the public as a preventive health care measure. The major hindrance to reducing falls in the home environment was adequate facilities of safety.

There were no adequate if any safety appliances and facilities that support the decreased in these incidences. This problem was that housing units offered insufficient facilities that maintained safety. Increasing safety measures would reduce falls that assured reduction of disabilities in the elderly thus increasing healthily functional lifespans. (WHO 2007.)

## **4 RESEARCH METHODOLOGY**

A literature review was used for conducting the research. According to Fink (2010), a research literature review was a systematic, explicit and reproducible method for identifying, evaluating and synthesizing the existing body of completed and recorded work produced by researchers, scholars and practitioners. In literature review, the central focus was examining and evaluating the topic that has been researched before and establishing the relevance on the acquired information. (Fink 2010.)

A literature review was the comprehensive study and interpretation of literature that addressed a specific topic. Literature review was important as it summarized the several literature available about one topic and was convenient for the reader. It was important to be updated as a health and social care professionals with recent developments. Therefore, this method assisted to collect recent developments and ideas at a glance without going thoroughly for several literatures. The research questions were important tools to recall throughout the whole process of literature review. (Aveyard 2010, 5-6.)

### **4.1 Inclusion and exclusion criteria**

The researchers used a systematic review with an inclusion and exclusion criteria for choosing the articles. The criteria offered to define the limits and boundaries that guided the research questions and topic. The researches opted to apply the criterions as to exclude other recognized elements that were related to the topic. The researchers were aware that inclusions of these elements broaden the subject matter to further explain the motives. For instance, the researchers were aware that there were other factors that resonated to falls for instance disease and illness, alcoholic abuse and so on. The intention was to observe safety in the home environment for the aged, elderly disabled and aged-related disabled. The articles were to be evidenced based on reliable books and specifically used databases. The articles were available and retrievable. They were to be published in English from 1999- to date and answered the research question. (Parahoo 2006, 135-139.)

TABLE 1. Inclusion and exclusion criteria

<b>Inclusion Criteria</b>	<b>Exclusion Criteria</b>
The study focused on technology devices that assist in the safety and independency of “normal older adults”.	The study focused on technology devices that assist in the safety and independency of elderly people with some specific disability or admitted in hospitals.
The study focus on prevention of falls among elders.	The study focus on falls related to disease and illness, alcoholic abuse and so on.
The research articles in full text.	The research articles without full text.
12 years (1999-2012) due to the scarcity of articles.	Articles relevant to topic and not connected to nursing.
English and Finnish were the language of choice.	Other languages were irrelevant due to interpretation.

#### 4.2 Data collection

The literature review was completed by a thoroughly assembling and analysis of scientific journals, articles and electronic web pages as well as books. The searched scientific information was prepared using different databases Ebrary, CINAHL, Ovid, SAGE Premier and Science Direct as well as reliable electronic publications. This included WHO and Statistics Finland. Besides that, manual search were carried out by using library books. In literature review, numerous articles were required for the researchers to choose articles that contained relevant information. Relevant abstracts were read before choosing the articles.

TABLE 2. Data before analysis

	<b>Before data analysis</b>				
	Aging	Housing Environment	Health promotion	Gerontology	Safety
Sage	26,712	965	70	2,973	7,284
science direct	9,799	1,081	937	173	36,127
Cinahl	4,923	78	38	247	331
Ebrary	289	29,809	72	31	1129

TABLE 3. Data after analysis

	After data analysis				
	Aging	Housing Environment	Health promotion	Gerontology	Safety
Sage	7	0	1	4	1
science direct	2	2	0	4	3
Cinahl	0	0	0	0	0
Ebrary	4	1	1	4	0

### 4.3 Data analysis

According to Neale (2009), content analysis was a research technique for the objective, systematic and quantitative description of the manifest content of communication. Furthermore, content analysis was carried out in different ways of communication for instance written, verbal, audio and visual. Content analysis was usually used when conducting a historical research involving use of words and sentences or phrases. In content analysis maximum information was obtained that increased the scope of questions to be answered. Content analysis had often been used in health and social care research to analyse media content and written material. Conducting a content analysis included familiarizing with the theoretical background to the research questions. However, data analysis would be a challenge if there is a bias in the material analyzed and time consuming. (Neale 2009, 78-83).

