How does polypharmacy impact on the quality of life of older people in New Zealand?

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I declare that the work presented in this thesis, is, to the best of my knowledge and belief, original and my own work, except as acknowledged in the text and reference pages.

Abstract of a thesis submitted in partial fulfilment of the requirements for the Degree of Master of Nursing

How does polypharmacy impact on the quality of life of older people in New Zealand?

by

Weerasinghe Mudiyanselage Nadeeka Priyadarshani Weerasinghe

The ageing population is increasing all over the world and people are living longer with multiple diseases thanks to the development of pharmaceuticals and other health care facilities. Older people who suffer from multiple diseases require multiple medications to control the severity of the disease. Polypharmacy can lead to the occurrence of adverse outcomes with prolonged usage. In New Zealand, many older people live with multiple diseases and they require multiple medications to control their diseases. Therefore, polypharmacy (using more than five medications) is prevalent among elderly New Zealanders.

Method and design

The purpose of this research was to investigate how polypharmacy impacts on the quality of life of older people in New Zealand. Participants of the study were 65 years or over and take five or more medications daily. To find out about the quality of life of those who take more than five medications, a validated questionnaire called Living with Medicines Questionnaire version 3 (LMQ3) was used. Out of 41 questions, 19 questions were considered for the study and the Visual Analogue Scale (VAS) used to measure the level of medication burden. A descriptive statistics method were used to analyse the collected data.

Results

The mean age of 28 participants was 71.33 and 67% of participants were female. Most of the participants were New Zealand Europeans and taking cardiovascular system-related medications. The majority of the participants claimed that polypharmacy affected neither their social life nor driving. Further, many stated that their medication was working well. But most of them stated that

they had concerns about the long- term impact of medication. The VAS showed that they experienced minimum medication related burden.

Conclusion

According to the findings of other literature which were written about polypharmacy in other countries, polypharmacy has a both positive and negative impact on older persons' quality of life. However, in this study, polypharmacy did not impact on the quality of participants' lives.

Keywords: Polypharmacy, quality of life, older people, multiple medications, multiple diseases, drug burden, adverse outcomes, drug-drug interaction, using five medication, side effects, likert scale, Survey, New Zealand

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Chapter 1: Introduction

1.1. Background

The world population is aging. Many people live longer than sixty years and the older population of aged 60 years or over is predicted to increase to two billion by 2050 (World Health Organisation [WHO], 2018). The reasons for the ageing population is an increased life expectancy, a drop-in fertility, and the baby boom after the World War 2. There is no agreed definition for elderly people; for some countries, elderly means 65 or over; for some 60, or over; and for others, it is the pensionable age (Tinker, 2002). The term elderly means, for many, living with both physical and mental disabilities. Older people who are 85 or over become more dependent on health services due to functional disabilities as they suffer from prolonged illnesses. On the other hand, many older and very old people do not suffer from prolonged illnesses and perform daily activities without any disabilities (Tinker, 2002). When it comes to New Zealand, the older population is predicted to double within the next 20 years and will rise to 1.2 million by 2036. This means twenty- three (23%) of the population will elderly within 20 years compared to 14% in 2012. By the middle of 2020, 30% of the New Zealand population will be elderly (Ministry of Health [MOH], (2013). *The Health of Older People Strategic Plan (2012-2017)* showed that stroke, falls, and bone health, dementia, and other psychiatric conditions are prevalent among New Zealanders. Because of this reason many older people who live longer will live with a disability later in their life (MOH, 2018).

1.2. Polypharmacy

There is no agreed definition for polypharmacy. The definition of polypharmacy can be differ according to the time period of drug usage and the number of drugs used. It includes the usage of two or more drugs for more than 240 days (prolonged usage), or five to nine drugs for 90 days or more. The definition can include the usage of five or more drugs when discharged from the hospital and the consumption of 10 or more drugs while admitted at the hospital (Masnoon, Shakib, Kalisch-Ellett, & Caughey, 2017). Alic, Pranjic, and Ramic (2011) defined polypharmacy as the usage of three or more medications in their study. In general, polypharmacy means the consumption of five or more drugs and hyper polypharmacy refers to taking ten or more drugs (Gutiérrez-V et al., 2017).

The importance of the study of the usage of polypharamacy is to know the negative outcomes which elderly people experience when they use polypharmacy to control their multimorbidity. Multimorbidity means an individual having two or more chronic disease conditions (Namara et al.,

2017) and polypharmacy is the result of multimorbidity which requires more medications to control disease related symptoms (Cambridge Centre For Health Services Research, n.d.). Elderly people who use five to nine medications may be prone to an increase in the severity of falls risk by four times compared to those who use less than five drugs, and the mortality rate is also considerably higher (Nishtala, Narayan, Wang, & Hilmer, 2014). Apart from negative drug reactions, polypharmacy can increase the cost of drugs, lead to the reduction of body functions, lead to nonadherence to taking their medications, and cause different geriatric syndromes to occur (Shah & Hajjar, 2012).

1.3. Polypharmacy and older people

Prolonged illnesses are ubiquitous among elderly people; approximately 80% of the elderly suffer from at least one disease condition and nearly 50% of them have two chronic diseases. Therefore, they need different types of medications to control their conditions (Shah & Hajjar, 2012). A study that was carried out in Europe revealed that approximately 46% of older people who live in the community probably have drug-drug reactions, and the severity of drug interaction can increase with the number of drugs that are used (Shah & Hajjar, 2012). Elderly people who use five to nine medications may be prone to an increase in the severity of falls risk by four times compared to those who use less than five drugs and the mortality rate is also considerably higher (Nishtala, Narayan, Wang, & Hilmer, 2014). Some drug groups such as opioid analgesics and psychotropic drugs are known to increase the rate of falls which can result in hip fractures (Ravona-Springer & Davidson, 2014). According to Ravona-Springer and Davidson research in 2014, the elderly who did not consume any drugs were three times less likely to have complications such as hip fractures. Moreover, the consumption of psychotropic and analgesic drugs can increase with age. Thirty eight (38%) of older people over 75 years who lived in the community used at least one of the psychotropic drugs -benzodiazepine (38%), antidepressants (12%), antipsychotics (6%)- and 28% of the elderly used at least two psychotropic drugs (Ravona-Springer & Davidson, 2014). Benzodiazepine can be associated with falls and hip fractures to occur as it reduces the cognition and increases the risk of dementia. Furthermore, antipsychotics cause an increase in stroke and mortality (Walsh et al., 2016).

Multiple drugs can preserve better health by minimising the disease progression, while improving the quality of life in the elderly population (Nishtala et al., 2014). On the contrary, medications which are prescribed to improve the health status of older people may bring many adverse effects, especially in older people who suffer from multiple diseases and geriatric syndromes (Jamieson et al., 2018). The appropriate usage of drugs can affect the better quality of life, on the other hand, inappropriate drugs can result in reduced quality of life among elderly people (Olsson, Runnamo, & Engfeldt, 2011).

1.4. Quality of life.

Researchers define the quality of life in different ways, and the quality of life (QoL) is directly associated with various health and health dimensions (Şahin, Özer, & Yanardağ, 2019). According to Panday, Kiran, Srivastava, and Kumar (2015), the QoL is a combination of an individual's functional health, confidence in capabilities, satisfactory involvement in social activities, and the independent performance of daily activities. The QoL is a broad complex concept which includes physical and mental health conditions, an individual's beliefs, social relationships, noticeable features of the surroundings where they live, and social wellbeing (WHO, 2019). The perception of wellbeing can be different from person to person and society to society (Şahin et al., 2019). The increment of the independent life expectancy is one of the indicators for the quality of life (WHO, 2019). This means living a longer life without any need for disability support services, and mortality and morbidity rates are considered as indicators for healthy quality of life (WHO, 2019). The QoL can be subjective and objective according to each person. Subjective QoL means having individual satisfaction and appreciation of one's own living condition such as income, security, safety, environment, satisfaction with education and health. Objective QoL means whether an individual meets those living conditions such as income security, education, and health (Şahin et al., 2019)**.**

1.5. Health status vs health related quality of life

Health status and health related quality of life (HRQoL) are different concepts, and health status is one of the domains of HRQoL. Previously, health status was defined as considering the functionality of mental health and physical morbidity. Health status means one's perception related to the capability of performing daily activities which is influenced by existing health conditions (Montiel-Luque et al., 2017) Poorer HRQoL is linked with factors such as age, being female, functional weaknesses, depression, prolonged disease, or polypharmacy However, the recent concept of health status is very complex and broad, and it overlaps with the concept of HRQoL (Bowling, 2014). Both concepts can include physical health (e.g., fitness, symptoms, signs of disease, and wellness), physical functioning (ability to perform daily activities and physical roles), social functioning and social health (relationships, social support, and activities), psychological well-being (depression and anxiety), emotional well-being (morale, control, coping, and adjustment), and perceptions (Bowling, 2014). These variables measure HRQoL instead of the narrow measure of physical and mental health. Some of the complex variables such as self-related constructs (e.g., self-efficacy, self-esteem, and perceived control over life), and the notion of health status, QoL, and HRQoL can be analysed. Some investigators consider cognitive mechanisms (e.g. expectations of life, level of optimism or pessimism, social and cultural values, aspirations, and social standards comparisons with one's situations in life) to evaluate

the relationship between anticipation of treatment and the results of patients and also their level of coping strategies and optimism (Bowling, 2014).

1.6. Disability

Disability refers to the inability to implement day-to-day activities independently in a normal way: incapability to perform Activities of Daily Living (ADL) and Instrumental Activities of Daily Living (IADL) (Millán-Calenti et al., 2010). People can be classified according to ADL when their ability to perform one or more day-to-day activities such as walking , bathing, and feeding without any other support, and according IADL when their ability to perform domestic activities such as taking medication, and using money (Lim et al., 2017). ADLs can be used to observe the aging process (Katz et al., 1963) and disability related dependancy is considered to be the major factor which impacts on the QoL of life of elderly, their caregivers as well as relatives (Millán-Calenti et al., 2010).

1.7. Research question

This study was implemented to answer the question '' How does polypharmacy impact on the quality of life of older people in New Zealand'' An online survey was carried out to collect data from elderly people who live freely in the community.

