EMERGING INFECTIONS IN THE ELDERLY: PREVENTION AND CONTROL CHALLENGES IN ELDERLY HOMES

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Abstract:

Background: Old age is inevitable. Successful aging is the wish of everybody. It is just unfortunately that aging is associated with some difficulties due to general body deterioration and immunocompromised. Healthcare facilities such as hospitals and acute care centers are frequently visited at old age. Infections are the reason or outcomes for the visits. Due to cost minimization and release of caring burden in the hospital and acute care, long-term care facilities are destinations for elderly. The aim is to have better life, but it is against the expectations, long-term care facilities are now reservoir of infections. Prevention and control of infections in long-term care facilities is still a challenge. Therefore, there is a need to highlight about infections in general especially in elderly homes since there are limited number of studies in that area. In doing that, this study intends to 1) identify the risks factors for infections in the elderly. 2) Identify the common types of infections in the elderly homes 3) identify the challenges facing infection prevention and control efforts. 4) Identify nursing roles in prevention and control of infections in the elderly homes.

Method: Literature review is an opted method due to time and fund limits. To achieve that, Via Arcada university of Applied science webpage, articles were searched from PUBMED, ELITE and SAGE and nine out of ten articles were selected and via Google search, the 10th articles was obtained which happened to be published in Science Direct database also. The content of these articles was qualitatively analyzed to get the results.

Results: The prevalence of infections in long-term care facilities is reported to have down sized trend from 9.1% in 2008 to (6-7) % in 2016-2017 for Finland. Reasons for this are: General body deteriorations, immune compromised state of elderly's bodies, unsafe living environment in long-term care facilities, care givers knowledge about old age, aging, and infections. Fund and other resources, unnecessary prescriptions and antibiotic use, as well as hands hygiene and aseptic techniques in general care. Patients /nurse ratio in long term care facilities, Lack of experts in infections prevention and control, poor preparation of new nurses from school.

Conclusion: The problem is still big, quick actions are recommended such as changing curriculum, in service training. Nurses have to be learning every day to update their knowledge and they should be the role model for patients and visitor.

Key Words	Healthcare associated infections, elderly homes, prevention challenges
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ABBREVIATION

OECD: Organization for Economic Cooperation and Development

ECDC: European Centre for Disease Prevention and Control

MRSA: Methicillin-Resistant Staphylococcus Aureus

HAI: Hospital Acquired Infections

HALT: Healthcare-Associated infections in Long-Term care facilities

LTCFs: Long-Term Care Facilities

HCAI: Health-Care Associated Infection

EU: European Union

ICU: Intensive Care Unit

CDC: Centre for Diseases Control and Prevention

VRE: Vancomycin resistant Enterococcus

ESBL: Extended-spectrum beta-lactamase

HDU: High dependency units

VZV: Varicella zoster virus

MDRO: Multi-drug resistance organisms

UTI: Urinary Tract Infections

NGT: Nasogastric Tub

Dedication

To my lovely kids CHRISTOPHER, CEDRICK and NIRVAN for their encouragements.

GUYS, we have made it

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First, Allah is always good to me. Alhamdulillah.

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Special thanks to my parents for their prayers and unconditional support at each step of my life.

No way I can pay you back for your kindness, just receive glory and blessings from almighty God.

Sihoja Hamis

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1 INTRODUCTION

As the world celebrates the increase in life expectancy, aging emerges as problems to some countries since it associates some complications with specific requirements. Finland leads other European nations by having a higher number of elderly aged 65 and above (Population Statistics in Finland, 2017). Much increase was predicted in few years to come as baby boomer retirement approaches (Heikkilä, 2012). As to many other European countries, Finnish healthcare sector faces some challenges, although it is reported to have a very good healthcare system with the best framework for elderly care (OECD: Better Policy for better Lives, 2013).

Infections are the global challenges that healthcare system encounter. They rank in top ten list of mortality and morbidity causes in the elderly, alongside with other chronic diseases such as heart problems, cancer, and stroke (Cross, 2006). There is a link between increasing in age and infections susceptibilities (Berg & Cassells, 1992). Geriatric population are attacked by infections in higher rate than other age groups (Cross, 2006). Age-related complications such as physical and mental instabilities weight more in the infections acquisition secondary to immunity-related factors. Lifestyle i.e. travelling, living arrangement and residing to nursing homes (Strausbaugh, 2001), malnutrition and functional impairment such as incontinence, immobility, and dysphagia (Cross, 2006) were mentioned as added factors for infections acquisition. Moreover, multiple comorbid diseases develop to functional decline and dependency in performing daily living chores, thus full-time care within nursing homes is required (Quagliarello et al, 2010).

Several reasons contribute to the challenge in caring of the elderly with infections. The absence of classical signs of infections such as fever in elderly make the suspect of infections difficult (Duin, 2012; Cross, 2006). Decline in physical functions, occurrence of new episode or increased state of confusion, falls, and loss of urinary or fecal continence might be observed instead (Duin, 2012). Diagnostic tests are among the challenges faced in nursing homes (Quagliarello et al., 2010). Despite the challenge, current world of antimicrobial resistance encourages the importance of correctly and timely diagnosis and

treatment. As the roles of caregivers, the wellbeing of the client should be promoted by performing their respective duties (Osler, 2017).

No one should be infected while receiving care but beyond the expectations, healthcare facilities are regarded as unsafe places due to infections. Hundreds of millions of peoples are affected every year (WHO Practical guide, 2002). Consequently, healthcare providers, caring devices, clothes, bed linens, air droplets are claimed to be transmitting agents of infections when colonized with infection pathogens. In fact, infections sources are undetermined, hospital and outside hospital environment can, however, be a source of infections, visitors, infected patients and other factors are to be considered (Quagliarello et al., 2010).

Infection prevention and control interventions have been not successful when implemented especially in the long-term healthcare facilities. Many reasons are said to contribute to these downfalls. Unclear information on the patient when moving in and out of one caring unit to the other such us homecare centers to the hospital and back, was mentioned by (Mody, 2007) as one of the reasons. Lack of physician assessment before transfer, poor documentation of patients' comorbidities and medications were added by (Stone et al., 2018) which might be the reason for unclear details of a transferred patient. It is very common for these units to unknowingly receive or discharge colonized and infected patient even with resistant pathogens as methicillin-resistant Staphylococcus aureus (Katz & Roghmann, 2016).

This study is not unique, much have been done concerning infections but mostly in resistance pathogens and specific infectious diseases. Very few articles talk about general ideas of infections especially in nursing homes, acute care units, and hospitals. Despite the importance of elderly homes as the primary destinations for most of new healthcare workers and nonindigenous caregivers for practical training and work after completion of their healthcare studies especially in Finland, there are no enough materials on infections in elderly homes. This adds to the challenges in the working field next to language barrier for non-experienced healthcare providers.

As the contribution, the literature review is done to have insight understanding most common infections and infectious diseases in the healthcare setting, elderly homes to be specific, their prevalence as well as risk factors for elderly. Secondly, the study intends to identify the role of a nurse/caregiver in preventions and management of infections in elderly homes, and the challenges encountered in improving elderly quality of life. Although this work focuses mainly on the healthcare settings and formal caregiver, it's wise to understand that infections are everywhere, and anything can be the agent for transmission. Visiting as part of care, friends and relatives play the significant role in infections acquisition and transmission of pathogens and infectious diseases.

2 BACKGROUND

2.1 Finnish Health Care System

Finland has area kilometers 338145 with almost 66% of its 5.5m population live in town while the rest are in rural areas. It's divided into 311 municipalities in which each has not less than 6000 inhabitants. The smallest municipal has no more than 100 habitants while Finnish capital city has 630000 habitants according to 2015 statistics (Association of Finnish Local and Regional Authorities, 2017). Municipalities have the mandate for tax collections and provide services to the people. They also provide health care services as well as funding the healthcare sector private and public. Finnish central government gives some fund from its insurance system for drugs and some projects. It also grants University hospitals for teaching and researchers (Teperi et al, 2009). Finnish health care system is successful organized, and citizens are satisfied with the services, but there is a gap between low and high-income population, low income have no the same access to some services as others. It is also predicted overloading of the municipalities' budget for healthcare in the next few years due to the fast-growing elderly population (OECD: Better Policy for better Lives, 2013).

2.1.1 Elderly care in Finland

European population is aging, birthrate decrease thus number of elderly increases (statistics report on population, 2017). Finland is leading other OECD member states by having

the higher percentage of elderly people in its population (OECD: Better Policy for better Lives, 2013). Statistics show nearly quarter of the population are elderly aged 65 years and above compared to 2010 and 2000 population distribution of 17.5% and 15% respectively as the distribution of elderly (Population Statistics Finland, 2017). Elderly are defenseless due to immunocompromised state of their bodies. Health and physical challenges they encounter encourage the need of medical and/or physical assistance. Fast growing fiscal challenges, change the normal human culture and demand every dynasty member to engage in economic support of self and/or family, hence nobody can fully devote to forerunner care at home (Quagliarello et al., 2010). Moreover, healthcare sectors are finding ways to minimize healthcare charges, shortening hospitalization time by discharging patients as early as possible is one among several other options (Suetens, 2012). These and many other factors led to the residing of elderly to the long-term care centers such as elderly homes and other long-term healthcare facilities (Mody, 2007). OECD: Better Policy for better Lives 2013 reported that, about 12% of elderly aged 65 and above are received some type of long-term healthcare services somewhere across OECD countries (these include 22 countries of the EU and European Economic Area (EEA)), in 2009. The proportional was 65.5 at home and the rest in the institutions (Suetens, 2012). The estimate of elderly residence in institutions was 3.7 million in that year, 2009 and increase to be expected (OECD: Better Policy for better Lives, 2013).