The researchers used content analysis to deepen the knowledge of the study. These assisted to formulate new hypotheses and interpret the findings. The researchers acquired information from the discussion, results and abstract. Data analysis process was initiated through studying the obtained materials. These assisted the researchers to relate the information to the research questions. Researchers encountered the phrase 'gerontology' that assisted in revealing related articles during the data analysis process. The researchers implied the knowledge that they had in regards to their questions in order to distinguish between relevant and irrelevant material. These revealed available material for analysis. The final step of a content analysis process was to analyse the data and relate the findings to the research questions. The researchers formatted the research questions, collected and analyzed the data and configured the conclusion.

## **5 ETHICS AND RELIABILITY**

Ethical issues were implied in every stage of research process from choosing the topic, selecting the design to publication of the findings. A good scientific conduct was required for a scientific research to be ethically acceptable. (Parahoo 2006, 111.) The articles chosen by following the evaluated scientific conduct with the checklist mentioned in inclusion criteria. The reviewed sources and their authors were respected and referred accurately.

The reliability was achieved by referring to recent materials available and effortlessly retrievable. The articles were chosen from the reliable electronic sources and school's library databases. The research project was about the desire of facilities in homes that prevents falls in elderly people over the age of 65 years. Consequently, this research project would be an awareness tool to the population about well facilitated homes for elderly people.



## 6 FINDINGS

The researchers related findings according to the research problems. The researchers divided the findings into two sub-headings.

### 6.1 Safe home environment and technology for the aging

Unraveling the fundamental mechanisms of aging was a pre-requisite for developing appropriate means of increasing mobility, activity, creativity and independence of the elderly. Aging was a process that posed significant safety, health and functional decline problems. The physiological changes that occurred with ageing originated in the molecular biology of cells, contributing to normal human ageing as well as age-related pathologies. However, aging individuals with a disability experienced an increased problems at an earlier age compared to individual without a disability. (Wilson, Mitchell, Kemp, Adkins & Mann 2009; Toussanit, Baret, Brion, Crass, Collette, Deyn, Geenen, Campard, Labeur, Aguilar, Linden, Leuven & Vanfletere 2000.)

The converging trends of an aging population and the increasing life span. Medical technology was migrating into the home in regards to design features of the home in contrast to health care institutions. It was important to gain an understanding of the most prevalent and serious threats to safety, the quality of care experienced and the wellbeing of care-recipients and caregivers. It was critical to develop a human factors approach to health care in the home that can accommodate the diversity, strengths, and limitations of humans. This was relevant to both the care-recipients and caregivers to address these threats effectively. (Dmjanovich, Nagy & Gapar 2001.)

There was a high repercussion to falls; it ranged from surgeries, admission to long term care and even death. Falls were the highest cause of hip fracture in Finland with the ratio of women being higher than men. This was due to women's low bone density and body size. The hip fracture risk was approximated to be 16-18% for women and 5-6% for men. There was a high incidence of osteoporotic fractures in men that was associated with morbidity and mortality. This occurrence was due to deficiency in treatment of osteoporosis in fracture patients. It was noted that falling was the highest cause of fractures in the aged with expensive drug treatment. (Salminen, Riih  & Heinonen 2011.)

In a 12 year cohort study, it was revealed that fractures were the most common incidence in the aged with a minor section due to extreme serious accidents. The risk increased with age and doubled with in a 10 year span. It further indicated that the population above 90 years old was highly vulnerable. This age group survived life threatening illness such as common diseases with

prevalence increasing with age. Moreover, dementia was regarded the highest burden in health sector. These were the constant challenges to health care. (Salminen et al. 2011.)

According to Schillmeier & Domenech (2010), development of technologies that supported the aged people at home was complemented by an ideological shift toward 'ageing in place'. Countries that adopted these concepts revealed that home setting was preferred. Besides that, it was the most cost effective site of care and support for older people. The contrast comprised of the aged and families that relocated to residential care settings experiencing significant stresses. (Schillmeier et al. 2010.)