1.8. Aims of the study

The main aim of this study is to investigate how polypharmacy affects the quality of life of the community- dwelling older people in New Zealand. There are some studies that address this topic in the world however, there was no published New Zealand study to date that has directly investigated the polypharmacy related quality of life of elderly people. According to several findings, some researchers such as Nishtala et al. (2014) and Henderson, Buchwald, and Manson (2006) stated that polypharmacy can bring positive outcomes to achieve QoL. However, Montiel-Luque et al. (2017) and Tegegn et al. (2019) showed that polypharmacy can negatively affect for QoL. After reviewing both national and international literature, the selected hypothesis for this study is that older New Zealanders who used five or more drugs have reduced quality of life. This was because, the adverse effect of polypharmacy seemed to be high when older people used some medication groups on a long-term basis and used more than five medications. This study investigates the drug groups commonly used and how those drugs could effect positively or negatively older people's health, and to what extent older people who used polypharmacy achieved their quality of life.

1.9. Significance of the research in New Zealand

In New Zealand, polypharmacy is prevalent among all ethnicities because of multimorbidity which can cause a reduction of QoL among the older population, although the life expectancy is increasing (MOH, 2020). According to the Health Quality and Safety Commission New Zealand (HQSCNZ, 2016), polypharmacy is more prevalent among Māori (31.7%) and Pacifica elderly (44.6%) who are aged 65 or over than European/other (24.2%) and Asians (20.7%). The usage of drugs has grown with age and more than half of European older people who were over 85 used five or more drugs on a long-term basis (HQSCNZ, 2019a). Although polypharmacy was more prevalent among Māori and Pacific older people in 2016, European and Asian elderly people showed higher falls related to hip fractures (HQSCNZ, 2019a). The risk of falls contributed negatively to older people's self-assurance related to the QoL (Jamieson et al., 2018). Although not all medications contribute to adverse drug reactions, medicine groups such as sedatives and anticholinergic showed negative effects on mental and physical functions (Nishtala et al., 2014). The reason may be the higher usage of benzodiazepine or zopiclone among European and Asian older adults compared to other ethnicities. HQSCNZ (2019) showed that of the European older people aged between 65 and 74, 9.3% used benzodiazepine or zopiclone, while 13.3% aged between 75 and 84 or over and 20.6% of 85 and over older people used benzodiazepine. There were 8.6% of older Asians who were aged between 75 and 84 and 11.5% of 84+ used BD. The older Asians who were aged between 75- and 84 and 84 or over showed the second highest prevalence of falls related hip fracture in 2016. Just over 5% of Maori aged between 64 and 75 used benzodiazapine and 2.4% of pacific aged between 75 and 84 used benzodiazapine (HQSCNZ, 2019).

Apart from adverse effects, route of drugs and nature of drugs can be contributed to medication-related burden and negative effect on individuals' social, psychological, and physical health (Mohammed, Moles, Hilmer, O'Donnel, & Chen, 2018). That could be another reason why there is a reduced quality of life among elderly people who have multiple diseases (Bell, Steinsbekk, & Granas, 2015). In addition, some older people repeatedly use their prescriptions for a long time to get the best health results (Bpac[nz], 2018). When these behaviours continue for a long period, they may be affected by adverse drug reactions (Bpac[nz], 2018).

Chapter 2: Literature Review

2.1 Introduction

This literature review consists of various research studies which were carried out to investigate the relationship between polypharmacy and the occurrence of different health conditions that can affect the quality of life of elderly people. Journal articles from Google Scholar, Pubmed and Proquest were reviewed. These articles were critically evaluated to find out how polypharmacy impacts older people's lives in various circumstances, and what other factors need to be considered in the determination of quality of life.

2.2 Drug burden in New Zealand

Jamieson et al. (2018) showed risks of falls related to drug burden among 71,856 participants who were 65 or older people and living independently in New Zealand. With their cross-sectional study, they collected data form September 2012 to January 2016 by using International Resident Assessment Instrument–Home Care (InterRAI-HC). The validity of InterRal-HC tool was tested by members from 12 countries (Hirdes et al., 2008). The purpose of this study was to investigate the influence of the usage of increased amounts of anticholinergic and sedative drugs which can contribute to high risk of falls. They discovered that the high amount of anticholinergic and sedatives medications could increase the falls risks among older people. According to Kouladjian, Gnjidic, Chen, Mangoni, and Hilmer (2014), anticholinergic and sedatives were widely used among older people and these medications could be related to poor cognitive function and functional impairments. The development of the Drug Burden Index (DBI) was based on anticholinergic and sedative drugs which are considered to be highly risky for older people by causing many adverse drug reactions (Hilmer et al., 2007). The DBI measures the increasing effect of anticholinergic drugs and sedatives on physical and cognitive functions (Kouladjian et al., 2014). The outcomes of the research showed that most of participants were women (61.0%) and 88.5% were New Zealand European. The reason for this could be higher usage of benzodiazepine among the New Zealand European elderly population compared to other ethnicities in New Zealand (HQSCNZ, 2019b). Jamieson et al. (2018) discovered that risk of falls and the DBI were associated with 18 possible confounders such as multiple diseases, walking speed, and ADL. They also discovered that falls could increase with age and more men were prone to the occurrence of falls. Another important point was that falls had less occurrence among Māori and Pacific people. Furthermore, Jamieson et al. (2018) found that falls risk affected the confidence of older people and their quality of life.

A recent study which was conducted by Krska, Corlett, and Katusiime (2019) showed how patients perceived the complexity of drug regimens and medication burden. This study found that the complexity of drug regimens increased with the number of medications. Researchers recruited 492 patients who were aged 18 or over who lived in the United Kingdom (UK). They had 2700 different prescription medications. They used a questionnaire called Living with Medications Questionnaire version 3 (LMQ3) which had been validated by testing against EuroQoL 5-level quality of life measure (EQ-5D-5L) and the Treatment Satisfaction Questionnaire with Medication version II (TSQM-II) (Krska et al., 2019). The Medication Regimen Complexity Index (MRCI) was used to measure medicine complexity and this tool was validated by eight pharmacists by testing 134 medication regimens (George, Phun, Bailey, Kong, & Stewart, 2004). According to their findings, 73% of patients used drugs for central nervous system related disorders, 45% used drugs for gastro-intestinal disorders, 36% of patients used them for respiratory track diseases, and 27% of patients used them for the genito-urinary system (Krska et al., 2019). Another important point was that cardiovascular diseases were the most prevalent disease among the UK population and the number of drugs used for cardiovascular disease was high (Krska et al., 2019).

According to Gao et al. (2017), in the UK, cardiovascular disease was reported to be high among those aged 65 or older and many older people had issues related to the quality of life due to overdiagnosis and overtreatment, although disease conditions were identified earlier in their life. In Krska et al.'s (2019) study, 162 (13.3%) of patients who reported having a high drug related burden. University of York (2017) showed that the elderly who were 60 or over, 60.4% had been given drug prescriptions, and nearly 20% of prescriptions which were used by the community-dwelling older people were found to be inappropriate (University of York, 2017). These inappropriate medications might contribute to drug burden and the highest drug burden might occur among older people who used both appropriate and inappropriate medications. Moreover, Kriska et al. (2019) found that a weak correlation between drug complexity measured by the MRCI and medicine burden. Kriska et al. (2019) did not consider the categorising of age groups to identify the degree of drug burden in each age drug group. Their study population was considered from 18 or over which was a broad age range. Therefore, it was not clear which age group was more prevalent in the above mentioned cardiovascular disease conditions and the amount of drugs that were used. Moreover, the researchers did not aim or try to identify the gender-based differences in drug burden.

2.3 Potentially inappropriate medication results in polypharmacy

Another study by Bala, Narayan, and Nishtala (2018) showed that the increment of polypharmacy led to a rise in the usage of potentially inappropriate medications (PIMs) among older people who were

65 or older in New Zealand. They used validated tools such as the International Resident Assessment Instrument-Home Care (interRAI-HC) as well as updated 2015 Beer Criteria. Beer Criteria is used by health professionals in their clinical care to improve the quality of care of older people. Beer Criteria provides information related to harmful drugs which contributed to adverse effects for the older people and how to get advantages of using those drugs with minimum drug burden (Steinman et al., 2015). The study population was 70,479 community dwelling elderly people and most participants were women (61.0%). The study revealed that 42.7% of older people had at least one inappropriate prescription (Bala et al., 2018). PIMs independently contributed to the drug-related harms and not just the number of drugs which were linked to adverse drug reactions but also some drugs were harmful when used independently (Ong et al., 2017). In New Zealand, Bala et al. (2018) implemented this study by using records of prescribed drug. Although older Māori had less falls risks and fewer prescribed medications than other ethnic groups, elderly Māori and European had high PIMs in 2015 compared to 2012-2014. PIMs in 2012- 2014 were 2.17% and this amount increased to 7.13% in 2015. The PIMs trend is increasing among the elderly Māori population (Bala et al., 2018). The reason for this may be the lack of data related to non-prescribed medications and inappropriate medicines and traditional medicines. It is important to know whether the older people in New Zealand use traditional medications as these can increses or decrease the effect of some medications but, there appear to be no research related to how traditional medicine contribute to polypharmacy or adverse outcomes among elderly Māori. However, international research carried out by Milić, Milošević, Kon, Božić, Abenavoli, and Borrelli (2014) showed that warfarin which was an anticoagulant interacted with many herbals medications containing components such as Hypericum perforatum (which reduces prothrombin time), Salvia miltiorrhizza (which inhibites the microsomal enzymes), Ginkgo biloba [ginkgo], (which inhibits platelet aggregation), Vaccinium [cranberry juice] (which elevates of INR) ,allium sativum [garlic], (which increases platelet aggregation) (Milić et al., 2014).

2.4 Adverse effects of anticholinergic and sedative medicines

A study which was conducted by Nishtala, Narayan, Wang, and Hilmer (2014), was based on the elderly in New Zealand and obtained data mainly from the Pharmaceutical Claims Data Mart (Pharms) which contained data related to individuals' prescriptions with a National Health Index (NHI) number and other reliable data sources. The analysed data were related to the usage of anticholinergic and sedative medicines within a one -year period, among community-dwelling older people in New Zealand who were 65 or older. The study population was 537 387. In this study, 54.9% were female older participants. This study showed that the Drug Burden Index (DBI) was higher among females than males and higher among Māori than non-Māori. There were 43.22% of older people who highly exposed to anticholinergic and sedative drugs and DBI was associated with a high risk of falls, frequent hospitalisations, and mortality. Polypharmacy was also independently associated with the above negative outcomes (Nishtala et al., 2014). According to the authors, DBI was a good quality indicator to make new policies to control the impact of polypharmacy (Nishtala et al., 2014). Nishtala, et al. (2014) stated that there is a lack of studies to support the use of benzodiazepines and psychotropic drugs in New Zealand. Many studies were conducted on drug withdrawals rather than considering the significant adverse outcomes that occurred (Nishtala et al., 2014).