2.1.2 Infection challenge in Long-term care facilities

Moving toward the 21st century, infections have become the major health concern (Joseph, 2006). European Centre for Disease Prevention and Control (ECDC) estimated 4.1m people acquire Hospital Acquired Infections (HAIs) in EU every year with approximately 37000 infections associated death (ECDC: Annual Epidemiological Report on Communicable Diseases in Europe, 2008). The number of patients with infections in Finnish Acute care hospital is estimated to be 50,000 in which approximately 700 die every year (Rummukainen, 2013). There were minor number of researches about the presence of HAIs in Long -Term Care Facilities (LTCFs) till 2008 when HAIs got special attention from ECDC. Between December 2008 and Maj 2011, ECDC funded the project for estimation of healthcare-associated infections in Long-Term care facilities (HALT) for EU countries and the report showed among 61,932 eligible residents involved in the

project 2,495 which is 4.0% had signs and symptoms of infections (Suetens, 2012). Unfortunately, no specified data for infection in long-term care facilities in Finland.

2.1.3 Exposure and susceptibilities to infections

To avoid misinterpretation of statements in this work, there was a need to identify the conditions or circumstances that might lead to infection acquisition in general. Infections in the healthcare facilities isolate nobody, but level of infection susceptibility differ due to differences in body defenses, exposure, and number of days under hospital care hence some people are more susceptible than other (Better Health Channel, 2018). For example, the patient with multiple diseases or with complicated health problem will obviously stay longer in the hospital while receiving medical care compared to outpatient. Being sick is not enough but being very sick encourage the infections acquisition much less than being very sick with surgical wound. Surgical procedures and operation expose one more to the infections. Procedure's environments and equipment are assumed to be contaminated unless cleaned and sterilized. Poor hand hygiene techniques contribute much more to the infections acquisition and spread to the patients and self. Presence of wounds facilitates the acquisition of infections if not dressed well with waterproof dressings. Exposure to high risks areas such as Intensive Care Units (ICU) and High dependency units (HDU) increase the likelihood of infections (Better Health Channel, 2018). These examples express the extent of vulnerability among the healthcare service's users.

Premature babies and sick children are at risk compared to adults, as children are much susceptible due to the ineffectiveness of their body immunity (Better Health Channel, 2018). Elderly and younger children to be more susceptible than other age groups since their bodies are of in adequate defense (Cross, 2006). Elderly are said to be more susceptible than other younger age groups as the body immunity response decrease in efficiency as we age but this does not imply susceptibility increase with age. There are some organs which have more risks of being infected than other at an old age such as lungs. The increase in susceptibility with age can be explained in terms of structure and functions decline (Gardner, 1980). The issue of malnutrition, catheterization, diseases, environment,

and/or other age-associated complications increase the risk more than old age itself. People with immune depreciation due to some diseases and those who are treated with chemotherapy or steroids are more prone than other categories (Better Health Channel, 2018).

2.1.4 Risks factors for infections in elderly

The elderly population is diverse. While some elderly population aged between 65 to 85 are enjoying successful aging with full body functioning in America for example (Crossley & Peterson, 2000), many other at this age range and even more are defined as the group with elevated risk of healthcare associated infections. If all at this age group demand exceptional care, then almost 20% of Finnish populations today would be in the healthcare facilities such as homecare, nursing homes, hospital, elderly homes etc. (Population Statistics in Finland, 2017). Experience usually dominate the discussion about healthcare associated infections in the elderly, but the situation is critical and broader. Several factors mentioned to contribute in the elevated risk of infections to elderly. Researchers show the direct association between age and susceptibility to infections (Better Health Channel, 2018). Immunocompromised state of elderly is the most popular factor which makes elders prone to infections (Senchina & Kohut, 2001). Physical and mental challenges associated with old age are additional factors (Cross, 2006). Incontinence was mentioned by (High, 2001) in addition to immobility and dementia that put elderly at risk of developing infectious diseases. Incapability to perform functional status and infections has circular relations that incapability lead to infections and infections encourage incapability (Quagliarello et al., 2010).

Aging is mostly associated with comorbid conditions such as diabetes, renal insufficient and arthritis. Illness increases the exposure to infections by being hospitalized (Kaye, 2011). The current move toward community-based care and shortened of acute hospital stay encourage admission to the long-term care facilities. An infected person admitted to the long-term care facilities may subsequently be a source of Hospital Acquired Infections to others (Pennells, 2000). This support (Berg & Cassells, 1992) statement that environment in which elder person lives contribute in greater percent in the exposure to the infections. Healthcare institution such as the hospital and long-term care facilities are at high risk of infections than home living environment (Berg & Cassells, 1992).

2.2 Hospital Acquired Infections

Hospital-acquired infections (HAIs) are defined as infections which started to show their signs few hours after admission while these signs were not there at the time of admission to healthcare setting (Custodio, 2016). Healthcare-associated infections (HCAIs) are those infections which show their appearance after the patient being discharged from the healthcare if they were not there before the hospital stay. WHO Practical guide 2002, defined HAI as 'infections acquired in the hospital by a patient who was admitted for a reason other than infection' while ECDC termed HAI as nosocomial infections or hospital infections and define them as 'infections which occur during a stay in hospital that was neither present nor incubating at the time of hospital admission (ECDC: Annual Epidemiological Report on Communicable Diseases in Europe, 2008).

Most common types of these infections are surgical sites infections (SSI), respiratory Infections, genitourinary infections and gastrointestinal infections (Custodio, 2016; Stubblefield, 2016). Breaches of infections control practices and procedures, non-sterile and unclean caring environments are the known major reasons. Viral, fungal and bacterial with the help of transmitting agents can easily spread when precautions are not taken during caring procedures and cause infections when reaching favorable environment (Custodio, 2016). Healthcare facilities are often used antibiotics for treating different health problems including infections but in recent years, these pathogens have developed multidrug resistance strain, now healthcare sectors worldwide struggle fighting against antibiotic resistance bacterial (WHO world Alliance for Patient care, 2016). Mortality, morbidity, prolonged hospital stays which directly affect patient hospital care costs are in turn the effects of infections and drugs resistance pathogens (Horan et al., 1984).

2.2.1 Common Hospital Acquired Infections for Elderly

Old age is associated with so many diseases that cause their mortality and morbidity, rehospitalization, prolonged hospitalization which also increased healthcare-associated costs (Stubblefield 2016; Montoya & Lona, 2011). Heart diseases, cancer, and stroke as mentioned by (Cross, 2006) are the main leading cause of death in the elderly but HAI still holds a position in top ten in the list (Cross, 2006). Aspiration Pneumonia due to the

use of feeding tubes, skin, and soft tissue infections, Urinary tract infections (UTIs), bacteria and septicemia due to the frequent use of catheter are infectious diseases most trigger older adults (Montoya & Lona, 2011; Cross, 2006). Montoya & Lona (2011) talked about the correlation between infections and antibiotic use as a reason for antibiotic resistance occurrence. Bowel Infection was added by (Brown, 2016) in the list of infections in the elderly.

2.2.2 Prevalence of Hospital Acquired Infections for elderly

Generally, infections are the global problem. The situation is worse in developing countries, is just there is no physical data to show the magnitude and surveillance activities require experts, resources fund (Elston et al, 2013). Surveillance systems in some developed countries provide regular reports on national trends of endemic HAI. According to the research conducted by (WHO: Save lives, clean your hands, 2012). 1.4 million People worldwide suffer from hospital infectious complications. The research was done in four WHO regions (Europe, Mediterranean, South East Asian and Western Pacific) and the results show 8.7% of the hospital patients had HAI. Although high prevalence was in eastern Mediterranean and South East Asia, but Europe had least prevalence value of 7.7% which is also high according to the expectations. The burden of HAI in developed countries ranges between 5-15% in the normal wards and 50% and more in the ICU (Nejad et al., 2011).

In Finland, HAIs are monitored by Finnish Hospital Infection Program (SIRO) which has almost 20 years of existence since its establishment. The aim of SIRO is to prevent HAI in the Finnish hospitals (National Institute of health and welfare, surveillances, 2017). A study done in 30 hospitals and 10 acute care hospitals in Finland, gave the overall HAIs prevalence value of 8.5%. Surgical site infection (SSI) was leading the other infections by having 29% followed by Urinary tract infection (UTI) which had 19% and clinical sepsis with percentage value of 17% (Lyytikäinen et al., 2005). Five years later, (Kanerva et al, 2010) reported the improved value for the infections as clinical sepsis reduced to 6%, surgical site infection holds 29% while pneumonia and UTI hold 15%. These two reports give the picture of how HAIs trigger Finnish

healthcare facilities. Figure 1 shows the infections distribution for developing and developed countries.