A research conducted in Hungary showed that gerontology was an orphan branch and no effective efforts represented were put into isolating it. There were obvious demands to maintain the life span of the aged. This was intended to positively, compel funding from agencies and scientific authorities. The focus involved attention and spending to preserve the working and health capacity of the aging population. Overall, the goal of these activities is not expanding the life span nonetheless the preservation of the mental and physical health and working capacity of the aging population. (Dmjanovich, Nagy & Gapar 2001.)

The results and benefits on the advanced technologies for habitable indoor environments could assist designers and building engineers. A beginning in incorporating the technologies in building construction could add basic value, functional value and economic value as well as a synthesis of building-related solutions. The technologies nevertheless, increasingly supported the medical profession in enabling independence in the aged clientele thus reducing institutionalization. (Hoof, Kort, Duijnste, Rutten & Hensen 2010.)

Advanced technologies such as smart homes offered remote centers for data collection. There was an ongoing observation of the situations and assistance. They were wearable and in vivo implantations that assisted the clientele within and outside their environs. The devices were applied to monitor individual's locations or monitor vital health signs such as blood pressure, Electrocardiogram (ECG), Blood Saturation Oxygen (SPO2) and so on. (Hoof et al. 2010.) The age-related changes create difficulties with coping and impairment to normal daily functioning as well as sensitivity with altered environments. The founder of modern nursing Florence Nightingale who was well aware of the influence of the indoor environment on the progress of disease and recovery, and her messages were not unnoticed by stating

In watching diseases [...] in private houses [...], the [...] symptoms or the sufferings generally considered to be inevitable and incident to the disease are very often not symptoms of the disease at all, but of something quite different – of the want of

fresh air, or of light, or of warmth, or of quiet, or of cleanliness, of each or of all of there.'(Hoof et al. 2010.)

According to Hoof et al. (2010), technology in lighting had significantly improved independence in people with dementia by increasing cognition, mood, behavior and sleep as well as vision. In addition, installation of the appliance could pose difficulties in well-being and supportive care. In the case of late installation, difficulties of proper orientation and usage would hinder best actualization of the technologies. The different technologies were found to be effective for instance, clients living alone that would be incapable to pursue assistance during an emergency due to unconsciousness, falls, strokes and myocardial infarctions. The smart homes technology offered the benefit of ensuring independence to live at home while allowing safety. (Hoof et al. 2010.)

Jukkula & Cook (2008) stated that possibilities of representing predictions in algorithms that could assist independent living. Temporal patterns associated with ADL would trigger a violation if detected. For instance, if a client was unsuccessful to recall taking medication a quick reminder would be sent while still assisting on the next set of following activities. (Mihailidis, Boger, Kautz & Normie 2007, 3-10.)

The level of technology in this age group differed, as there were researches that proved failure of usage of the advanced technology. Moreover, it would be in the occurrences that the client had cognitive problems; stroke and sight problems as well as not being accustomed to the technologies. In these surveys, the elderly either were unsuccessful to use the technology or asked for their removal. (Mihailidis et al. 2007, 19-26.)

A research on bed-exit alarm systems that were used to reduce patient falls constituted to serious problems for the person(s) fallen and the institutions involved. Furthermore, these systems had to be checked for functionality and correction on position from time to time. Restless patients produced false alarms due to wrapping and pulling at the cord. This triggered the alarm as it recognized absence of weight. Integrated bed-exit alarm systems could be perceived as technologically advanced. However, full-scale deployment in the geriatric and home care setting was unachieved due to affordability of the beds. (Hilbe, Schulc, Linder & Them 2009.)

Therefore, it was important to create technologies for these potential older users deemed worthwhile and required in their lives. It was clear that this population of non-users would not adopt the technologies. Consequently, it was either until there were changes in perceptions on the usefulness of the technology or changes in technology to better address their interests and needs. The main obstacles were to offer individual specifications that addressed different ages, disability, homes and supportive environment as well as financial limitations. Considerations involved the costs of even

the simplest establishments. The ability of an individual and the family or caregivers to handle the technology was evaluated. (Hilbe et al. 2009.)