2.5 Medicine taking practices in New Zealand

Tordoff, Bagge, Gray, Campbell, and Norris (2010) conducted a study to investigate prescription and non-prescription medicine usage of elderly people in Dunedin, New Zealand, and to investigate medicine taking practices. The researchers recruited 810 older people who were 75 or older community living elderly people who lived in urban areas. They extracted data from the electoral role and they divided them into three age groups: 75–79, 80–84 and ≥85 years. They excluded people who lived in rest homes and who did not mention their home address or PO box number, and were not listed in the telephone directory. Researchers developed a survey questionnaire by arranging a meeting with five to ten groups of older people aged 75 or over to discuss their problems related to medicine usage. Among the 810 study population, 514 met the study criteria and 320 consented to participate in the study. They considered 316 interviews for the analysis. There were 172 men and 144 women who were aged between 75 and 98 years. The majority of the participants (84%) were New Zealand European or European. Participants used 377 prescription medications and 358 over the counter medication. The majority of prescribed medicines (80%) were used for cardiovascular system related diseases and nearly one third (32%) of prescribed medications were used for nervous system related diseases. Most common over the counter medications were paracetamol (17%) and glucosamine chondroitin (14%).   More than half of the older people (58%) agreed that taking

medicines improve their health and 38% stated they were unsure. Most of the participants who were aged 65 or older used mean of seven prescribed medications. Most of the participants held positive attitudes for the questions: medicines keep them alive, help with their symptoms and are necessary. They also accepted having medications was a part of their lives and were resigned to it. More than half of the participants were aware of the purpose of having medications, 93% of them asked from the doctor regarding side effects, and one fifth of them worried about side effects. Three quarters of people had suffered from a medication related adverse outcome, and which resolved by themselves with various measures. A quarter of participants used the internet to search for information about thier medications. However, other participants did not want to search because it made them worry. A quarter of older people forgot to take their medications at the correct time and the most of those who forget to take their medications were male. The researchers found that the participants had difficulty in reading or understanding instructions and leaflets and some older people were confused about medications after hospital discharge. Therefore, the researchers stated that there was need to improve labelling and educating the older people about medication usage. Three quarters of participants responded high or medium to the question related to the non-adherence to medication (Tordoff et al., 2010).

This study is currently relevant because this gives overview of medication usage in New Zealand. The results showed that most of the participants used polypharmacy. As this study was conducted in one region, They considered non-European New Zelanders ethnicities (16%) under one group called ' *New Zealanders'* and few Māori participatants could be seen (2%) in that group. Therefore, this study could not provide results based on different ethnicities. The overall findings could not be generalised to the whole New Zealand population. This study is older than a decade, therefore, the trends related to medication practice and the perception regarding medication problems may have changed.

2.6 Polypharmacy and the quality of life

Montiel-Luque et al. (2017) investigated the medication-related quality of life of older people who lived in Spain. The researchers recruited 375 older people who were 65 or older, used five or more medications, and who were included in an electronic prescription program. The majority of the participants were women (63.5%). Older people with physical and mental disabilities that prevented the independent usage of medications, patients who were admitted in public or private hospitals, older people who did not consent for the study, and those with language problems were excluded (Montiel-Luque et al., 2017). The researchers used EuroQol-5D an instrument which was a validated questionnaire for their study. '' This EuroQol-5D, contains five domains: mobility, selfcare, usual activities, pain/discomfort, and anxiety/depression and five levels: no problems, slight problems, moderate problems, severe problems, and extreme problems'' (Reenen & Janssen, 2015, p.5). The findings of the research showed that women had perceived their health to be poorer than men. Furthermore, researchers found a statistically significant association among the medication associate factors such as taking more than ten drugs, nonadherence to treatment, medication errors, and incapability to identify the drugs associated with diseases, and these can contributed to poor QoL among older people (Montiel-Luque et al., 2017). Moreover, the older people who had high socioeconomic status had shown a better QoL and independence in day-to-day activities (Montiel-Luque et al., 2017). One of the limitations of the study undertaken by Montiel-Luque et al, was that this study design, which was a cross sectional study, could not successfully to observe a direct relationship between medication related factors and HRQoL, but they could achieve the main purpose of this study by identifying the issues associated with the HRQoL.

Another recent study which was carried out by Tegegn et al. (2019) explored the quality of life of 150 older people in a hospital who took multiple medications in Ethiopia in 2017. The researcher used a validated survey tool called the MRQoLS-v1.0 questionnaire for the elderly (65 or older) who took five or more medications (Tegegn et al., 2019). This six likert scale questionnaire contains three scales: '' Role limitations due to medication'' (six subscales), ''self-control'' (five subscales), and ''vitality'' (three subscales) having a total of 14 subscales. They excluded the older people who had difficulty filling in the questionnaire due to their major psychological and physical condition. In this study, two thirds of participants (67.3%) were females. They discovered that a large proportion of patients (75.3%) who used more than five medications were prone to have a reduced quality of life. Older people's response to each scale showed that QoL had been impacted by polypharmacy related harms and most of the older people (81) showed severe harm in the ''self control'' scale. There were 64 older people who responded to the role limitation scale as they had difficulty to carry on day-to-day activities. Moreover, the severity of impairment of MRQoL was highly positively correlated with frequent hospitalisation

and number of drugs that were used. This study further stated that there was a lack of research conducted to evaluate MRQoL and the research available for HRQoL were insufficient to evaluate medication changes related to quality of life (Tegegn et al., 2019).

A study which was carried out by Olsson, Runnamo, and Engfeldt (2012) in Sweden assessed the quality of older people's prescriptions and the quality of life (QoL). Prior to this implementation, researchers conducted a prescription review and promoted the patient participation in primary care. For this study, researchers recruited 150 community-dwelling elderly people who were 75 or older and had been discharged from a hospital between September 2006 and May 2007 and used five or more medications. They continued their study for a one-year period until May 2008. They excluded the elderly people who were suffering from dementia, abuse, had malignant conditions, and who were in aged care facilities. They divided the people into three groups: Group A (control), group B (intervention) and group C (intervention). They used two validated tools: EQ-5D for overall quality of life and EQ VAS which was used to assess self-rating of QoL according to the older people health status (Olsson et al., 2011). In these three groups, there were more female participants than male. Researchers found that hyper polypharmacy was common among all groups which can be an indicator to the occurrence of adverse outcomes related to drugs. Both EQ-5D and EQ VAS assessments indicated that older people perceived themselves to be low status in their HQoL. Another finding of this study was that a number of specialised prescribers were involved in older people's health and they prescribed medications according to their specialty. However, there was no prescriber to take whole responsibility related to their drug prescription. Moreover, prescribers do not try to change previously prescribed drugs as it was time-consuming work. It was important to note that the researchers had a few chances to find correct prescriptions from three groups. Many participants from group C tended to have the wrong dosage and wrong regimens and they did not want to might any problems that can effect the relationship with the doctor (Olsson et al., 2012). Similarly, in New Zealand, some people visit many prescribers, and the secondary prescriber does not know the previous drugs (Bpacnz, 2019). This may be one of the reasons there are multiple inappropriate drugs which bring enormous side effects for the elderly people (Bpacnz, 2019).

Henderson, Buchwald, and Manson (2006) conducted a survey and a home interview to investigate the association between polypharmacy and HRQoL among a group of older American Indians. They recruited 63 people who were 50 or older who lived in the community and they used four or more different medications on a regular basis. Therefore, the researchers defined polypharmacy as using four or more medications in this study. The nurses conducted interviews at their home. The interviewer recorded all prescription and over the counter medications with name, dose, and

frequency. They also collected demographic data (age, annual income and education), comorbidities and the history of the usage of alcohol and cigarettes. The researchers assessed medical outcomes by using the Short Form (SF- 36) which enabled the participants to choose from four options: excellent, very good, good or versus fair/poor (Henderson et al., 2006). SF- 36 has 36 questions divided into eight domains that measure physical and mental health related to HRQoL. The four domains of physical functioning include (PCS): physical functioning (ten items), role-physical (four items), bodily pain (two items), and general health (five items). The domains for mental health measure include (MCS) (four items), social functioning (two items), role-emotional (three items), and mental health (five items) (Heyde, 2007). They did not find any significant relationship between MCS and polypharmacy. On the other hand they found an association between polypharmacy and PCS. The researcher found that most of the participants were females and the mean age was 66. The age was not significantly related with the medication usage and medication usage did not associate with the HRQoL. Most prevalent diseases were hypertension, arthritis, and diabetes. Statistical analysis showed that low education correlated with increased usage of medications. This study showed that some other factors can also affect the behavior of medicaton usage and can contribute to change the perception of HRQoL.

2.7 Polypharmacy and frailty

A recent longitudinal study was carried out in the United States of America (USA) for eight years to discover the relationship between polypharmacy and the risk of frailty among older adults. They extracted data from Osteoarthritis Initiative (OAI) which contained data related to the high risk of knee osteoarthritis among 4402 North Americans between February 2004 and May 2006 (Veronese et al., 2017). Then they collected data related to frailty from baseline for 96 months. In this study the majority were female participants (2558) and the mean age was 61.2 years. By using a questionnaire, researchers collected data related to prescribed drug names, period of time usage, route of administration, and number of medications. Veronese et al. (2017) found that polypharmacy highly impacts the progress of frailty symptoms among participants. It was significant that people who used four to six medications showed nearly 55% risk of frailty. Moreover, those who used seven medications showed a two and half fold risk of the progression of frailty. According to Gnjidic et al. (2012), using more than five medications could affect the occurrence of frailty among elderly men who were 70 years or older when they used drugs for two years continuously. They recruited 1662 older males who lived in the community in Australia and the mean age was 76.9. Their findings suggested that the frail participants used more medication and had a higher drug index burden (DBI) compared to healthy participants.