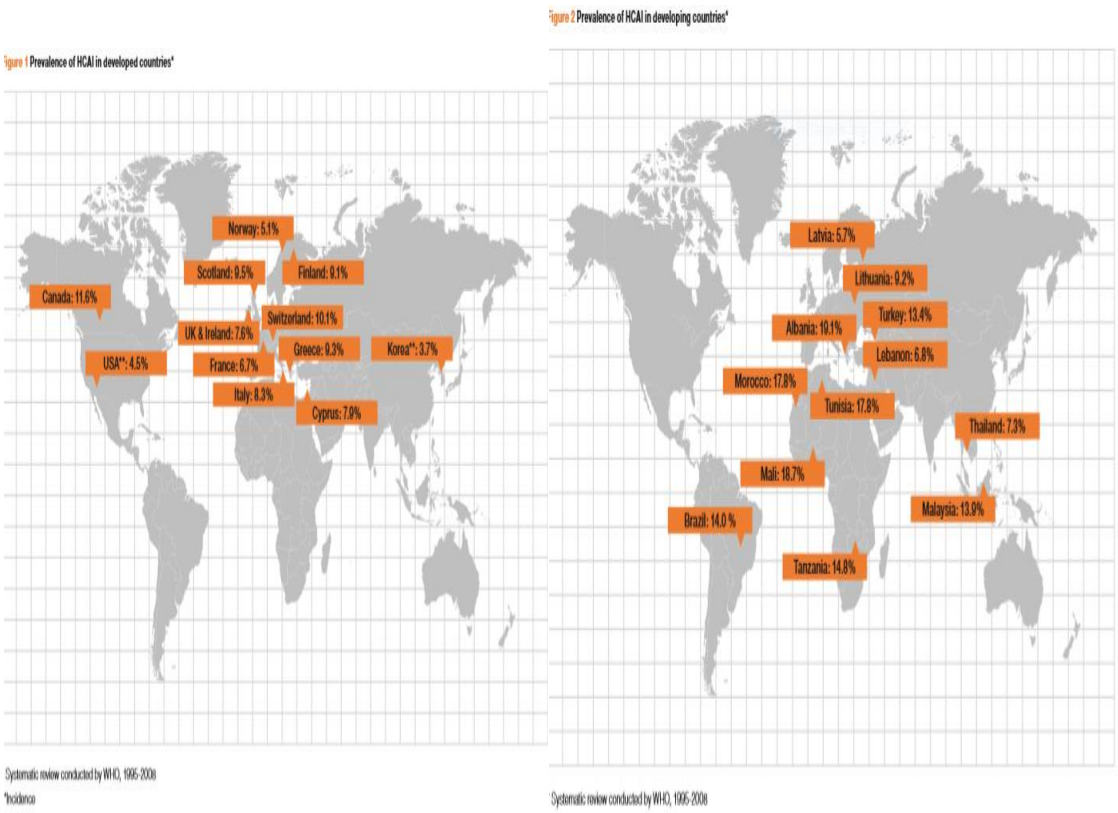

Figure 1: Burden of healthcare associated infections in the world

Source: http://www.who.int/gpsc/country_work/summary_20100430_en.pdf.

2.2.3 Impact of Healthcare associated infections to elderly

The infections occur frequently in the healthcare facilities and they are related to services delivered by care givers to the clients. They have both financial and health related impact on the elderly. Generally, most of the studies target on specific infection's area and specific types of healthcare facilities, which makes the idea of general extrapolation to be challenging (Strausbaugh & Joseph, 2000). But HCAIs are the global burden, prevention and elimination is the current issue (WHO world Alliance for Patient care, 2006).

HCAIs are the major source of debility, hospital admission, and death in the elderly nursing home, the extent of these events is globally undetermined (Makris et al., 2000). They

also cause disability, distress, and increased microorganism's resistances because of frequent use of antibiotics which is in the other hand hectic problem to both care givers and patients (Hypes 2012; Mullings et al., 2010). Patient with infections are more likely to be debilitated than ones without infection which means the elevated risk of hospitalization and death (Koch et al., 2008). The morbidity and mortality increased rate due to HCAI places a financial burden on the family, society and healthcare providers. A prolonged time of hospital stay as well as rehospitalization direct touches the economic status of the client (Strausbaugh & Joseph, 2000). Although that cost is not seen directly, infections accompanied with diagnosis, antibiotics and frequently to and from movement to hospital. Indirect cost including nursing care facilities, cleaning of environment and caring suppliers is the cost that goes direct to healthcare providers. The use of additional supplies for infection control, are also factored into the total cost for HCAI in nursing homes (Hypes, 2012). Permanent damage and unnecessary death are among unwanted results that society is forced to accept (Senchina & Kohut, 2001).

2.3 Health promotion and Infection control practice

Healthcare services user are at risk of acquiring infections. More than 300000 people get contact with infection associated with healthcare (NHS 2015; NICE: Clinical guideline, 2012) when receiving care. Healthcare associated infections such as MRSA, Bloodstream infections and Clostridium difficile infections are mentioned as leading cause of death by (NICE: Clinical guideline, 2012). Thus, infection prevention and control are vital to providing safe and effective care. It is therefore acknowledged that infection control programs should be implemented to support the hospital efforts (Plianbangchang & Omi, 2004).

Health promotion aims at enabling people to increase control over, and to improve, their health (WHO: health promotion, 1986). It is the nurses' role to promote public health. Although in the implementation, the focus is traditionally on changing individual behavior toward health living and preventing the diseases, but their role is more than that since nurses have mult-displinary knowledge and experience in their nursing practice. They are also a model in applying principles and guidance to demonstrate the commitment to patient safety and quality of care (Kemppainen et al., 2013).

2.3.1 Infection Prevention and Control in Finland

Many of health promotion programs end up failing when implemented in organization. Different factors contribute to the failure (Wardherr & Dur, 2012). For example, in an organization such as hospital or long-term care facilities, infection prevention and control interventions are interfered due to the interaction between the professional, clients and others who are involved in the caring process. Therefore, for successful implementation; communication, collaboration and self-engagement are well encouraged (Ministry of Social Affairs and Health, Helsinki, 2017).

In Finland, clients, family members and healthcare staff are responsible for the promotion of client's health at caring place. This includes medication, medical equipment, treatment and other caring services. But, nurses are well educated with experience as it is in many other countries as they play a key role in proving information and education to the clients (Ministry of Social Affairs and Health, Helsinki, 2017).

According to HUS (the hospital District of Helsinki and Uusimaa- a joint authority which comprises of 24 municipalities with the aim of having patient timely and equal access to specialized medical care), infections are prevented by following hospital prevention and control procedures. Hospitals have some staff who specialize in infection control. They provide instruction and training on infection safety. However, infection safety and improvement are under the hospital management (HUS: Infection control, 2018).

2.4 Guidance on infection control

Infection prevention and control is a practical and evidence-based approach that prevent patients and healthcare workers from being harmed so as to ensure quality of health care. It involves hand hygiene and hygienic working environment, monitoring of infections and having a plan to reduce their frequency rate, discarding used needle and syringes and avoiding unnecessary use of antibiotic (Plianbangchang & Omi, 2004).

Healthcare providers are playing big part in controlling and maintaining safety of their patient while under care. It is part of their duties to help in reducing the prevalence of Healthcare Associated Infection in the unit. It is the nurse's role to minimize the risk of

cross infection. Hand hygiene is a very important technique for infection prevention and control. WHO report reveal that 90% of healthcare workers do not clean their hands effectively. Thus, SAVE LIVES: clean your hands is the annual global campaign to support the improvement in hand hygiene (WHO: Save lives, clean your hands, 2012).

Generally, effective infection prevention and control needs proper hands hygiene, correct use of protective gears, safe use and disposal of sharps, proper disposal of clinical wastes, management of blood and other body fluids, decontaminations of reusable equipment, achieving and maintaining clean clinical environment, appropriate use of indwelling devices, managing accidents, good communication with working colleague, patients and visitors, training and educations must be the habit (WHO Practical guide, 2002).

2.4.1 Hand hygiene

Hand hygiene is regarded as the basic element for infection control activities. It is the basic method for germs prevention and if implemented properly can even eliminate antibiotic resistance bacterial. Effective performance of hand hygiene by healthcare workers alone can significantly reduce the risk of cross-transmission of infections in healthcare facilities (HCFs). Thus, in the current world of the increasing burden of Healthcare associated infection, multidrug resistance pathogen, and severe diseases with complexity of treatment, healthcare practitioners are flipping to the simplest technique of infection control such as hand hygiene (Mathur, 2011). Evidence shows the effectiveness of this simple technique in infections prevention, but unfortunately, healthcare providers perform hand hygiene less than half of the times they are supposed to do (CDC: Clean Hands Count, 2018) and most of the times, it's poorly done (Mathur, 2011). This lead to the new acquisition infections in daily basis of healthcare activities. In average, 1/25 hospital patients catch HAI in basic situations due to improper hand hygiene (CDC: Clean Hands Count, 2018).

2.4.2 Reasons for ineffective hand hygiene Practices

Although hand hygiene is encouraged in almost every hospital, there is rarely enough reminders to keep healthcare service users alert in practicing proper hand hygiene. It is noted that less than 40% occasions in the institutions where hand hygiene is reminded.

Hand hygiene attempts reflect the behavior, belief and attitude of healthcare services users. Although to some instances, hand hygiene is taken as activity for leisure instead of the serious logic it carries (Mathur, 2011).

Several factors contribute to the ineffective hand hygiene practices in healthcare institutions. For instance, it has been said that there is a tendency of classifying the healthcare staff in the working place in regarding to who must perform hand hygiene. For example, physician are seen as superior to the nurses and therefore are exempted in performing hand hygiene. Moreover, ignorance if not forgetfulness and lack of roll model can also contribute in not or poorly performance of hand hygiene (Mathur, 2011).

Additionally, some healthcare providers claim that frequent cleaning of the hands damage the skin or make them dry and this is normally attributed to some washing agents and disinfectants. Location of washing sink, missing soap at the sink and so forth, places inconveniences and therefore might contribute to in effectives hand hygiene (Mathur, 2011). Lack of knowledge carries much weight in the failure to perform proper hand hygiene. It is therefore recommended that proper education about hand hygiene is given in every healthcare centers (Mody, 2007).

2.4.3 Improvement of hand hygiene compliance

There are several things that could be done to improve hand hygiene. For example, education and in-service training about hand hygiene is highly recommended. Furthermore, posters could be placed to every possible place to remind everybody the importance of cleaning hands before and after providing care to clients or patients (Mody, 2007). Mathur (2011) emphasis of system changes in the work place to support infection preventions approaches hence provide safe care. This include supportive administration, motivation, availability of alcohol-based hand rubs, training and intensive education to healthcare workers as well as reminders of safe care at the work places. In addition, there should be quite enough products to facilitate and encourage hand hygiene performance such us hand cream, lotion and disposable towels. The role models who can reinforce hand hygiene are also important (Mathur, 2011).

3 THEORETICAL FRAMEWORK

3.1 Health Promotion Theories.

Since recognition at the beginning of 21st century, infections in the healthcare facilities have been major health concern that the number of researchers has been done as contributions from different aspects. The aim of these invested efforts is to eliminate totally, but for untreatable and with no vaccine, means to prevent further dispersal should successful be implemented. Theories have also been emerged to facilitate implementation of these measures.