Clinicians ought to be aware that irrespective of an individual's impairment or functional decline; occurs earlier in the elderly with disabilities than the normally aged. This would enable the clinicians to offer recommendations for assistive technology, including environmental adaptation and behavioral strategies. Hence, this would further slow functional decline in the aging process and support aging in place. (Wilson et al. 2009.) According to Schillmeier & Domenech (2010), it was discovered that these technologies had potential to enhance and maintain the well-being and independence of aged as well as reduce the number of aged people relocating to residential care and hospitals.

In a study by Demirbilek & Demirkan (2004), universal design was a concept that extended to a broad diversity of users to integrate with the built environment. Homes were designed to address life span services in order to improve the quality of life. These included promotion of independence, safety, use ability and attractiveness for the residence. For instance, an elbow operated door handle and a door screen was proposed to allow elderly users to observe visitors. Moreover, proposed devices designed for the main entrance door to position shopping bags or seating units while searching for keys in the bag. The purpose of these designs was to develop a safe and functional housing in order to promote and maintain independent living for the elderly. (Demirbilek et al. 2004.)

## **6.2 Factors that promote safe environment**

In a research conducted in University of Southern California, it suggested that home modification aids in reduction of falls. It further concluded that professional assessment, education and installation of home modification were effective. These improved functioning, decreased fear of falling and reduced the incidence of falls among elderly. The specific supportive features such as grab bars in bathrooms, handrails on both sides of staircases, nonslip flooring and adequate lighting was considered as universal benefits for all users regardless of age. These assisted in prevention of falls and promoted safety. In addition to that, Stewart (2001) discussed that provision of non-slippery floor, positioning cupboards in suitable heights, safety catches to windows as well as grab rails to the bathrooms would contributed in reduction of falls among aged. (Steinman, Pynoos & Nguyen 2009).

According to Gray (2007), safe environment included absence of environmental hazards, modifications of the facility and implementation of alarm system. In addition, it included proper mobility to aid physical or occupational therapy as well as practice of assistive devices. Furthermore, home modifications only, were not adequate to reduce fall. Besides that, home modification and environmental hazards were to be addressed. This included for instance eliminating clutter, extension cords, rugs, providing non slippery floors, improving lighting and so on. (Gray 2007).

Ambient technologies were means to support ageing-in-place by monitoring clients in the home. Maintaining good health and independence is essential for the ageing world. Assistive devices were designed with consideration of social, aesthetic and emotional factors to support the quality of life of the elderly. They were attractive, affordable and non-stigmatizing. Assisting the elderly to remain independent in the setting of their choice was a complex multifactor endeavor. A research conducted by Hoof et al. (2011) showed that ambient technologies contributed to an increased sense of safety and security at home particularly in fall cases and feeling unwell. The technologies were effortlessly adopted by the respondents including home variety modifications and assistive devices. (Hoof et al. 2011.)

According to a study conducted by Rosenberg & Nygård (2011), Assistive Technology (AT), for instance time aids and locator devices were encouraging. The possibilities for assisting people with dementia age in place at home were by compensating functional losses. In addition, AT were significant to enhance well-being and safety for the person with dementia and their families. Moreover, AT offered the potential of promoting time orientation supporting maintained independent living. (Rosenberg et al. 2011.)

A four-part assessment would be determined during AT installation. Firstly, the applicant's self-assessment of once difficulties and requirements were considered. Secondly, the occupational therapist's assessment of the applicant's disabilities and abilities was established. Proposed methods to resolve the functional complications would be suggested. Thirdly, the engineer's technical assessments of adaptive solutions would include solving the difficulties of structural barriers. Lastly, there were examinations of legal guidelines concerning the grant to be used. (Rosenberg et al. 2011.)

Functional independence remained a key component of the emotional and psychological wellbeing of older adults. Aiding the elderly in retaining their independence was through the use of technology. The researchers addressed issues that related to the essentials and characteristics of the aged. The designs of such an environment, lead to extensive issues remaining unexamined. The

matters of acceptance, comfort, and perceived usefulness were crucial to the implementation of the technology.