Saum et al. (2017) conducted a longitudinal observational cohort study among community living older people from Germany to investigate whether polypharmacy could be a reason for an occurrence of frailty. Their study population included 3,058 older people aged between 57 and 84 years. They conducted cross-sectional analysis among 3058 older people for an eight-year period and they collected data between eight and eleven years to observe the frequency of frailty. They conducted their longitudinal study among 1998 older participants. They found that the mean age was (71.5) among older people who used five or more drugs and those who used ten or more drugs. Polypharmacy had shown equal distribution among both genders. The results showed that the level of frailty was more prevalent among participants with hyper polypharmacy and polypharmacy compared to other participants. Participants with polypharmacy or hyper polypharmacy had 1.5 times of risk of progressing frailty within three years and two times higher risk of frailty without the number of diseases and the seriousness of diseases. Multi morbidities were comparatively higher among people with polypharmacy and hyper polypharmacy.

2.8 Association between polypharmacy and dementia

Park, Park, Song, Sohn, and Kwon (2017) conducted a longitudinal study to investigate the relationship between polypharmacy and dementia among older people. They analysed a database called the National Health Insurance Service-National Sample Cohort (NHIS-NSC) in South Korea, examining data from 2002 to 2013. The research method was a nested case-control design (Park et al., 2017). In a nested case-control study, a particular group of population (cases) was selected that had the same disease condition and a control group was also selected among them of whose disease condition was not progressed (Ernster, 1994). The population was 1,025,340 of free- living elderly people in the community who were older than 65. Their inclusion criteria was the elderly who had used the out-patient department more than once, did not have any hospitalisation records, and who were newly diagnosed as dementia patients from 2005 to 2013. They investigated drug prescriptions, potentially inappropriate drugs (PIMs) such as benzodiazepines, and anticholinergic medications, as well as multiple diseases which were known to be associated with dementia. The study population included more than two thirds of females and the average age of population was 73.3. In their study, they found that multiple diseases were prevalent among dementia patients. Hypertension was prevalent among both dementia (cases) and non-dementia group (controls). Psychiatric illnesses such as depression, delirium, behavioural disorders due to alcohol, and schizophrenia, were three times higher among cases compared to controls. The polypharmacy among dementia patients was as high as 1.7 times compared to control group. Another important finding was that PIMs were considerably higher among cases than control. Hence, polypharmacy is one of the factors that enhances the occurrence of dementia among older people. According to Zhong et al. (2015), the risk of dementia can increase

(22%) with every twenty additional daily dose per year and the risk of dementia is higher among people who use benzodiazepine in a long -term basis than non-users.

Lai et al. (2012) conducted a study to explore the relationship between polypharmacy and dementia among older people who live in Taiwan. They extracted the data related to 7135 newly diagnosed older people who had dementia and 28,540 of randomly selected controlled older population without dementia from the National Health Insurance (NHI). They analysed data of the NHI from 1996 to 2008. The study population included people who were 65 or older who used prescribed drugs for two years. The results showed that the number of drugs were related to increased risk of dementia and also the risk increased with age. There was an increase of the occurrence of dementia (3.27%) among older adults who were aged 85 or more who used one drug, and the percentage increased up to 9.65% for older people who used ten or more drugs. Furthermore, females were more prevalent than men in the occurrence of dementia (Lai et al., 2012).

According to Lai et al. (2012), those who have disease conditions such as cerebrovascular diseases, diabetes mellitus, chronic kidney diseases, and cardiovascular diseases, independently relate to dementia occurrence. When it comes to the New Zealand context, it is significant that there were approximately 50,000 people who suffered from dementia in 2014 and this is projected to grow to nearly 78,000 in 2026 (MOH, 2014). Moreover, due to the increase of life expectancy, one in four adults have two or more long term diseases conditions (MOH, 2016).

2.9 Polypharmacy and cognitive ability

Alic, Pranjic, and Ramic (2011) conducted a study to investigate the association between polypharmacy and cognitive ability among elderly people in Bosnia and Herzegovina. The researchers had conducted random interviews among 54 male and female elderly people who regularly attended family clinics in Bosnia and Herzegovina from April 1st 2010 until May 1st 2010. Their inclusion criteria were elderly people who were 65 or over and used various types and number of medications. Prior to the study, they had had a list of the most commonly used medications from each patient. They collected some details: records of their preparation prior to taking medications, body mass index (BMI), medication doses, and the signature of the participants after using medications. They conducted a survey including more questions such as the usage of alcohol, cigarettes, vitamins and self- medications, living environment (with a family or alone), history of disease, morbidity, and daily routines. They considered use of three or more drugs as polypharmacy and they divided into two participants' groups those who used more than three medications and those who used less than three medications. They implemented a survey called Short Portable Mental Status Questionnaire (SPMSQ)

which was completed by health care workers to evaluate the reduction of mental status of the participants. They also used the tenth International Classification of Diseases, in Federal Bureau of Statistics (B&H) to assess the mental disorder in the particular elderly population. There were 36 females and 18 males participated in this study and found the most commonly used medications were related to cardiovascular diseases, antidiabetic, long acting benzodiazepines, and anti-inflammatory drugs. Nearly half of the participants used more than three medications which was known to have the occurrence of side effects. SPMSQ showed that the elderly who used polypharmacy were prone to have reduced cognitive abilities, and 23 out of 54 patients presented with reduced cognitive abilities. However, the author claimed that many diseases related to elderly life cannot be treated with medications and the drug action depends on the pharmacokinetic difference such as absorption, distribution, and metabolism, and pharmacodynamic difference such as ethnic origin, age, genetic factors, reactions, disease, and interactions between drugs (Alic et al., 2011). Similarly in New Zealand, the older population is derived from mixing many ethnicities from the world. More than ten percent of population can be identified as more than one ethnic group which means the mixing of ethnicities and formation of biologically mixed population (Rocha, 2012). Pharmacokinetic action in a body can vary according to the different genotype of those different ethnic groups and also can change with age (Bart, Lenz, Straka, & Brundage, 2014). Therefore, some older people need different drug doses according to the above factors. Sometimes they may be sensitive to regular doses that contribute to side effects and drug toxicity (Alic et al., 2011). There is a lack of opportunity to measure pharmacokinetic and pharmacodynamic status among older New Zealanders related to polypharmacy. Because of that, polypharmacy related quality of life cannot be measured as a single factor.

2.10 Polypharmacy and death

A systematic review and meta-analysis undertaken by Leelakanok, Holcombe, Lund, Gu, and Schweizer (2017) showed the relationship between polypharmacy and rate of death. They analysed 47 research studies which were extracted from MEDLINE/PubMed, EMBASE, Scopus, and International Pharmaceutical Abstract up to 2016. Their inclusion criteria for their search was polypharmacy research articles which investigated polypharmacy and its impact on mortality. The articles that investigated considered five or more medications as polypharmacy and ten or more as hyper polypharmacy. There were 36 studies where the mean age was 65 or more as the study population and there were eight studies that had people who were younger than 65. One study did not mention the age limits of their population. According to the research outcomes, polypharmacy was related to the risk of mortality of older people. However, they concluded that the polypharmacy may not always impact on mortality because of unmeasured disease process. Many studies did not

consider mental illnesses as they did not carry out research related to mental diseases. The authors also concluded aspects such as mistakes that could occur in conceptualisation and measuring the multiple diseases, the precision of available data related to multiple diseases, various kinds of comorbidity index such as Charlson comorbidity index (CCI) (Sundararajan, 2004) can affect the correctness of the research adjustment, sources, and completeness (Leelakanok et al., 2017).

2.11 Drug disease and drug- drug interactions (DDI)

Dumbreck et al. (2015) carried out a study to investigate how many drug-disease and drug-drug interactions can be identified as chronic physical and mental condition within National Institute of Health and Care Excellence (NICE) clinical guidelines in the UK in 2015. They selected three guidelines that were common and significant to physical and mental health conditions such as heart failure, type two diabetes, and depression, and also considered nine potential multiple disease conditions: osteoarthritis, chronic obstructive pulmonary disease (COPD), hypertension, secondary prevention after myocardial infarction, dementia, rheumatoid arthritis, chronic kidney disease, atrial fibrillation, and neuropathic pain. These 12 guidelines were assessed by a panel of three medical staff: a general practitioner and two pharmacists, and they reviewed the recommendations for commencing chronic drug treatments. Researchers defined their medication treatments as first line and second line. The medications recommended for all patients with a specific disease conditions were known as first line treatment and the recommendation of medications for some special reason regardless of first line medications were known as second line medications. They discovered that there were 32 drug-disease interactions related to chronic kidney disease and twenty seven of them belonged to the clinical guideline for type two diabetes. There were six and ten drug-disease interactions which belonged to the guidelines for depression and heart failure. It is significant that there was 133 drugs pairs that showed severe drug-drug interactions and 25 of them were related to type two diabetes guidelines. Of those 25 drugs which belonged to the first line drug treatment group and nine medications that belong to the diabetic guidline did not showed any drug-drug interactions. There were 111 harmful drug-drug interactions which showed up among drugs used for cardiovascular diseases and twenty one pairs of them belonged to first line treatment. There were 89 drug interaction pairs in depression guidelines. The most serious drug-drug interactions include: serotonin reuptake inhibitors, antidepressants, and non-steroidal anti-inflammatory drugs. Medication such as aspirin can develop the risk of bleeding, lithium and digoxin can increase the risk of toxicity, and myopathy can occur with statins (Dumbreck et al., 2015). According to Guthrie, Makubate, Hernandez-Santiago, and Dreischulte, (2015) the medications related to heart diseases, central nervous system, gastrointestinal, and endocrine drugs have increased considerably from 1995 to 2010 by contributing

to polypharmacy among adults in the UK and drug groups which belong to cardiovascular, central nervous and musculoskeletal systems highly contribute to DDI (Guthrie et al., 2015).