Although, there are natural factors such as climate changes which can cause some diseases acquisitions, human actions are also said to contribute (Morse, 1995). Several studies mentioned human behavior as the major role in infections acquisition and dispersion. Ryan (2009) reported that, 50% of human's health is influenced by one's behavior and one's behavior also contributes in the occurrence of diseases and illness. Morse (1995) gave an example of HIV diseases dispersion and acquisition to be influenced more by human behaviors.

Thus, for successful constructions and implementations of any possible actions for diseases emergence controlling, human behavior should be motivated. Behavioral and social science Research (2016) also reported that, for successful public health programs and initiatives are those which based on understanding health behaviour and the context in which they occur. Additionally, behavioural and social science research suggested the consideration of individual behaviour in any health promotion interventions.

Therefore, since this work is about infection prevention and control, and infections control needs behaviour change for the possible outcome, then social and behavioural theories are preferable in serving as theoretical framework for this study.

3.1.1 Social and Behavioural Theories

Theories are not as science's laws that hold universally, the social and behavioral theories/models work perfectly in a limited range of settings (Behavioral and social science Research, 2016). Thus, according to the needs, several social and behavioral theories/models have been formulated to serve in different purposes. Among them, the Health Belief Model, the theory of planned behavior, Diffusion of innovation theory, Social Cognitive Theory, The Trans theoretical Model (Stages of Change), relapse prevention, information processing paradigm, support theory, community organization model, ecological approaches, Theory of reasoned action and organizational change theory. In **Appendix 1**, the summary and short descriptions of these theories are given.

More than one theory from the list which could suit the purpose of this work and serve as a theoretical framework. They have been useful and successful in promoting a different kind of health behavior change interventions for years. They tackle targeted group of intervention and who to deliver them, expected outcome, factors influencing these outcomes and how to improve the outcomes (Ryan, 2009). But it is necessary to choose one that can perfectly fit, then the integrated theory of behavior change can serve as the theoretical framework in this work. This theory was chosen because, it meets the general purpose of infections prevention and control which is health stabilization if not total alleviation of infection. It also seems to embrace other reviewed theories in so many aspects. Integrated theory of behavior changes sounds like shortcut of all other to reach out the target in effective way.

3.2 Integrated Theory of Health Behavioral Change

Infections are not friendly in and out of clinical settings, readmission is not desirable, unnecessary cost caused by long time hospital stay is unacceptable, and then the target is to eliminate infections and improved health status. An integrated theory of health behavior meant to guide healthcare professionals in the implementation of health promotion interventions. It allows the assessment, follow up and give chance to detect sensible outcomes before accepting successful behavior change (Ryan et al., 2011). The theory

merges preexisting concepts from other theories and some new concepts that allow evaluations of the outcomes (Ryan, 2009). It assumes that engagement to self-management of health-related behavior is a result of self-regulation and skills which is facilitated by self-positive belief and knowledge together with social facilitation (Ryan, 2009). Once there is the successful engagement to self-management health-related behavior (proximal outcomes) then improvement of health status must be achieved (distal outcome). Knowledge and beliefs are required factors which comprise of behavior knowledge, self-efficacy, expected outcomes and personal goal. These together with social influence, support and collaborative relations among the healthcare professionals, families and other members facilitate self-regulation and skills. Self-regulation and skills include goal setting, self-monitoring, and reflective thinking, and decision-making, planning for and engaging in required health behavior (Ryan et al., 2011). See **figure 2** for details of the theory.

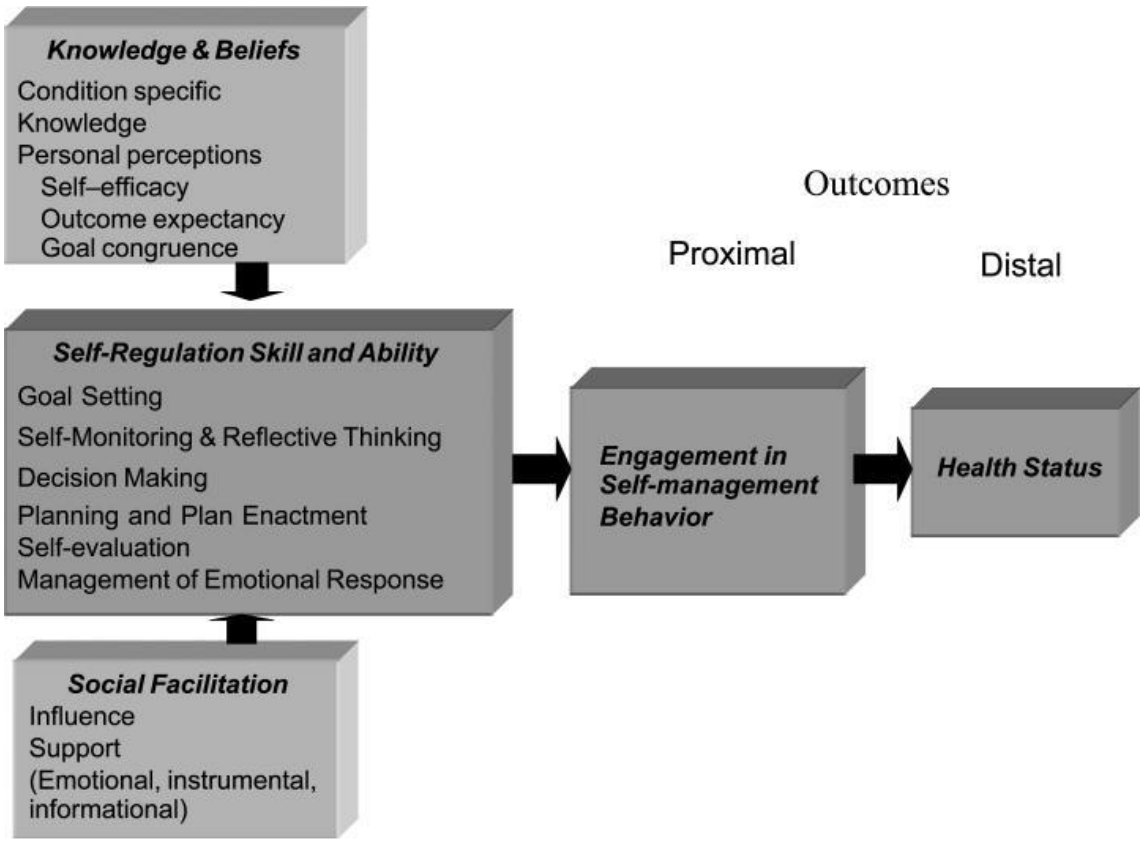

Figure 2: Integrated theory of health behaviour change

Source: *https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2778019/*

Health status is the general outcome that prevention and control of infections aiming at achieving. During analysis of the difficulties in attaining the required outcomes, challenges encountered will be identified and that is the answer to the one of the questions, whereas the risks and prevalence question would possibly be answered at the beginning of the intervention process. The role of the nurse question would be identified by identifying the part played from the beginning to the achievement of the distal outcome.

4 THE AIM AND OBJECTIVE OF THE STUDY

4.1 The aim of the Study

This study aims at providing the better understanding of infections and infectious diseases that are mainly in elderly by reviewing literatures. To create awareness to the new professionals and know some strategies taken by stakeholders in minimizing if not alleviate the problem hence improve elderly life and help them to achieve their goal of having ‘successful aging'.

In doing that, the author is focusing on answer the following research questions.

(1) What are the risks of infections for elderly?

(2) What are the common types and prevalence of infections among elderly?

(3) What are the challenges encountered in preventing and controlling infections in elderly homes?

(4) What are the roles of the nurses in preventions and control of infections in elderly homes?

5 METHODOLOGY

5.1 Sources of Data

Due to limited time and resources, the data collection for this work was done via literature review. The relevant articles were collected through Arcada University of applied science's data base. From Arcada' webpage, tools, library, Libguider then Nursing, the various searching Databases such as Academic Search Elite (EBSCO), Cinahl (EBSCO), Cochrane Library, Nursing Reference Center Plus, PubMed, Sage, Science Direct and Springer Link were visited by using different searching phrases, to have general idea of articles available and accessibility. Searching Phrases such as 'infections in elderly', 'infection prevention and control', 'prevention and control challenges', 'healthcare associated infection', 'healthcare associated infections in elderly' and 'infection prevention and control in elderly and so forth were used.

The articles were repeating themselves in different searching phrases and searching data bases. There were also some restrictions in accessibility such as no free access, some were connected to the link which need registration etc. Then, the writer had to consider only few searching bases such as Academic search elite (EBSCO), Sage and PubMed to save time and deviate to some extent from these obstacles. In addition, to avoid much diversity and to get up to date and relevant materials, some searching limits were set in each Database visited. The limits were about language i.e. article must be written in English and do not exceed ten years old. Moreover, searching phrases were also three out of the several mentioned earlier to minimize workload, so 'Healthcare associated infections in elderly', 'Infections in elderly, prevention and control challenges', and 'healthcare associated infections in elderly, old age and geriatric' were used in the searching for the articles.

5.1.1 Criteria used for inclusion

For the article to be saved for further consideration, the following must be attained.

1. Language i.e. English
2. Latest i.e. published from 2007 to 2018.
3. Full free access and not linked to free access.

4. Focus should be to the general healthcare associated infection in elderly.
5. The theme must link at least one of the objectives of this work.

5.1.2 Exclusion Criteria

The articles which would not match the inclusion standards in section were simply exclude at the first stage of analysis.

5.2 Searching process

The searching process proceeded by getting to the searching Database, place searching phrase one at a time, set the limit like language and year interval and see what came out as a result. Starting with 'healthcare associated infections in elderly' as the searching phrase, six articles were retrieved from Academic search Elite (EBSCO) in which none was taken after reading the titles. When this searching phrase was applied to the searching Database PubMed, this phrase with free access and yearly interval limits, gave 8756 articles, going through titles for these articles, none was considered for further analysis since the title where very far in associations to the research topic and objectives. In Sage, when the year and language limits were applied, 1090 hits resulted of which 6 were taken to the next stage of analysis. The same exercise was repeated for the other two searching phrases in the same searching Databases.