A structured interview with 17 older adults aged 65 to 75 were conducted in a technology-rich home environment with the aim of examining these concerns first-hand. Two devices were discussed using preliminary qualitative acceptance. As adults developed older, the physical and psychological decrements that they endure positioned them at a functional disadvantage. Considerable research was established to examine the physiological causes of these decrements. Nevertheless, it was extensively with at least these changes were inevitable.

These age-related declines were remedies for elderly to retain functional independence. These was for instance outside of an institutionalized environment. Significant numbers of the elderly could be assisted biologically and medically. There were focuses on the use of technology to counteract these effects. However, data suggested that the elderly were often neglected in the design of environments and technology products. It was important to consider their special capabilities and needs when designing any technology. Nevertheless, it was essential that these characteristics be at the center of the design process. The aim was to improve the quality of their lives.

## 7 DISCUSSIONS AND CONCLUSION

Safe home environment for the aged comprised of different features and appliances. These maintained safety from injuries associated with falls as well as other related hazards. The residential falls related hazards were consequences of deficient handrails on stairs, non-slip surfaces in the bathroom and grab bars, slipping hazards (such as throw rugs, waxed flooring), outdoor steps, presence of electrical or telephone cords in the walkway and inadequate lighting. In addition, physical ability level, individual behaviours and lifestyle would not to be ignored. The elderly safety is improved through modification of these simple measures and the introduction of emerging advanced technology.

It was revealed that universal design, smart homes, aging in place and so on had not been integrated in existing building designs. Incorporating these architectural designs would enable features that provide safe environment for the elderly. In these designs focus would be established through the elderly's relationship to the environment. These included loss of balance, cognitive impairment, loss of strength, visual impairment, and hearing impairment as well as sensitivity to cold and direct sunlight. These included features such as zero steps on home entrances, wide interior doors, accessible route inside homes, reinforced bathrooms walls and accessible light switches and controls as well as non-slippery and uncluttered floor.

Emerging care technologies were designed to enhance and maintain the well-being and independence of the aged to reduce population in residential care and hospitals. As a result, houses were designed to maintain healthy and independent lifestyle enhancing ability to live at their homes longer. These included environmental control solutions such as wireless control for electronic equipment at home for instance hands free telephones, lighting and door systems linked to tele-care solutions. Electronic pill dispensers designed to dispense tablets at preset times and setting off an alert call if unresponsive.

Smart homes or wearable devices designed to monitor and gather continuous data. These included motion detectors to detect falls, inactivity, use of household appliances and facilities such as fridges and so on. In addition, there were smart clothing and fabrics with inbuilt sensors to monitor individual health status such as heart rate and pulse. Moreover, electronic monitoring and tagging devices were designed to identify patterns of movement and location. Furthermore, robotic pets were designed to address social isolation and some of the emotional needs of the elderly.

Home injuries were not accidents; most were predictable and more importantly preventable. Professionals could help the aged through health promotion in lifestyle changes that could prevent home injuries. This would be by promoting safe behaviour and changing hazardous home environment. Information was a key ingredient in preventing predictable and preventable injuries. This would be through training, videos, brochures and guidelines on use of devices and prevention checklist for falls and so on.

The installation of these devices could assist in alerting unpredictable illnesses through continuous monitoring of rate and pulse. They could hinder deterioration of illnesses for instance electronic pill dispensers, vital sign monitors as well as continuous monitoring of the aged from remote locations. It was important to ensure that all emergency systems were up to date for the provision and maintaining safety environment for the aged.

Although the intention to advance technology is to develop self-determination, the choices and decisions regarding one's quality of life free from external influence are determined by their ability. These abilities include indicating preference and pursuing action, identifying concepts and making judgments while anticipating consequences thereof. Furthermore, using knowledge and reasoning to make decisions without being overly influenced by the outside environment or others. Effective functional autonomy can be utilized if there is an early inclusion to the technology thus familiarizing before cases of cognitive deterioration.