2.12 Multimorbidity and health related quality of life

Mujica-Mota et al. (2015) conducted a study to investigate the relationship between multimorbidity and the HRQoL in England. They extracted data from the English General Practice Patient Survey which was implemented as an annual postal survey to identify their experience with primary care and was conducted between 2011 and 2012. They sent their questionnaire in two waves: 1.4 million in July 2011 and 1.36 million in January 2012. They asked the respondents about multimorbidity which they defined as having two or more conditions according to their list of 12 most common conditions or unspecified conditions that respondents had within the last five years. They integrated their survey with EuroQoL-5 dimensions (EQ-5D) which contained five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression, and three levels of ordinal scales: no problems, moderate problems, and severe problems. Age was categorised as 18–24 years, 25–84 in 10-year bands, and 85 and older for the analysis purpose. They analysed data of 831,537 responses from patients aged 18 years or older in 8254 primary care practices. The researchers found that multi-morbidity was stated by 23 % of all respondents, 7 % of these under 45 years of age and 51 % were 65 years and older. Most of the participants with multimorbidity were females. The researchers found that having multimorbidity was related to less reduction in HRQoL among older people. The authors stated that the lower association between multimorbidity and HRQoL among older people might be due to the absence of long- term condition, lower expectations in health and the ability to adapt to the novel life -style changes as a result of negative outcomes of diseases. Some certain conditions such as diabetes and arthritis were contributed to the reduction of HRQoL.

Another similar study which was conducted by Brettschneider et al. (2013) to investigate the relationship between multimorbidity and HRQoL among older people in Germany. They conducted their study as a part of another study,namely the MultiCare Cohort Study. This study was implemented by randomly selecting primary care patients who suffered from multi morbidities from databases belonging to 158 general practitioners, and this study investigated the patterns of multi morbidities over time. Researchers measured the HRQoL by using EQ-5D and the EQ-5D Visual Analogue Scale (EQ-VAS). EQ-VAS was ranged between 0 and 100. Zero represented the worst imaginable health state and 100 represented the best imaginable health state. They considered 3,189 participants who were aged between 65 and 85 who had given informed consent. The researchers conducted interviews for 16 months. They defined multimorbidity as having a minimum of three disease conditions according to their list of 29. They also collected data related to demographic factors such as incomes and level

of education. The mean age of the population was 74.4 and more than half of the participants were female. Participants had a mean of 7.0 for chronic diseases conditions. Researchers found that greater morbidity was associated with reduced HRQoL and higher age was also linked with the reduced HRQoL because of the difficulties in mobility, and daily activities. Females participants were more prone to face some difficulties in performing daily activities and suffered from more pain and anxiety compared to males. They discovered that the different diseases such as Parkinson's disease, rheumatism, depression, cardiovascular diseases and obesity and the disease severity affects HRQoL differently. They also discovered that low social support can reduce the HRQoL dimentions of those suffering from multi morbidities (Brettschneider et al., 2013).

These two studies showed how multi morbidities affect the HRQoL of both young and older people. Regardless of whether the disease contributed to the reduction of HRQoL or not, however, polypharmacy is required on a long -term basis. However, multiple disease conditions need multiple medications which contributed to adverse effects with a high drug burden (MOH, 2020). Although researchers did not pay attention about medication usage or their side effects, the studies explored that all diseases did not affect the reduction of HRQoL. Most of the elderly people in New Zealand suffer from diseases such as diabetis, cardiovascular system related diseases, and arthritis that can reduce the HRQoL regardless of polypharmacy (MOH, 2020). Acccording to Brettschneider et al. (2013), social support services can contribute to shape the perception related to HRQoL. In New Zealand, older people can have various support services after having an assessment with a health care professional. A trained health care professionals asesses the difficulties of performing activities due to various disabilities and provides home care support or refers to a elderly care home (MOH, 2011). Therefore, the responses for the medication related QoL can also be dependant on the quality of social services that they receive in New Zealand.

When it comes to the analysis of the outcomes of national and international research, polypharmacy negatively and positively effects the elderly population. Although polypharmacy has been broadly investigated, few researchers have studied the probable relationship of polypharmacy with health-related quality of life (Henderson, Buchwald, & Manson, 2006). The quality of life cannot be measured as a single factor and can be influenced by many factors such as socio-economics, and medication errors (Montiel-Luque et al., 2017), and low education is associated with an increase in the number of medication used (Henderson et al., 2006).   According to Tegegn et al. (2019), and Montiel-Luque, et al. (2017), the female population is more prone to have the impact of polypharmacy and reduced QoL. Other studies showed that the DBI was comparatively higher among women in New Zealand and it was more prevalent among Māori. In New Zealand, although the PIM trend is increasing among the

Māori population, they have fewer drug prescriptions compared to the European population (Bala et al., 2018). Although, polypharmacy was most prevalent among Māori than Europeans, Māori participation was low in their studies (Tordoff et al., 2010). According to Tordoff et al. (2010), older people used over-the- counter medication in New Zealand. This means that there are also non-prescribed medications that contribute to polypharmacy. Tordoff et al focussed on collecting data related to non-prescribed medications and herbal medications which are popular among the older Māori population. Olsson et al. (2012) excluded the older people who suffer from dementia. Dementia is one of the adverse outcomes of polypharmacy and the rate of people with dementia is on an increase not only in New Zealand, but also worldwide.

Chapter 3: Research Design and Methodology

3.1 Introduction

This chapter discusses the method and methodology and the research design which was chosen to collect data related to the quality of life of older people who use polypharmacy in New Zealand. Although, there were numerous overseas studies related to polypharmacy and quality of life, there were only a few studies in New Zealand related to the same topic to date. Therefore, this study relied on the comparison of overseas studies to learn how New Zealanders who use polypharmacy for multiple diseases perceive their quality of life.

3.2 Research design

After analysis of previous studies which were conducted to investigate the HRQoL and related studies, research was designed to investigate the polypharmacy related QoL. As this research needed a large elderly population who were difficult to recruit through face- to-face interviews and due to the time constraint and the research topic also addresses the medication- related quality of life, it was hard to reach most of the population because of privacy issues. Therefore, this survey was conducted anonymously in order to recruit a large population online and to collect reliable data for the study. Most of the researches related to the QoL with large populations implemented survey methods as this method was suitable to assess attitudes of older population with a validated set of questions that can perform statistical analysis to interpret data meaningfully and compare with other studies that used the same method. This research was analysed using mainly descriptive methods and used Snowball sampling survey method to collect data.

3.3 Quantatative method

Quantitative methods can be used to analyse relationship between variables, examine the hypothesis, and identify the number of observations (Hoe & Hoare, 2012). This study was mainly designed with quantitative methods which was a philosophical approach used to explore causes, interactions, and how they are correlated and impact on the outcomes. Quantitative studies provide unbiased analysis and interpretation for a specific problem as well as provide a precise method to collect data (Gillespie, 2013). To implement a quantitative research, a researcher needs a broad knowledge related to various statistical methods and procedures and needs specific knowledge of terminology and principles which are based on probability theory (Lewin, 2005).

Surveys include the preparation of a questionnaire for survey, and interviews, learning to analyse responses from participants and responses by using statistical methods (Nardi, 2018). Many statistical methods can be used as tools and methods to understand and present data. Statistics is very important when gathering data from a large population and to compare and conclude the findings (Lewin, 2005). Quantitative research method are used in clinical and biomedical researches and used for a large sample size to implement randomised control trials (Meadows, 2003). This method was therefore, suitable to implement research related to medication related QoL. The quantitative study can be used in the investigation of the relationship between particular variables and can use for studies with small sample size and for large sample size (Meadows, 2003). Statistical methods consist of hypothesis testing, reliability and validity, enumeration, and statistical inference (Meadows, 2003). This method comprises experiments and surveys and standardized methods such as questionnaire and structured interviews are used to collect data. Non-experimental studies which contain a questionnaire, an interview or, a scale or test are suitable for health-related quality of life studies. One advantage of collecting data in a numerical format is that it allows researchers to make generalised statistical results. Quantitative method are used to collect data which can be used to investigate a hypothesis or can be used to interpret ideas from the collected data (Meadows, 2003). This method can be used to analyse data of different variables that are pre-specified such as age, gender, and diseases (Meadows, 2003).

3.4 Hypothesis and null hypothesis

After reviewing both national and international literature, the hypothesis was that the polypharmacy impacted negatively for the elderly people. Therefore, this study was conducted to find out to what extent the findings might support the hypothesis. On the other hand, a null hypothesis used to show that there was no relationship between particular variables (Frick, 1996).

3.5 Descriptive statistics

Descriptive statistics were initially used to analyse the collected data and to calculate the central tendency, distribution of variables, and frequencies and the percentages were calculated for participants' responses of each likert scale questions. These data were summarised by drawing graphs and charts. Bar charts were created for three domains by using the percentages of strongly agree, agree, neutral, disagree and strongly disagree. It can reflect the response percentages for each question and how the percentage of each question contributed to interpret the HRQoL. However, this type of analysis could not be used to make a conclusion of the hypothesis. The measuring of central tendency (mean and median) is the most common type of descriptive statistics which can be used in research, mathematics and quality improvement studies (Conner, 2017). Therefore, mean and median

were calculated. The mean was used to interpret the average age. The median was used to interpret the middle age and the middle value responses for the Visual Analogue Scale (VAS).

3.6 Cross sectional survey

Cross-sectional surveys can be implemented to identify the occurrence of diseases or diagnosis and related risk factors or other causes which occur in a particular period (Hoe & Hoare, 2012) and this method was suitable to address the impact of polypharmacy related problems which affect the HRQoL.

Surveys have a fixed set of questions and they are most appropriate to investigate the weighting applied to a particular issue according to participants feelings and opinions (Harrell & Bradley, 2009). A questionnaire is a standard way for researchers to collect data from participants during an organised interview or the participants may complete the survey questions by themselves (Lewin, 2005). Questionnaires can be used among population who can read and to evaluate attitudes and opinions (Nardi, 2018). The questionnaire needs to be easy to increase the respondent rate. The questionnaire should be validated before using and needs to reliably collect appropriate data (Lewin, 2005). Surveys are most commonly used when needed to recruit a large number of participants (Kelley, Clark, Brown, & Sitzia, 2003; Nardi, 2018) who are interested in the particular issue (Kelley et al., 2003). The advantage of a survey is that this method is quick, time-saving, and easy for the participants to respond to. The researchers can clearly identify the extent of agreement and disagreement between the participants. However, one of the drawbacks of a survey is that the numerical form of data cannot be analysed when it comes to a person's characteristics. That is their identities, beliefs, and perceptions which can be difficult to quantify (Choy, 2014). Another disadvantage is that a large study population is needed to effectively conduct a study (Choy, 2014).