Searching exercise from the mentioned Databases retrieved a total of 56,963 hits. Reading through article titles, swipe away most of them and 29 articles were left for further analysis. Careful reading of abstract wiped away 20 out of 29 articles and 9 articles were considered for this work. The repeated articles within the data bases under different searching phrases encountered, but if the article is to be taken, the first output was to be considered.

Up on the repetition challenge in selection of the articles, prior observation is, materials are scarce, since no enough articles talking about infections or healthcare associated infections in general. Enough data are on infectious diseases such as MRSA, UTI, Pneumonia, and so on. The scarcity leads the writer to opt on google scholar for extra article.

In google, each searching Phrase was placed for material searching and several results were retrieved. Going through titles and correlations with the research topic and objectives with accessibility to full text, one article was obtained and considered in this study. The article happens also to be published in Science Direct database. Therefore, total of 10 articles have been used in this work to search for the related answers to the research questions. A summery for the searching process and the results is given in **Appendix 2**.

5.3 Presentation of the selected Articles

Infections or healthcare associated infections is the wide topic to be discussed. Although there is scarce of data, articles considered in this work were from different journals and in different infection perspectives. The articles were from *journals of infection control* (Mullings et al 2010; Roberts et al., 2010), *Current Opinion on Infection Diseases* (Katz & Roghmann, 2016), *Clin Geriatr* Med. (Mody, 2007), *Euro surveill* (Suetens, 2012), *Critical care Nurse* (Hardin, 2015), *Nursing standard* (Phair & Harth, 2011), *The Journal of Health Care Organization, Provision, and Financing* (Stone et al., 2018), *Scand J Caring Sci* (Sund-Levander & Tingström, 2013), and from *Current opinion on microbiology* (Kline & Bowdish, 2016). **Appendix 3** represents these articles in detail**.**

5.4 Subjects in the selected articles

The articles selected contributed to the healthcare associated infections in the elderly from different angles. The author of this work classified the subjects from these articles in three categories depending on the objectives of this study. These are healthcare associated infections in elderly, old age as high-risk group to infections (Kline & Bowdish, 2016; Phair & Harth, 2011; Roberts et al., 2010), healthcare associated infections, care givers' alert on exceptional consideration of elderly as vulnerable population (Hardin, 2015; Phair & Harth, 2011; Roberts et al., 2010; Suetens, 2012) and lastly, infection prevention and control programs (Stone et al., 2018; Sund-Levander & Tingström, 2013; Mody, 2007; Katz & Roghmann, 2016; Mullings et al., 2010).

In the first category, Kline & Bowdish (2016) used literature review method to study and summarize the prevalence of healthcare associated infections in elderly, immune system

relates to infections acquisition, different common infectious diseases to elderly and their impacts were addressed. Robert et al. (2010) did a survey in the nursing home's residence to assess the types and prevalence of HCAIs. The influence of home size, gender, age and residence categories were studied. Understanding the significance of frailty in older people by a nursing was the work done by (Phair & Harth, 2011). This was done via literature review where old people were the subject.

In the second category, Suetens, (2012) gave a summary of the outcome of HALT projected in European countries (from December 2008 to May 2011) about the infections prevalence in long term care facilities. Hardin (2015) studied through literature on how vulnerable elderly are and importance of having the elderly health status during elderly care. Care provider should be the first person to suspect infections before the specific signs start to show up. For the infections prevention and control programs, (Stone et al 2018) used cross-sectional survey of 2514 random sampled United states' Nursing homes to assess Infection prevention training, staff turnover, and infection control program characteristics. Nursing homes staff were the subject for this research.

Lastly, (Sund-Levander & Tingström, 2013) studied on how nursing assistance could be useful in detection of infections in elderly through their experiences to the elderly people they are caring. The focus of the research was on nursing assistants where approximately 100 nursing assistants were aware and involved in the project. Mody (2007) and Katz & Roghmann (2016) used literatures in doing their study, the subject selected for Mody's, (2007) study was on elderly infection control issues while Katz & Roghmann, (2016) focused on various healthcare settings regarding the infections in elderly. Finally, Mullings et al, (2010) did a survey in elderly who are in care homes to find the estimation of the prevalence of infections.

5.5 Data analysis

Data analysis refers to a set of procedures for the systematical, replicable analysis of data. It involves classification of part of text through the application of a structured. Qualitative research can opt out of different approaches for data analysis. Context sensitive, Holistic perspective, unique case orientation, Voice, perspective, and reflexivity are some of these

approaches (USC Libraries, 2016). This study opted for an inductive approach, which involves reading through the article's content several times and discover the patterns, themes and inter-relationships. Inductive data analysis process involves three main stages as preparation, organization and reporting stage (Elo & Kyngäs, 2008). Following these stages, preparation was done by repeatedly reading through the articles and gather information that linked with research questions. Noticing that, one article answers more than one questions, or different articles answer the same question, highlighting the concepts with similar mark to easy referring during the organization and finally reporting the findings.

5.6 Ethical consideration

The issue of ethical consideration is unavoidable as far as the research secondary data concerned. The Main target is to harmlessly benefit from these data meanwhile preserving the right, dignity and privacy of participants. To be safe, Arcada guideline as instructed in thesis guide 2014, version 2.1 was maintained and by using Arcada official students' credentials to access the academic database, electronic articles were retrieved. In addition, all quotation from the articles are acknowledged to avoid copy right violation and plagiarism.

6 RESULTS

The articles are generally talking about elderly care, infections and infectious diseases that trigger elderly's life [1; 8; 10], types and prevalence of these infections [1; 2; 3; 8; 9;10], risk factors [1; 2; 3; 5; 7; 8; 9; 10] as well as the challenges encountered in surveillance efforts [5; 9]. On the other hand, some of these articles went further and give opinions of how a nurse who takes care of elderly should act to maximize the possibility of maintaining elderly's quality of life [4; 6; 7]. The summary of the findings is presented in this part according to the objectives of this study.

6.1 Risk of infections for elderly

The population is aging, and old age is associated with increase of infections susceptibility [1; 2; 5; 7; 8; 9; 10] due to immune system dysfunction, malnutrition, dehydration, comorbidities, function impairment (i.e. incontinent or immobility) [1; 2; 5; 8; 10] and physiological changes [2; 5; 8]. Old age also increases the risk for vulnerability [1; 2; 6; 7] and incapability to be independent [2; 6; 7]. An anomalous increase in number of elderly population and the health problems associated with old age, the demand of healthcare facilities such as hospitals, acute care centers as well as long-term healthcare facilities [8; 9] also increases. Frequency visit healthcare centers due to infectious diseases related causes [8; 10] carries much impacts to elderly health deterioration than old age itself. Infections led also to several other effects like unnecessary caring costs, deterioration of physical and mental condition [6; 7], debilitation, hospital admission, and eventually death [6; 8]. Due to deficiency of resources to accommodate the high-risk age group of elderly in hospitals and acute care centers, reducing hospitalization and shorten the length of hospital stay [9] are the immediate solutions to overcome the problem. Long-term healthcare facilities such as rehabilitation centers, homecare, assisted living, home, outpatient settings, nursing and elderly homes seem to be as options for elderly [8; 9]. Residing of this people to healthcare facilities shift the problem of infections and infectious diseases to these units [1; 2; 9]. Infections also lead to unnecessary antibiotics prescription which also increase the rate of multidrug-resistance micro-organisms such as MRSA, ESBL and VRE. Thus, HAI are more in caring homes residence than in acute

care facilities different from how it was traditionally known [2; 10]. Nursing home residents are known to be reservoir for antibiotic resistance pathogens [9].

6.2 The common types and prevalence of infections in the elderly

The findings have provided the general picture of infections and infectious diseases in long-term care facilities [2; 3; 5; 8; 9; 10], as well as a list of different types of healthcare associated infections that are common in elderly [1; 2; 3; 8; 9; 10]. According to five out of six articles, Pneumonia (respiratory tract infections) is leading all other infectious diseases [1; 2; 3; 8; 10], especially lower Respiratory Tract Infections (LRTIs) [1]. Urinary Tract Infections follows Pneumonia in disturbing elderly health comfortability [2; 8; 9; 10] and is most persisting infection due to miss-diagnosis and miss interpretations which leads to unnecessary antibiotic use [8; 10]. Skin and soft tissue infections also mentioned in [1; 3; 8; 10] as major problem in elderly life. There are also Conjunctivitis [8], gastrointestinal infection [3; 8], and Clostridium Difficile [1; 8; 10] among others. Latent/reactivated chronic infections, the aging microbiome and susceptibility to infection are mentioned by [1] to be also common among elderly population. Varicella zoster virus (VZV) is also common for elderly but cause 'chicken pox' to young people [1], these infect dorsal root ganglia and remain dormant in those cells for decades. The summery for the infections types and prevalence values are given in **appendix 4** as per the articles report.

Additionally, the problem of unnecessary antibiotic prescription has been most mentioned in some of these articles [1; 2; 5; 8; 10] to take part in elderly's life. 12.7% was given by [2] as percentage prevalence of antibiotic use among the residence in care homes while [5] reported 40% of all medication prescribed to elderly are antibiotics. The prevalence of 47%-79% antibiotics use for nursing home residents was mentioned by [10]. Antibiotics account for 20 % of drugs adverse reported from nursing homes [10]. Although the reason for unnecessary prescription are not clear stated, [8;10] report the issue of Urinary Tract Infection (UTI) to be a reason for these prescriptions due to miss-interpretation of UTI where 30-56% of antibiotics prescribed for UTI reason [10]. Unnecessary use of Antibiotics and make them less effective [1] hence development of multidrug resistance

organisms [5; 10]. Unfortunately, most of these antibiotics are in use for elderly but some of them are not documented which in return can cause more serious danger in the elderly [5]. Most of infections that elderly are facing caused by multidrug resistance organisms [1; 5]. Clostridium difficile infection as an example of adverse of antibiotic use [1; 8]. Antibiotics over use alter pharmacokinetics [1] and Multi-drug resistance organisms (MDRO) such as methicillin resistance S. aureus (MRSA) and antibiotic resistance gram negative rods, allergic reaction and others mentioned by [10] among the consequences. In long-term care facilities more than 35% of the residence are colonized with malt-drug resistance organisms.