It is important for technologists to acknowledge pre-existing practices and enhance them rather than replacing them. Extreme new systems may have maximum effectiveness but may be rendered useless if no one is able to use them. The systems need to be clearly flexible and open-ended to allow the clients to incorporate the technology into their own lives as applicable without much restraint.

Governments' ought to strategies on the way forward in addressing "aging in place" initiative due to the projected growth of the aged. Support of these strategies have been acknowledged in countries such as the United Kingdom which established an investment of £80 million from 2007 to 2010 to initiate drastic amendments in design on housing, health and social care. The approach is not only set to create well-being and independence but rather reduce the number of aged people in residential care and hospitals (Milligan 2009).



The new technologies have the capability of monitoring falls, movement, eating patterns, irregular vital signs and so on. Furthermore, it is indicated that a level of independence or control brought a sense of joy and a feeling of inclusion to the aged people. However, we ought not to be oblivious to the fact that some technologies are simply a redirection of the aged independence from physically present care to remote care systems.

Moreover, the concept of these technologies is with intent not only to create independence but also reduce resource on caregiving thus manageable caregiver visits. This in retrospect will reduce contact with caregivers of which may contribute to a rise to exclusion and isolation that will alleviate stress and depression. It is therefore, critical to evaluate the extent to which independence is required by individuals while also inconsideration that informal or formal care givers cannot be excluded.

The technologies were designed to enhance and maintain the well-being and independence of the aged to reduce population in residential care. This resulted to health and independent lifestyle enhancing abilities for the elderly to live longer at their home. Nurses should be familiar with available technology to improve safety for the elderly. It is critical to ensure safety of the elderly to their independency and life quality. The technologies help the healthcare and family caregivers to assist the elderly remain independent and reduce cost. Some appliances and technology may initially be regarded as expensive and unnecessary but in the long term they will be cost-effective. This is in regard to preventable accidents that lead to surgeries, institutionalization, disability and death. Families planning to enable their elderly be independent ought to consider the appliances for home safety.

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## APPENDICES

Author, Year	Purpose	Method	Findings
Daniel, K., M., Carson, C., L., & Ferrell, S. 2009.	To review currently available devices and products that were intended to obtain home safety needs of the elderly.	Literature review	The available technologies provided independent to the elderly. Nurses should be familiar with available technologies to improve safety of elderly.
Mann, W.C. 2008.	To synthesize knowledge about disability and aging approaches to maintain independence and quality of life.	Literature review	Livable homes and communities, smart homes and robotics, and assistive technology were effective to provide independence.
Demirbilek, O. & Demirkan, H. 2004.	To guide designers to provide safe and functionally appropriate environment for the aged.	The participatory design model was proposed.	The physical environment can enhance or impede the independence and mobility of elderly. The designed model proved to be potential source for designers.



Steinman, A. B., Pynoos, J. & Nguyen, Q. D. 2009.	To assess direct effects of self-rated vision, home modification and limb functioning.	Logistic regression was used.	The effects of self-rated vision and home modifications decreased fall. No evidence was found for a moderating effect of vision status on limb functioning.
Spoelstra, S. L., Given, B., You, M. & Given, C. W. 2012.	To determine whether a fall influences early nursing home replacement (NHP).	Retrospective longitudinal study	Fall was the prior predictor for NHP. Thus, risk factors for NHP should be considered.
Hoof, V.J., Kort, M.H., Duijnste, H.M., Rutten, S.P. & Hensen, M.J. 2010.	To provide an overview of the indoor environmental parameters, as well as the integrated design and implementation of relevant building systems.	Literature review	Results would support designers to create optimal living environment and raised awareness among health care professionals about influence of the indoor environment.
Weinstein, M. & Booth, J 2006.	To perform a comprehensive assessment of individual and surrounding to determine risk factors for fall.	Multifactorial approach	By making individual aware of their increases risk for falling and providing. Strategies for prevention, one can remain safely at homes and communities.

Yuen, H. K. & Carter, R. E. 2006	older adults' intention to implement home modifications that can prevent falls.	Qualitative study	Older adults presented a greater intention to implement home modifications if they perceived that modifications would reduce falls and if they had have previously encountered fall-prevention adaptations at their home.
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