3.7 The questionnaire for elderly population

A validated questionnaire was used to get answers related to the quality of life. Krska et al. (2014) designed the Living with Medicines Questionnaire version 3 (LMQ3) with a Likert-type scale consisting of 41 questions with eight domains which are considered to be valid to get answers for medication-related burden. The eight domains are lack of effectiveness, side effects, practical difficulties, interferences with day-to-day life, communication problems with health care professionals, general concerns, cost of burden, and lack of autonomy (Katusiime, Corlett, & Krska, 2018). This questionnaire met all the aspects of quality of life because this valid questionnaire was tested against EuroQoL 5-level quality of life measure (EQ-5D-5L), and Treatment Satisfaction Questionnaire with Medication (TSQM-II)(Katusiime, Corlett, Reeve, & Krska, 2016). EQ-5D-5L has five domains: mobility, selfcare,

usual activities, pain/discomfort, and anxiety/depression. Those domains have five degrees of problems: no problems, slight problems, moderate problems, severe problems, and extreme problems. Visual Analogue Scale (VAS) was used in LMQ3 questionnaire to measure the medication burden in a ten-point standard scale**.** The EuroQoL research group has members from Australia, North America, Asia, Africa, and New Zealand who have tested this survey worldwide.

For this research project, 19 questions which directly reflect drug burden and quality of life have been selected, because the elderly participants may miss some questions when they start to fill out a long questionnaire and therefore, the time to complete the questionnaire needed to be limited. These 19 questions were categorised into three groups: the quality of life related questions, the positive aspects of polypharmacy, and the negative aspects of polypharmacy. The VAS was also considered for this survey to measure the medication burden experienced by elderly people. While in the implementation of SF 36 health survey questionnaire among elderly population in the UK, Hayes, Morris, Wolfe, and Morgan (1995) found that older people who are 75 or older could miss at least one of items of the questionnaire when they fill the form by themselves**.** Furthermore, they noticed many older people who have visual impairment could overcome this problem by getting assistance from another person (Hayes et al., 1995). Therefore, the older participants of this research were allowed to get another person's assistance when they have visual or physical impairment. Apart from this questionnaire, the information regarding the list of medications that were used for their diseases and the demographic data such as age, ethnicity, and postal codes were also collected. When the participants did not know the genre of medications, they could write the names of the disease condition. The regions related to the mentioned postal codes were analysed by using the website called Postcode Directory. This website provides information related to postal codes and addresses in New Zealand (''Postcode Directory,'' 2020). Furthermore, participants needed to write whether the medications were prescribed or over-the-counter medications.

3.8 Identifying medication classifications

After the elderly people mentioned the name of the medications that they have been using, the medications needed to be classified into groups to make it easy to analyse. British National Formula 68 (BNF) was used to identify the classes of medications. The British Medical Association and the Royal Pharmaceutical Society published the BNF under the authority of the Joint Formula Committee (Joint Formula Committee, 2014). The Joint Formula Committee has representative bodies called the UK Health Departments, the Medicines and Healthcare products Regulatory Agency, and a national guideline producer. BNF provides up to date information for prescribers, and other health care professionals related to the usage of medications. It includes selecting, prescribing, dispensing, and

administration of medicines. BNF was validated by the expert clinical writers after reviewing literature critically in various databases such as Cochrane Library and other web-based sources (Joint Formula Committee, 2014).

3.9 Reliability and validity

Reliability means having the same outcomes when implementing the same assessment or measures several times. Validity means the collection of data to answer the research question is accurate rather than considering measurements that produce reliable outcomes (Lewin, 2005). A survey is not valid, if it does not measure the concept which the researcher wanted. The validity depends on the reliability of the data and it can be threatened by the statistical methods that are chosen for the study (Lewin, 2005).

3.10 Likert scale

This research was conducted by using a five-point scale questionnaire called a Likert scale. Older people could select responses which would be the best answer option that they could provide. In 1932, Likert found a technique to measure attitudinal scale as it was very difficult to analyse characters and personal qualities. At the time it was invented, Likert used an array of questions with five responses: strongly approve, approve, undecided, disapprove, and strongly disapprove. He calculated the total score which was used as the base of data analysis for the list of questions that he used to create an attitudinal scale, and he combined the responses from the questionnaire rather than analysing them as an individual item (Boone & Boone, 2012). Although some researchers believe that a seven point Likert-scale can achieve maximum reliability when there are unfluctuating responses, some researchers have stated that increasing the scale from three to five can increase the internal reliability and extra discriminating power (Croasmun & Ostrom, 2011).

3.11 Visual Analogue Scale (VAS)

Visual Analogue scale (VAS) is a psychometric measuring instrument which is used to measure the severity of disease-related symptoms and to observe the development of a particular prolonged disease condition or the effectiveness of a treatment (Klimek et al., 2017). VAS is simple to understand and measure the strength of pain or emotional responses which lie on a range (Price, McGrath, Rafii, & Buckingham, 1983). VAS is not only used to measure pain, but also to measure different subjective

experiences such as anxiety and quality of life (Briggs & Closs, 1999). In this research, participants were able to show the level of their medication related burden within a one to ten-ranged scale VAS. At the beginning of the scale, there is a picture which shows an emotional response of no burden at all, medium burden is five or six, and an extreme burden emotional response lies at the end of the scale at ten.

3.12 Sampling theory

Sampling means the selection of a particular group of people, events, behaviour, or other element to conduct research, and the sample can generalise and can give meaning for the findings. Sampling criteria also refers to the eligibility criteria. This includes a number of characteristics which are needed to be eligible for the study. Inclusion sampling criteria means the subject (person) or element (the individual unit of the population and sample) that have the characteristics of inclusion criteria. The target population was the community-dwelling older adults (65 or over) who live in New Zealand. The sample size was 100 older people of both sexes. Moreover, those older people needed to use five or more medications for at least six months and use drugs with or without prescriptions. Exclusion criteria means the characteristics which do not possess the inclusion criteria (Burns, & Grove, 2009). The exclusion criteria for this research was people who were younger than 65.

3.13 Snowball sampling method

Snowball sampling is a popular method which is used in the field of studies such as sociology and psychology, and this method is used to recruit hard to reach populations. For example, the people with rare diseases, drug-addicted youngsters, and illegal immigrants. These people are usually reluctant to express their ideas openly. Therefore, snowball sampling is suitable to study their attitudes, behaviour, and perception which cannot be generalised to the whole population (Dragan & Isaic-Maniu, 2013). This method is a referral sampling method which recruits the study population by identifying potential subjects in the population and requesting them to forward the questionnaire to the people that are known to be suitable for the study, for example, family members and associates (Bagheri, & Saadati, 2015). The study population may grow like a rolling snowball. The snowballing method starts by using both a probability and non-probability method to recruit the initial sample. After that, secondary participants are to be recruited through the initial sample and this continues as a non -probability method (Acharya, Prakash, Saxena, & Nigam, 2013). Non-probability sampling can

be seen as a deviation from the probability method because it includes recruiting samples that do not totally represent the target population; however, they hold some characteristic of the target population (Meadows, 2003). This method is useful to recruit participants who would voluntarily decide to participate in the study and this sample was convenient as there was no need to invite people individually to participate in the study. When the invitation was posted on social media, participants had many chances to see the invitation (Vehovar, Toepoel, & Steinmetz, 2016). In a non-probability method, the target population is not guaranteed an equal chance as this method uses a non-systematic method to reach the population (Elfil & Negida, 2017). In a probability method, all individuals in a target population can have an equal chance to be selected for the study (Elfil & Negida, 2017). This method contains two ways of recruiting participants: identifying potential subjects in the population and requesting them to forward the questionnaire to the people that they are known to be suitable for the study (Bagheri, & Saadati, 2015).

3.14 Web-based survey

Conducting surveys online is popular nowadays and researchers send their questionnaires to target populations through emails or placing their survey links on popular websites, creating websites themselves or hiring survey sites such as survey monkey. Although, web-based surveys can target large populations, limited access to computers and differences of computer owners such as ethnicity, age, sex, level of education, and economic background can affect the results of the survey (Nardi, 2018). A web-based survey is advantageous when collecting data from the population which is hidden or difficult to access and the data can be accurate and genuine compared to the data collected by face-to-face interviews (Miller, Johnston, Dunn, Fry, & Degenhardt, 2010). The elderly people who were highly concerned about their privacy and dignity related to their disease conditions may hesitate to participate in this study, if it was conducted as a face-to-face survey. Therefore, this survey was conducted through an online snowball method.

In order to increase the response rate and the quality of data, it is necessary to build trust with the respondents. Therefore, the researcher needs to provide an information sheet which includes the purpose of the study, respondents selection criteria, who can use the data and how it will be used (Buchanan & Hvizdak, 2009). The participants can give their informed consent to participate with the study after reading the information sheet which is provided with the questionnaire. Although, the elderly people in New Zealand use computers to communicate with their friends or search about their disease conditions, their interest to use a computer can decline when they get older (from 77-87) and

they may need modifications in computers due to physical disabilities and the lack of knowledge related to computers (Dhillon, Ramos, Wünsche, & Lutteroth, 2011). As my target population was 65 or over, there were few participants who completed the web-based questionnaire. However, a hard copy of the survey was sent to the older people who requested it because they were not familiar with internet usage or filling online surveys.

3.15 Ethical consideration

After deciding the research topic and designing the research plan, it is essential to decide who or what is being studied and whether humans are involved in the study. There is need to get ethical approval prior to the data collection (Nardi, 2018). A research can be beneficial for both researchers and participants when the findings can be useful for a particular group of the population, however, participants may have some issues such as the invasion of their privacy or mental and physical harm (Nardi, 2018). Privacy means a person's right to decide which information should be shared and it depends on the time, extent, and the situation (Burns & Grove, 2009). Therefore, various ethical considerations which are related to planned research and the study population were identified prior to applying for ethical approval. Many professionals and academics conduct their research according to their institutional code of ethics to collect data (Nardi, 2018). The application to grant ethical approval was submitted to the Eastern Institute of Technology (EIT). The Institutional Review Boards (IRB) in institutions evaluate research proposals to find out whether the research follows the code of ethics. Prior to the collection of data, the link to the information sheet which included the nature of the survey and the purpose of the survey was distributed to the questionnaire to get informed consent. Having informed consent is necessary, when participants can decide to what extend they may lose privacy when they participate in a survey and they can refuse the participation (Nardi, 2018). Before, starting the survey, participants can give their consent after reading the information sheet via a link provided in the google Doc questionnaire. Ethical approval was obtained from the Eastern Institute of Technology Research Ethics Committee. This study was conducted among all ethnicities in New Zealand.