6.3 Prevention and control challenges of healthcare associated infections

Elderly with infections have many challenges as far as caring is concern. Moreover, long-term care facilities such as nursing homes and old people's homes have their unique characteristics that make caring process more complex. To analyze these issues, this section is divided into four sub-sections as: susceptible people i.e. elderly, long-term care facilities i.e. nursing homes or old people homes, care givers i.e. nurses and nursing assistants, and management for easy classification.

Susceptible Group i.e. elderly

Elderly undergo several care transitions from one unit to the other [9] and the vulnerability state of their bodies add credits on infections susceptibility [1; 2; 5; 6; 7; 8; 10]. Severe illness, polypharmacy, level of debility, mental status, incontinence, living environment, and indwelling devices such as Urinary catheter, intravascular catheter, and nasogastric tub (NGT) increase the susceptibility for this group [9]. Moreover, manifestation of health problems in the elderly is a challenge since their characteristics differ from other age groups [5; 6]. Unusual signs appearance such as changes in physical capacity and mental decline [3; 5; 6; 7] are what can be observed to elderly as signs to infections instead of fever and white cells counts which are the usual definition of infections [1; 5]. This is due to physiological and Immunological changes that associated with old age which compound even the diagnosis process hence delay of treatment [1; 4; 9]. Misdiagnosed and mismanagement of infections normally endanger the life of elderly [1]. Large number of

elderly to be living together [2;3], shortening of hospital stay [9], frequent transfer of elderly to/ from hospitals as well as polypharmacy worsen severity of illness in the elderly and add cost to the unit and to the elderly too. Nursing home residents are known to be reservoir for antibiotic resistance pathogens [9].

Long-term care facilities i.e. nursing homes or old people homes

Residing of elderly to the long-term care facilities is an added challenge to the units and to elderly themselves [9; 10]. Although the intension is to have a safe, comfortable and supportive living environment [2], deficiency of resources, frequent staff shifts changing, time limit, high ratio of care giver [5; 8; 9] and deficiency of financial support [10] are the challenges that hinder infections prevention and control efforts. Screen, isolate, and grouping infected individual living in long-term care facilities is almost impossible since long-term care facilities serves as home and medical care center for elderly [9; 10]. For the sake of maintaining quality of life, elderly shares dining room and participate in the other communal activities [5] and these endanger their health if any communicable disease is available. The frequent transfer of the elderly from the units to hospital and back [8; 9], makes the prevention and control of healthcare associated infection in long-term care facilities much complicated [8]. The transfers are sometimes done without physician's report and with no proper documentation which might lead to the receiver of sicker patients and even with severe illness. Poor documentation and communication double the risk of infection [4; 9]. Thus, a different approach for prevention and control of infections is advised by [1].

Care givers i.e. nurse and assistance nurses

Apart from the challenges in elderly and the living environment, care givers are also mentioned in many studies to be an added challenge in infection prevention and control exercise especially in long-term care facilities. Most of the basic care activities done in long-term care facilities (LTCFs) such as changing of bed linen, dressing, providing hygiene, help during the toilet visit, and transferring contribute in infection transferring [10] if not handled in ascetical way. Health care providers are said to have no enough knowledge in managing infections in the units [9; 10]. Inadequate staff i.e. patient to nurse ratios are not satisfactory as far as safe care is concerned. No enough staff with infection knowledge in LTCFs and the few available is also assigned with multiple tasks which make them not

available all the time in the units [5]. There were 73% nurses with infection certificates in acute care units while only 2% are in long-term care facilities as reported by [10]. Communication among healthcare providers was mentioned by [4; 9] to add on the limits in timely assessment and management of infections in elderly homes.

Management

Infection prevention and control is vital across the healthcare settings [9]. This consists of keeping records and managing critical data, which include surveillance information for endemic and epidemic infections, to develop and recommend policies and procedures, to arbitrate directly to prevent infections, and to provide education for all [9]. Staff education is critical in the settings as insisted in most of recent literatures, advancement of the technology, frequency demand [9]. Lack of in-service training about infections was mentioned in [5; 9] to be among the challenges this leads to less increase in number of infections experts in these units. The ratio of staff /patient is mentioned in many studies as the problem that contribute to the failure for effective infection prevention in long-term care facilities [5; 9]. Very few infection control personnel are employed in long-term care facilities [9] and they are not available all the time in the units for infection management [5]. This also contributes to the poor care quality given to the residents and hinder effectiveness of almost all surveillance activities that are meant to help for infection prevention. Educational based activities which includes antibiotic stewardship programs are also failing due to this scarcity. Moreover, unavailability of devices and lack of knowledgeable healthcare providers also lead to difficulties in specimens' collections in nursing homes [9].

6.4 Role of the nurses

In many of the articles, infections knowledge was addressed to add a challenge that hinder even implementation of infections prevention and control programs [1; 6; 8; 9; 10]. The role of the care givers is to provide services in safe ways, this includes prevention and control of infections to patients and to themselves. Thus, it is their responsibility to seek for updated knowledge about infections especially in this period of limitation in terms of funds, devices, and unsupportive working environment while infections on the other hand attain new level that long-term care facilities beat acute care units [4; 9; 10]. Healthcare

providers are also expected to give the knowledge to their residents and whoever involved in caring process [9] including the visitors. This can be done by practice aseptic techniques in caring activities at least for the basic, costless and most effective one of hand hygiene [9; 10]. Contaminated hands confirmed to play a big role in pathogen transmission since the first recognition by Holmes Semmelweis and others 100 years ago [9].

The knowledge about the elderly's well-being is important for all nurses who are working with elders [6; 7; 9]. Early recognition of any urgent need of intervention and delivery of appropriate is most important in elderly care [6; 7]. Apart from having enough knowledge about aging and infections, there is a need of maintaining proper cooperation and communication within and between healthcare professional to achieve the goals of attaining a high quality of life [4]. This includes respecting each other's opinions on the report given about the patients and put them into consideration when taking actions [4]. Additionally, it is important to record and read about the health status of every resident in the daily basics and immediately act if unusual signs observed [4; 10]. There is also the issue of unnecessary prescriptions and antibiotics uses in the long-term care facilities which cause a lot of problems to elderly including drug resistance, C. Difficile, and allergic reactions [10]. Nobody was mentioned to be responsible for these prescriptions, but antibiotic stewardship must be effectively practiced [10].

7 DISCUSSION

The focus of this study was on healthcare associated infections that elderly are facing in old age lives. Elderly homes have been in this work used interchangeably with nursing homes while long-term care facilities are the general term used to represent all institutions different from hospitals and acute care centers. These have the same characteristics as far as infections is concerned. By equating these terms, it was possible to find useful information that could answer the questions hence fulfilling the objectives of this study. It was also possible to get useful information on infection care and prevention in elderly homes.

The wish for elderly is to get a relief at least after their life journey. It is also a wish of the healthcare providers to perform their duties without complaints, blame or even harm to self and the receiver of their services. For the institutions, it is a good feeling to have healthier customer and worker, which is counted as an achievement. This is only possible when all these works together as a team (Sund-Levander & Tingström 2013). Generally, successful aging is the dream of elderly and healthcare stakeholders at large, it is just unfortunately that old age is associated with complications.

7.1 Elderly Life and Living Environment

From the findings, elderly undergo a lot of changes in their bodies in the whole process of aging. The situation seems to be serious especially when there is diminish in physiological state that an elderly is incapable of managing his/her daily errands and demand some assistance. Being sick and immunocompromised state of the elderly is one of the factors as mentioned in (Mody, 2007) while (Katz & Roghmann, 2016) reported the acquisition of infections is more likely to increase when an elderly can't independently perform the hygienically activities and that have direct impact on morbidity and mortality. Deterioration of physical capability accompanied with the change in psychological state that demand the changes in life style. Long-term care facilities are the destinations for the quick and effective help for them. The elderly homes idea is good, but the challenge come in management of infections and maintain health status (Suetens, 2013).

The study found several factors that hinder the efforts of healthcare stakeholders in managing health status of the elderly when they are under care in healthcare institutions. Apart from physiological and psychological states of elderly which facilitate the need of extra helps in running daily life errands, healthcare workers are mentioned in all most all the articles to play roles in infection transmission. Infections knowledge underlie all the mentioned errors that healthcare providers do during the care. Awareness of possible infections and immunological situation of elderly could help so much in bringing attention to caregivers throughout the caring process (Mody, 2007).

Lack of infections expert in healthcare facilities is another challenge which seems to be given little attentions in the whole situation. Infections are large problem, and it is likely to occur at any moment in elderly life. It is wise to have healthcare workers with at least infections knowledge to minimize the problem in these institutions. It would be also wise to adjust the teaching curriculum in our learning institutions and give opportunity for healthcare expert to learn about aging, elderly life and infections in general (Hardin, 2015). It is also important to have in service training for those who are in the field already (Mody, 2007).

The study also found that long-term care facilities are reservoir for resistance microbial strains as (Stone et al., 2018; Suetens, 2012) mentioned due to antibiotic use is the main cause of antibiotic resistance organisms. UTI was mentioned to be the reason behind wrong and unnecessarily prescriptions of antibiotics due to misinterpretations hence mismanagement (Katz & Roghmann, 2016). This emphasis the point of experts and knowledge about UTI and aging.