3.16 Anonymity

This research was conducted anonymously online (Google doc) and any elderly person can participate voluntarily in the survey or decline. Anonymity can decrease the social anxiety, and social desirability, and increase the self-esteem of a person (Joinson, 1999). Some researchers state that anonymity can increase the response rate while some other researchers found that this is not always the case. Researchers need to convey to the email-survey participants that the email address will not be recorded in the system and only the data will be recorded. Researchers can assure the respondents' confidentiality (Heckathorn, 2011). When participants complete a hard copy of the survey, they could request for a hard copy with a stamped envelope. The collected data was kept confidentially in Google Doc.

3.17 Handling of missing data

Missing data can be seen in medical research and it has been found to be a common problem experienced on a long-term basis among researchers (Allison, 2010) and common in research involving older people (Kaambwa, Bryan, & Billingham, 2012). Missing data can contribute to biased parameters which can produce invalid results (Fox-Wasylyshyn & El-Masri, 2005). There are three ways of having missing data in a study: missing completely at random (MCAR); missing at random (MAR); and missing not at random (MNAR) (Jakobsen, Gluud, Wetterslev, & Winkel, 2017). MCAR means there is no association between missing of the data, and any values or observed data and no effect can happen for the results from missing some data. MAR means a systematic association between the tendency of missing values and observed data (Jakobsen et al., 2017). MNAR means there is an association between missing values and the tendency of a value to be missing. When data collecting involves a self-reported measure, data can be missing at the item level or variable level such as age or gender (Fox-Wasylyshyn & El-Masri, 2005). When analysing the data, the missing data which was under 5% can be ignored and can also be ignored when the study involves very sick or very ill participants. (Jakobsen et al., 2017). When there is a large amount of missing data (more than 40%) found in an important variable, then the results can be considered as only hypothesis generating and there is a need to discuss the missing data as a limitation of the results. Missing data can be excluded for the analysis, however, when the situation is MCAR, statistical power can be reduced due to the lower sample size (Jakobsen et al., 2017).

Chapter 4: Data Analysis

4.1   Introduction

This chapter discusses the survey findings. All the data were collected through an online survey. Four participants who asked for hard copies of the survey did not return. Demographic data such as gender, ethnicity, and age were considered, but demographic data such as socio-economic status, and education level were not considered for this survey. The participants were asked to write their medication list and medications were categorised according to their class. Participants were asked to mention the postal code to show the region they lived in. There were 34 participants who responded via the online survey, but one female person was under 65 and one participant did not complete the questionnaire. There were four participants who seemed to be fake. Four respondents filled the questionnaire at the same date and the same time period and mentioned the postal code related to the same region. One of the postal codes did not exist and there were some similarities in the responses for the questionnaire. VAS responses were different from Likert scale questions. Therefore, they were not included, and 28 participants were considered for this study. Some of the participants missed some questions: age 10%(n=3), postal code 3%(n=1), total number of medications 3% (n=1), medication list 21% (n=6), and responding to the Likert scale question 7%(n=2). Despite this, all participants responses were considered for the study. In order to analyse the results, 19 questions were categorised into three domains: aspects of quality of life, positive aspect of polypharmacy, and negative aspects of polypharmacy. The sum value of strongly agree and agree as well as the sum value of strongly disagree and disagree were considered to analyse the data. Individual neutral response values were also considered for the analysis.

4.2   Demographic data

Sixty seven percent 67% (n=19) of the females and were 33% (n=09) of males participated in this study. According to New Zealand Postcode Directory in 2020, most of the respondents were from the Hawkes Bay region (n=18) and Auckland (n=5). Fewer participants were from the Bay of Plenty (n=2), Canterbury (n=1) and Otago (n=1).

4.3 Ethnicity

The majority of the respondents were NZ European 53.57% (n=15), and 21.4% (n=6) were Asians, 10.7% (n=3) were Māori, 3.5% (n=1) were Pacifica, 7.1% (n=2) were New Zealanders and 3.5% (n=1) were Dutch. See Table 1.

Table 1
Ethnicity Distribution

Ethnicity	Percentage of respondence	Number of respondence
NZ European	53.57%	15
Māori	10.7%	3
Pacifica	3.5%	1
Asian	21.4%	6
New Zealanders	7.1%	2
Dutch	3.5%	1
Total	100%	28

4.4   Age distribution

The second question was related to age distribution of elderly participants. The majority of the participants were aged between 65 and 74. Their mean age was 71.33, and median age was 69. See Table 2.

Table 2

Age Distribution

Age groups	Percentages of age	Number of participants
65-74	75%	18
75-84	20.83%	5
85 or over	4.17%	1
Total	100	24

Mean age = 71.33

Median age = 69

4.5 Medication related data

4.5.1 Number of medications used per day

Apart from the demographic data, the data was collected relating to the number of different medications that elderly people used per day. Most of the participants used five or six different medications per day. See Table 3

Table 3

Number of medication usage

The number of medications used per day	Percentage of participants	Number of participants (N)
5	35.71%	10
6	32.14%	9
7	7.14%	2
8	7.14%	2
9	3.57%	1
10	3.57%	1
12	7.14%	2
13	3.57%	1

4.5.2 Frequency of medications

The fifth question was the frequency of medication usage of older people. Most of the participants used medications twice per day. See Table 4

Table 4

Frequency of medications

Frequency of medication usage	Percentage of participants	Number of participants (N)
Once	27.3%	9
Twice	48.5%	15
Three times	15.2%	3
More than three times	9.1%	1
Other (once or twice	18.1%	6

4.6   Analysis of Likert scale questions

4.6.1 Quality of life related questions

When analysing the questions related to the quality of life, 64.27% (n=18) of participants disagreed or strongly disagreed that the medications interfered with leisure or social activities. There were more than half of the participants (n=15, 53.57%) who stated that the side effects gained from taking medication did not affect their day-to-day living. The majority of the participants (n=16, 57.13%) strongly disagreed or disagreed that medication could affect driving, and more than half of the participants (n=17, 60.71%) strongly agreed or agreed that medications allowed them to live their lives as they wanted. More than half of the participants (n=17, 60.71%) disagreed that medication affects their social relationships. More than two thirds of participants (n=20, 71.42%) disagreed or strongly disagreed that taking medication affects their daily tasks. More than half of the participants (n=15, 53.55%) disagreed that the side effects they experienced from medications adversely affected their wellbeing. See figure 1.
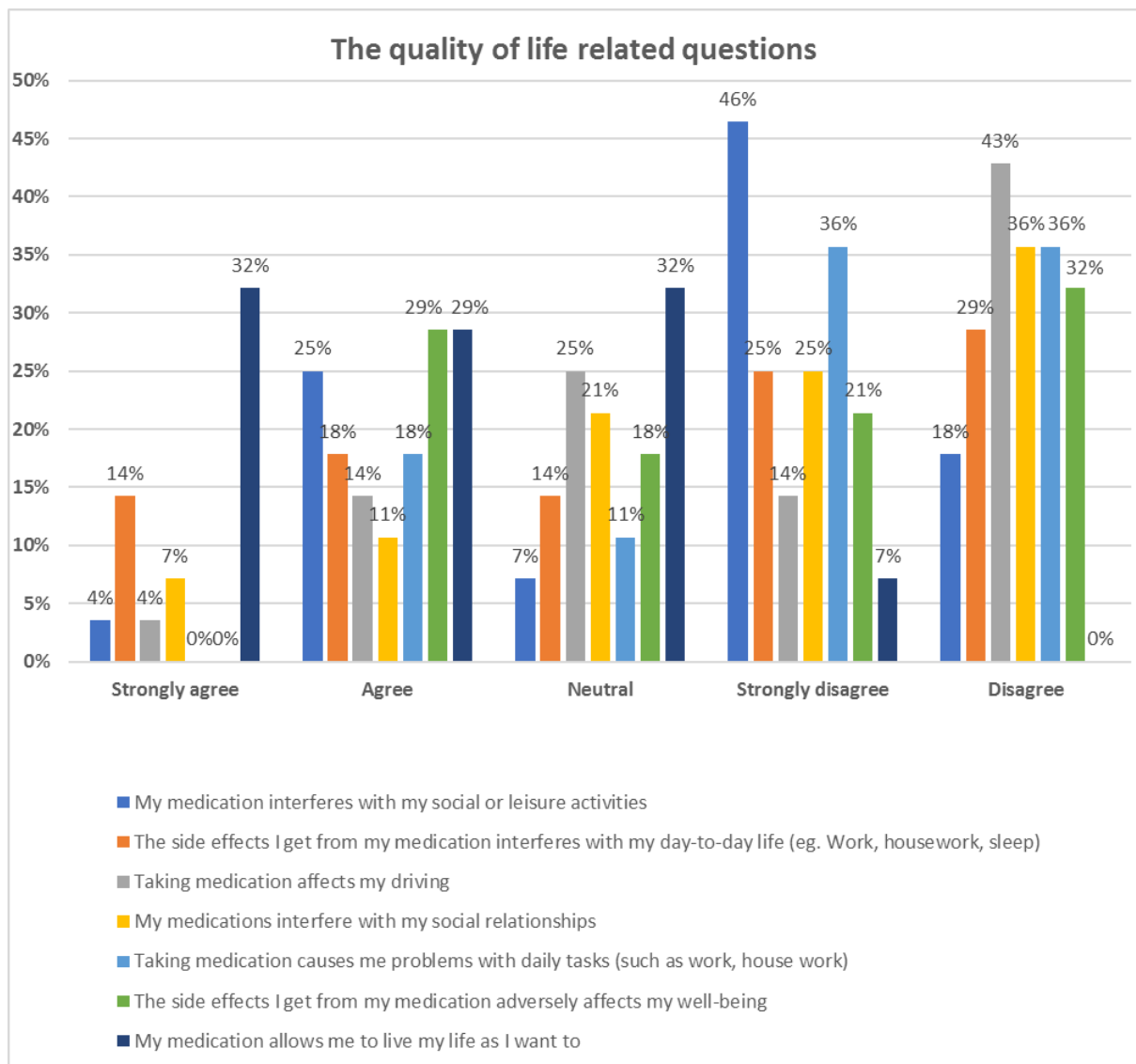
Figure 1. Quality of life related questions