Communal life style to maintain social and active living is good for the wellbeing of the elderly but in the other hand is the challenge when communicable diseases are in the units (Stone et al., 2018). Quagliarello et al. (2010) reported the spread of including pneumonia, urinary tract infection, prosthetic joint infection, and infected endovascular foreign bodies with bacteremia when there is a sharing living environment. Isolation in elderly homes is almost impossible to avoid the feelings of being isolated hence the prevention is almost not possible in the elderly homes (Mody, 2007; Katz & Roghmann, 2016).

Handwashing was also mentioned in the findings to be a challenge for healthcare providers between patient contact and that was reported by (WHO: Save lives, Clean your hands 2012; Joseph, 2006). Hands perform almost all activities in the caring process and with hands contact with patients, caring devises and everything are touched. Hands can be a good carrier and transfer of pathogens from place to place within and outside the units (CDC: Clean Hands Count, 2018; Mathur, 2011). Therefore, there is significant need of performing hands hygiene throughout the caring process for better outcomes of care.

7.2 Prevalence of Healthcare infections for elderly

The prevalence of healthcare associated infections/infections in elderly seem to be high compared to the effort made by the healthcare stakeholders. Higher percentage rates reported from the findings. The minimum value for infections was 1.4 to 5.2 infections per 1000 days of bed care. On the percentage units, a minimum value was 3-15% of 1.43 million people which is also enough to be considered as a shock. WHO reported the prevalence of HAI in European countries to be 7.1% which is equivalent to 4131000 patients affected every year. In Finland, the figure was 9.1% as reported by (ECDC: Annual Epidemiological Report on Communicable Diseases in Europe, 2008) while the value was 6% in 2010 as reported by (Kanerva et al, 2010) report. The value is (6-7) % infection as per (ECDC; Technical Document, 2016) report. The burden is too big and wide as it can be seen from figure (1).

Pneumonia, Urinary Tract infections, skin and soft tissue infections are mentioned to be so common in long-term care facilities (Kline & Bowdish, 2016; Mullings et al., 2010; Robert et al., 2010). Living environment when it is reservoir of a pathogen can be one of the sources of pneumonia transmission especially for susceptible population like elderly, also direct transmission from person to person in form of air droplets (Suetens, 2013; Joseph 2006). The transmission ways show how difficult can the home care living environment could be in prevention and control of pneumonia. Urinary tract and Skin tissue infections have been also debated in the findings as common in residential living environment where Urinary tract infections is following pneumonia although it doesn't result in mortality like how pneumonia does (Quagliarello et al., 2010). UTI was associated

with antibiotic resistance outcomes because of misdiagnosis and treatment (Katz & Roghmann, 2016). UTI is reported to be costly and resources intensive condition among Medicare beneficiaries (Quagliarello et al, 2010; Joseph 2006). Pharmacokinetics are disturbed and shift the problem to the development of bacterial resistance. The total of 25000 EU, Iceland and Norwegian people died due to different multidrug-resistant bacteria such Staphylococcus aureus, Enterococcus *spp.*, Escherichia coli, Klebsiella *spp.*, Enterobacter *spp*. *or* Pseudomonas aeruginosa. In Finland, the value was 1.5% (Kanerva et al, 2012). Additionally, Clostridium difficile was mentioned in the articles as the results of antibiotics misuse (Kline & Bowdish, 2016; Suetens, 2012; Katz & Roghmann, 2016). These are bacterium that cause diarrhea and more intestinal conditions like colitis.

7.3 Management of healthcare associated infections in elderly homes

Several factors were mentioned in our findings to contribute to the failure in infections management in elderly homes. Elderly heath deterioration state and living environment are among these factors, but on the other hand management also play part in this failure. There is a need of having enough knowledgeable healthcare workers in the long-term care facilities as it is in acute care and in the hospitals (Katz & Roghmann 2016) for quick change on the infections trend. Very few experts are available, and they are also assigned with other activities in the unit which seem to be out of care providing tasks. There is also a tendency of feeling superior in the units that care providing tasks are for those with lower education and knowledgeable people are assigned with other tasks like medications and so forth (Mathur, 2011). Ratio of patients and care providers is a challenge that there is no enough time in caring for a patient hence aseptic techniques are minimal applied or even negligible. Time factor is what rules the whole caring process for satisfactory of management and workmates (Mathur, 2011).

7.4 Applicability of the chosen Theoretical framework

The aim of all the efforts exerted by healthcare sectors on infections prevention and control programs is to minimize the transmission of persisted infections if not to eliminate completely for the possible ones from the units. This would be achieved if there will be

complete behavior change and health caring and living are well practiced. The study has been associated with the integrated theory of behavior change to facilitate the implementation of infections prevention and control interventions. As the aim of these interventions is to have positive outcomes, then complete behavior changes would be of emphasis. Therefore, this theory fits the whole scenario since it focuses and emphasis on the positive end results. The theme has connection to the findings, that for better achievement in infection prevention and control, complete change in all situations is necessary (Ryan et al., 2011).

8 CONCLUSION AND RECOMMENDATION

8.1 Conclusion

Healthcare associated infections are the serious ongoing problems that healthcare sector. Many factors have been mentioned and discussed to contribute in the failure to have infections free caring environment especially in the long-term care facilities. There is quick turnover of the infections trend from acute care centers to the long-term care facilities as the acute care units minimize the caring burden. Efforts against infections are directed to the hospitals and acute care centers in terms of fund and other caring resources while long-term care facilities are equipped with the basic ones.

Long-term care facilities as elderly homes are the lifetime living environments for elderly when they reach to the stage of demanding attention and help. The aim is safe living, so it would be fair then to create conducive living environment in these homes that can support their goals. This would include having knowledgeable healthcare providers since elderly have much faith in the care givers especially nurses. The faith that elderly has to the nurses can be turned down if the living environment won't be safe for them. The issue of infections knowledge must be given special attention from the ground. Nursing schools should include in the teaching curriculum the infections educations as suggested in many studies. Having basic knowledge about infections at school and in services training would minimize the problem in the long-term care facilities since it has been proved to work in the hospitals and acute care centers.

Nurses should have a tendency of learning in general since learning never end and everyday there are something new coming up. This could help in making the working environment self to patients and even to themselves. The knowledge about aging, old age, elderly life is important especially for those who are working in elderly homes.

Management in long term care facilities should consider the infections problem as serious as it should be since apart from affection elderly, the effects are also to these facilities as extra caring cost and risking worker's life. This can be done by employing much infections experts and sent the rest for training since infections do not segregate. Enough caring equipment are to be available and accessible such as washing sinks, soap, disinfectants, gloves, and other protective gears.

8.2 Recommendation

Infections is not an easy problem to everybody and when it comes to elderly, infections contribute much in deterioration of their body capability in making the aging life smooth. There is a needy of exclusive attention to be given to the elderly and long-term care facilities. This would include creating good living environment with knowledgeable care givers.

More researches are needed in this field as the problem attain new face when acute care unit and hospitals are shortening the hospital stay and patients moved to the rehabilitations centers, nursing and elderly homes. The aim is to rescue these people since it was traditionally known that hospital and acute care centers are infections reservoir, but the outcomes are quite different from the reality. The whole scenario ends up to the shifting the problem to the long-term care facilities.

8.3 Critical Analysis and future studies

8.3.1 Critical analysis

This study is so broad when thinking of infections as the core of the study and there are not many researches which have been done on this. This gave difficult moment to the author in searching and get materials suitable for the study. Most of the studies have been done on the specific infectious diseases such as UTI, Pneumonia, MRSA and so forth. There is a need to write more about infections as general term and to raise our voice of the infections in long-term care facilities to get attention from the policy makers.

8.3.2 Future researches

Based on the findings and the general idea of infections in long-term care facilities, there is need of something new to be done. Currently, the general infections knowledge should be given to everyone in the caring system at least to draw attention on how the situation read out there.

The research on how healthcare stakeholders could be involved in the paying attention in the long-term care facilities as the way acute care and hospitals was given. This would help in solving the problem in the long-term care facilities and not the current one which has just moved it from one unit to the other.

Investigating the means in long-term care facilities to try cutting down the problem before the big changes comes in from the policy makers. This might be increasing number of workers per working shifts or caring facilities such as protective gears and so on.

Investigating on how can teaching curriculum be changed for the new coming nurses to include aging and infections studies that would minimize the worries which current nurses are now having in the field when it comes to caring of a patient with for example MRSA.

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APPENDICES

Appendix 1

Table 1: Social and behavioral theories/models.

Theory/Model	Components	Explanation
Individual Behaviour		
The Health Belief Theory	Perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action and Self-efficacy.	Founder: The HBM was developed in the 1950s by social psychologists Hochbaum, Rosenstock and Kegels. A model attempts to explain and predicts individual behavior influenced by focusing altitude and belief of the person. It assumes that an individual is likely to adopt the new health behavior if he/she feel to be at risk, the outcome is severe, adoption of new behavior outweighs the risk, capability of new behavior adoption, confidence in performing the new behavior. (Jones et al, 2015. Health Promotion and behavior change Theories)
The Trans theoretical Model (Stages of Change)	contemplation, contemplation, preparation, action, Maintenance, and termination.	Developed by Prochaska and DiClemente, assume individual behavior change passes through the mentioned stages and at any time during the process personal behavior can relapse into the earlier stage (Prochaska & Velicer, 1997).
Relapse prevention	Emotional (skills training), mental (cognitive reframing) and physical (lifestyle rebalancing) relapse	Proposed by Marlatt & Gordon Cognitive behavioral approach to identify and prevent risk occurrence. Adoption of new behavior can proceed to behavioral change or setback to the original behavior. (Larimer et al, 1999)
Information processing paradigm.	Stimuli, exposure, attention, comprehension, acceptance, retention, memory.	Was first developed at Yale by Hovland, so it is also known as Yale or Hovland model. For the behavioral change, a person must be exposed to the need for change which is a stimulus and should have the memory all over to maintain the new habit (Flay et all, 1980).
Interpersonal Relation		
The theory of planned behavior	attitudes, social norm, and behavioral control, behavioral, and behavior.	The theory of Planned Behavior (TPB; proposed by Ajzen & Fishbein, 1991), Intension of doing new behavior is influenced by some factors as personal attitudes, social norm and behavior control (Ajzen, 1991).
The theory of reasoned action	Behavioral belief, normative belief, control belief, Perception behavioral control, Subjective norms, attitude	This model developed by Fishbein & Ajzen in 1975. The Theory of Reasoned Action is an extension of the theory of planned action with assumptions that attitude toward action, social norm and control are

	toward the behavior, Intention, Behavior	also influenced by the belief in each component. (Albarracín *et* al, Jan 2001)
Social support	Emotional support, Instrumental support, Appraisal support and Informational support	It is the aid and assistance exchanged through social relationships and interpersonal transactions. It uses *Promotoras* to enhance health behavior change. *Promotoras* guides emotionally which includes expressions of empathy, trust, caring. There is also instrumental support which is tangible aid or services. Appraisal support as information used for evaluation and information support as advice and suggestions. (Fleur *et* al, 2009)
Social Cognitive Theory	Reciprocal Determinism, Behavioral Capability, Observational Learning, Reinforcements, Expectations, Self-efficacy.	Albert Bandura created it in the year 1960 as social learning theory and in 1986 was developed to Social cognitive theory. It assumes that new behavior achieved with the interaction between new behavior, environment and dynamic and reciprocal of a person (Bandura, A. 1989).
Community		
community organization model	Understand the cause and root of the problem. Participating in decision making and finding the solution. Focusing efforts on specific issues Actively engaging participation Developing and maintaining capacity and power Providing feedback	It is the model which allow participation in identifying the cause or problem and in decision making to find the solution. Community focus on the resources available to enhance the solution. (Karabi et al, 2013 & Andersson et al, 2002)
organization change theory	Initiation, decision, and implementation.	The new behavior will probably be adopted in an organization by the following procedure. Awareness stage: getting to know problem and planning for the solution. Making a decision on what approach is suitable and finally the implementation (Batras *et* al, 2014).
ecological approaches	Intrapersonal Interpersonal Institutional Community Public policy	Behavior change influenced by so many factors. The new idea with personal perception when interacting with the environment. Relationship with others in an institution or community, institutional environment community surrounding the institution and public system (Pardeck, 1988).
Diffusion of innovation theory	Relative advantage Compatibility Complexity Trialability Observability	Historically the model was discussed by the French sociologist Gabriel Tarde who plotted the original S-shaped diffusion curve, then in the year, 1943 Ryan and Gross who introduced the adopter categories that were later used in the current theory came to be famous by Everett Rogers (Kaminski, 2011). Spread and adoption of new health behavior by the society are done at a different speed or levels. Once

		the behavior is adopted by the number of individuals in the organization through these levels that can be sustained (Alberta, Health Services 2010).

Appendix 2

Table 2: Summery of the searching Process of the article

DataBase	Pubmed	Elite	Sage	Google scholar
Phrase 1	Healthcare Associated Infection in elderly, old age, geriatric, adult			
Hits	41689	4431	28	Several
Phrase 2	Infections in elderly, prevention and control challenge			
Hits	244	8	714	Several
Phrase 3	Healthcare associated infections in elderly			
Hits	8756	6	1090	Several
Reading the titles for each article retrieved, some articles were disqualified, and few were taken for further analysis				
Phase 1	Healthcare Associated Infection in elderly, old age, geriatric, adult			
Hits	2	9	0	1
Phrase 2	Infections in elderly, prevention and control challenge			
Hits	7	3	2	0
Phrase 3	Healthcare associated infections in elderly			
Hits	0	0	6	0
Reading through abstract and full text for the selected articles and applying Inclusion and exclusion criteria				

Phrase 1	Healthcare Associated Infection in elderly, old age, geriatric, adult			
Hits	1	3	0	1
Phrase 2	Infections in elderly, prevention and control challenge			
Hits	2	0	1	0
Phrase 3	Healthcare associated infections in elderly			
Hits	0	0	2	0
Total number of articles selected				
10				

Appendix 3

Table 2: presentation of the articles which are analysed in this work

Author	Title	Published year	Journal name
Article 1 Kimerly A Kline and Dawn ME Bowdish	Infection in an aging population	2016	*Current opinion on microbiology*
Article 2 Abigail Mullings, Fiona Murdoch, Audrey MacKenzie, Shona Cairns, Jacqui Reilly	Healthcare associated infection in care homes for older people in Scotland: results from a pilot survey	2010	*Journal of Infection Prevention*
Article 3 C Roberts, J Roberts & R J Roberts	Survey of healthcare-associated infection rates in a nursing home resident population	2010	*Journal of Infection Prevention*
Article 4 Märtha Sund-Levander & Pia Tingström	Clinical decision-making process for early nonspecific signs of infection in	2013	*Scand J Caring Sci*

	institutionalized elderly persons: experience of nursing assistants.		
Article 5 Patricia W. Stone, PhD, RN, Carolyn T. A. Herzig, PhD, MS, Mansi Agarwal, PhD, MPH, Monika Pogorzelska-Maziarz, PhD, MPH, and Andrew W. Dick, PhD	Nursing Home Infection Control Program Characteristics, CMS Citations, and Implementation of Antibiotic Stewardship Policies: A National Study	2018	*The Journal of Health Care Organization, Provision, and Financing*
Article 6 Heath H, & Phair L	Frailty and its significance in older people's nursing	2011	*Nursing Standard*
Article 7 Sonya R. Hardin	Vulnerability of Older Patients in Critical Care	2015	*Geriatric care*
Article 8 Suetens C.	Healthcare-associated infections in European long-term care facilities: how big is the challenge	2012	*Euro Surveill*
Article 9 Lona Mody, MD, MSc	Infection Control Issues in Older Adults	2007	*Clin Geriatr Med*
Article 10 Morgan Jane Katz & Mary-Claire Roghmann	Healthcare-Associated Infections in the Elderly: What's New	2016	*Curr Opin Infect Dis*

Appendix 4

Table 4: Types and prevalence of common infectious diseases for elderly

Types of HAI	Prevalence	Article title	Author/s
Infections	(1.4-5.2) infections/ 1000 resident care day	Nursing Home Infection Control Program Characteristics, CMS citations, and Implementation of Antibiotic Stewardship Policies: A National Study	Stone et al.,2018
	6.04 infections/1000 bed days	Survey of healthcare - associated infection rates in a nursing home resident population	Robert et al., 2010
	4% of 61932 residents had signs and symptoms of infections.	Healthcare-associated infections in European	Suetens, 2012

	4.1 million of European population acquire healthcare associated infection in acute units	long-term care facilities: how big is the challenge?	
	11.5% HAI prevalence for >85 years old 11.27% HAI prevalence for 75-84 years old 10.64% Hai prevalence for 65-74 years old and 7.37 % HAI for younger than 65 years old	Healthcare -Associated infections in the elderly; What's New	Katz & Roghmann, 2016
	3%-15% of 1.43 million of older adult	Infection Control Issues in Older Adults	Mody, 2007
	9.3% of 922 residents	Healthcare associated infection in care homes for older people in Scotland: results from a pilot survey	Mullings et al., 2010
Pneumonia	Most common and 6th leading cause of death in US and 90% of death occur in > 65 years old people	Infection in an aging population	Kline & Bowdish, 2016
	2.52 number of bed/1000 bed care days	Survey of healthcare - associated infection rates in a nursing home resident population	Roberts et al., 2010
	33.6% of 61,932 residents	Healthcare-associated infections in European long-term care facilities: how big is the challenge?	Suetens, 2012
	13.8% of 922 residents	Healthcare associated infection in care homes for older people in Scotland: results from a pilot survey	Mullings et al., 2010
	It is among the most common bacterial infections, estimate is 60% of women are affected and it increases with age	Healthcare-associated infection in the Elderly: what's new	Katz & Roghmann, 2016
Urinary Tract Infections (UTI)	51.7% of 922 residents	Healthcare associated infection in care homes for older people in Scot-	Mullings et al., 2010

		land: results from a pilot survey	
	30%-50% 0f 1.43 Million of older adults	Infection Control Issues in Older Adults	Mody, 2007
	22.3% of 61,932 residents	Healthcare-associated infections in European long-term care facilities: how big is the challenge?	Suetens, 2012
	Critical problem in the elderly due to high rates of mis-diagnosis and much associated with unnecessary antibiotic use.	Healthcare-associated infection in the Elderly: what's new	Katz & Roghmann, 2016
Skin and soft Tissue infections	21.4% of 61,932 residents	Healthcare-associated infections in European long-term care facilities: how big is the challenge?	Suetens, 2012
	12.6% of 922 residence	Healthcare associated infection in care homes for elder people in Scotland: results from a pilot survey	Mullings et al., 2010
	1.57/1000 bed care days Includes the surgical site infections	Survey of healthcare - associated infection rates in a nursing home resident population	Roberts et al., 2010
	No specific value but Skin, chronic wound, and soft tissue infections are very common. 6.5 million people are having chronic wounds	Infection in an aging population	Kline & Bowdish, 2016
Conjunctivitis	8% of 61,932 residents	Healthcare-associated infections in European long-term care facilities: how big is the challenge?	Suetens, 2012
Gastro-intestinal Infections	4.6% of 61,932 residents	Healthcare-associated infections in European long-term care facilities: how big is the challenge?	Suetens, 2012

	13.8% of 922 residents	Healthcare associated infection in care homes for older people in Scotland: results from a pilot survey	Mullings et al, 2010
	0.41 infections/1000 bed care days	Survey of healthcare - associated infection rates in a nursing home resident population	Roberts et al., 2010
Reactivated Chronic Infections	common in aging and elderly population (caused by immunosenescence), Varicella zoster Virus (VZV) causative agent of 'chicken pox' in young people.	Infection in an aging population	Kline & Bowdish, 2016