When analysing the responses to the positive aspects of polypharmacy related questions, a significant number of participants had positive attitudes to having polypharmacy. There were 64.21% (*n*=18) of the participants who were satisfied with the effectiveness of their medications and more than half of the participants (*n*=17, 59.71%) thought that their medication prevented their condition from getting worse. More than two thirds of the participants (*n*=21, 71.42%) believed that their medications were working and 57.13% (*n*=16) believed that side effects were outweighed by the benefits of the medication. There were 50% (*n*= 14) of the participants who believed that they relied on medications. More than one third of the participants (*n*= 11, 39.28%) found that their lives revolved around using medication. See Figure 2.
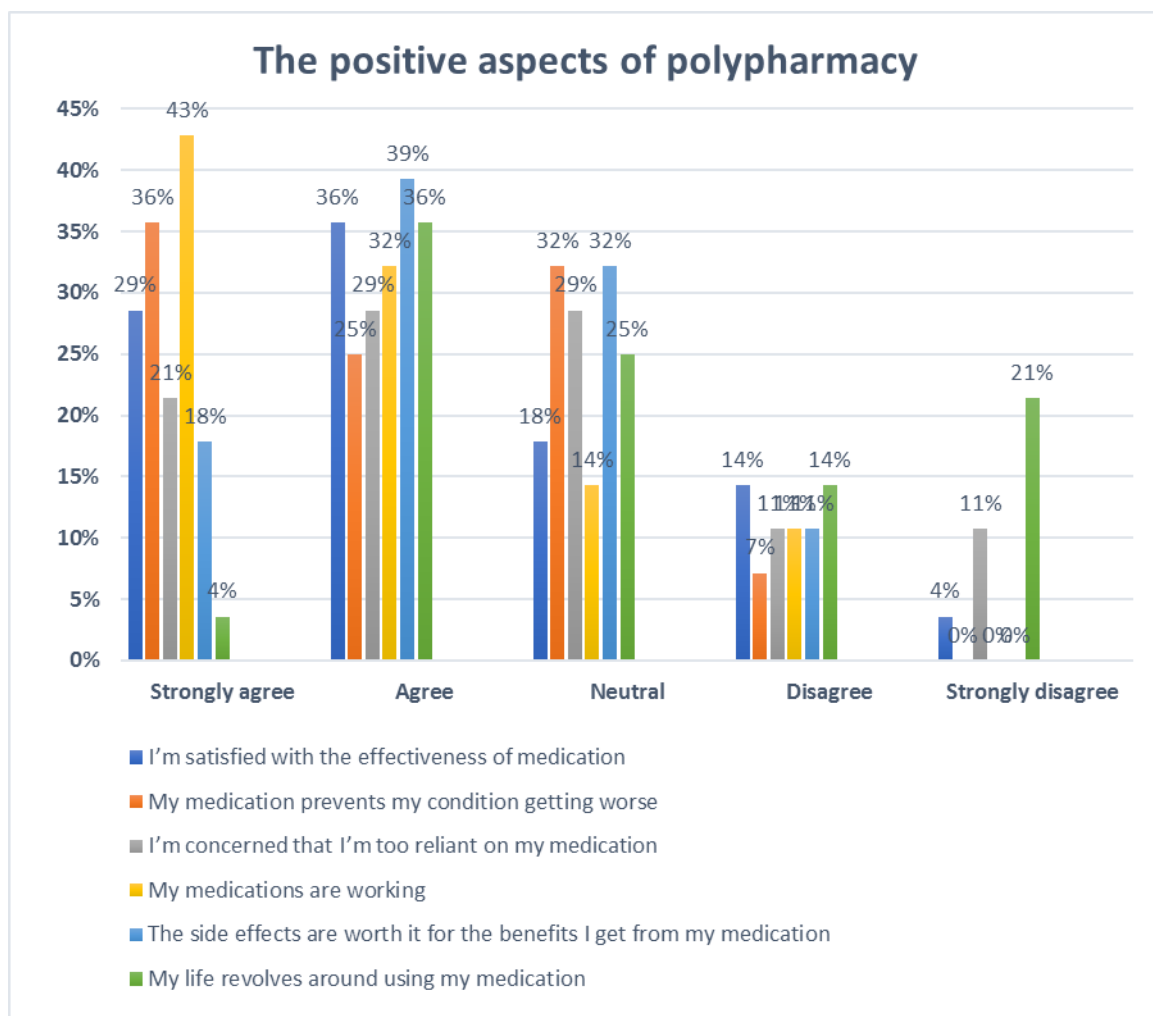

Figure 2. Positive aspects of polypharmacy

4.6.3 Negative aspects of polypharmacy

The majority of the participants (*n*= 15, 53.56%) were not concerned about taking several medications at the same time. There were 64.28% (*n*=18) of participants that did not feel that the medication-related side effects were bothersome and 35.71% (*n*=10) participants thought that medication can interact with alcohol. More than half of them (*n*=15, 53.55%) did not think that their medications may interact with each other. However, 57.14% (*n*=16) were concerned about the long-term damage that may result from polypharmacy. More than half of the respondents (*n*= 16, 57.14%) did not think the side effects were worse than their disease conditions for which they were treated. See Figure 3.
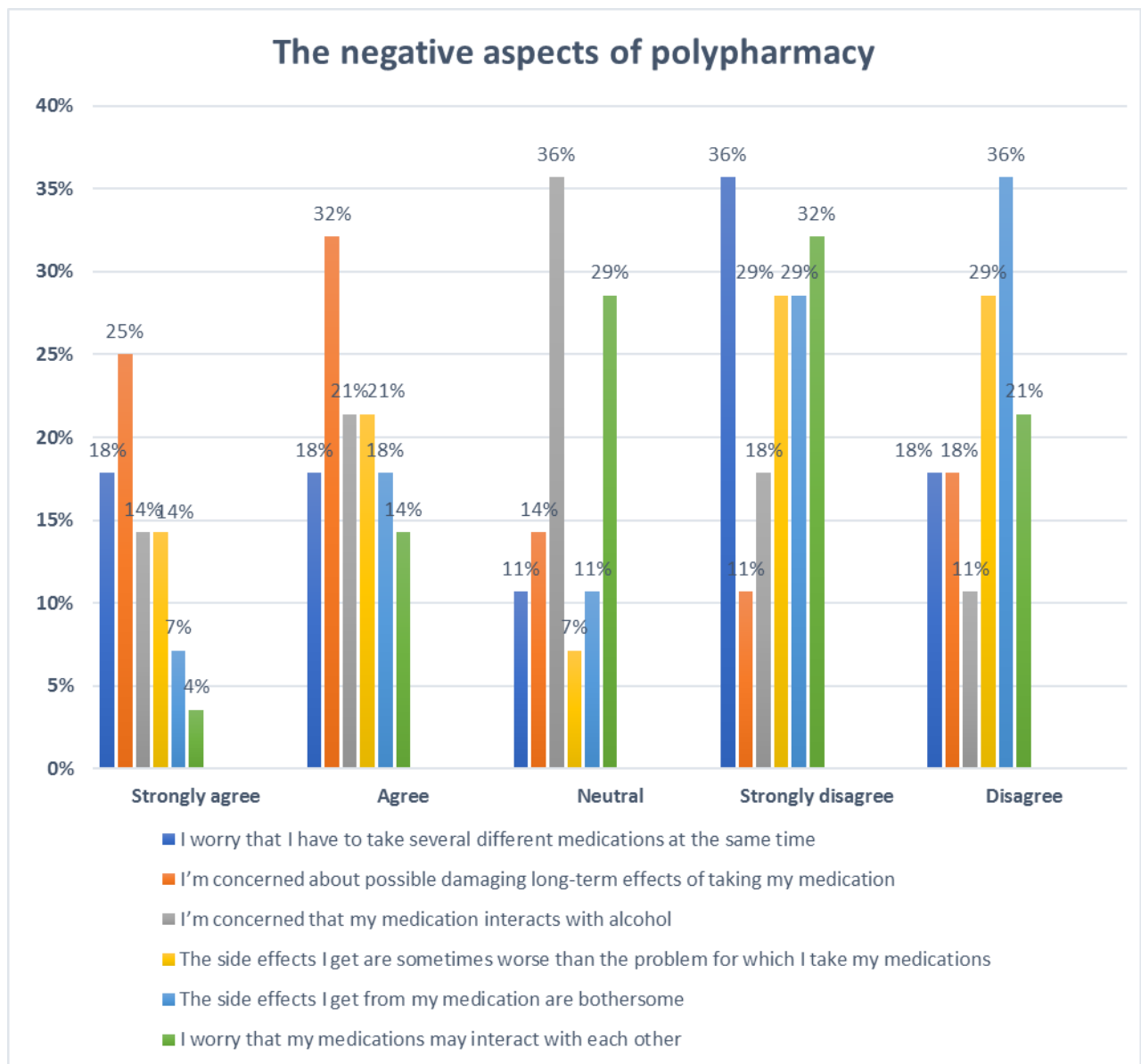

Figure 3. Negative aspects of polypharmacy

4.6.4 Analysis of Neutral responses

However, one third of respondents (*n*=9, 33.14%) held the neutral option for questions; ''my medication prevents my condition getting worse'', I'm concerned that I'm too reliant on my medication (*n*=8, 28.57%), I'm concerned that my medication interacts with alcohol (*n*=10, 35.71%) my medication allows me to live my life as I want to (*n*=9, 32.14%) and the side effects are worth it for the benefits I get from my medication (*n*=9, 32.14%).

4.6.5 Visual Analog Scales (VAS) analysis

In this study, VAS showed the overall opinion from one to eight and there was no one who marked nine and ten. There was seven (25%) who marked one to show no burden at all, five (17.85%) participants who marked two, three (10.71%) participants marked option three and four (14.28%) participants marked four while five (17.8%) marked five and six, three (10.71%) marked seven, and one (3.57%) marked eight which showed exceeding the medium level of drug burden. The mean of the medication burden was 3.375 and median was three. Therefore, older people had low medication related burden. See figure 7.
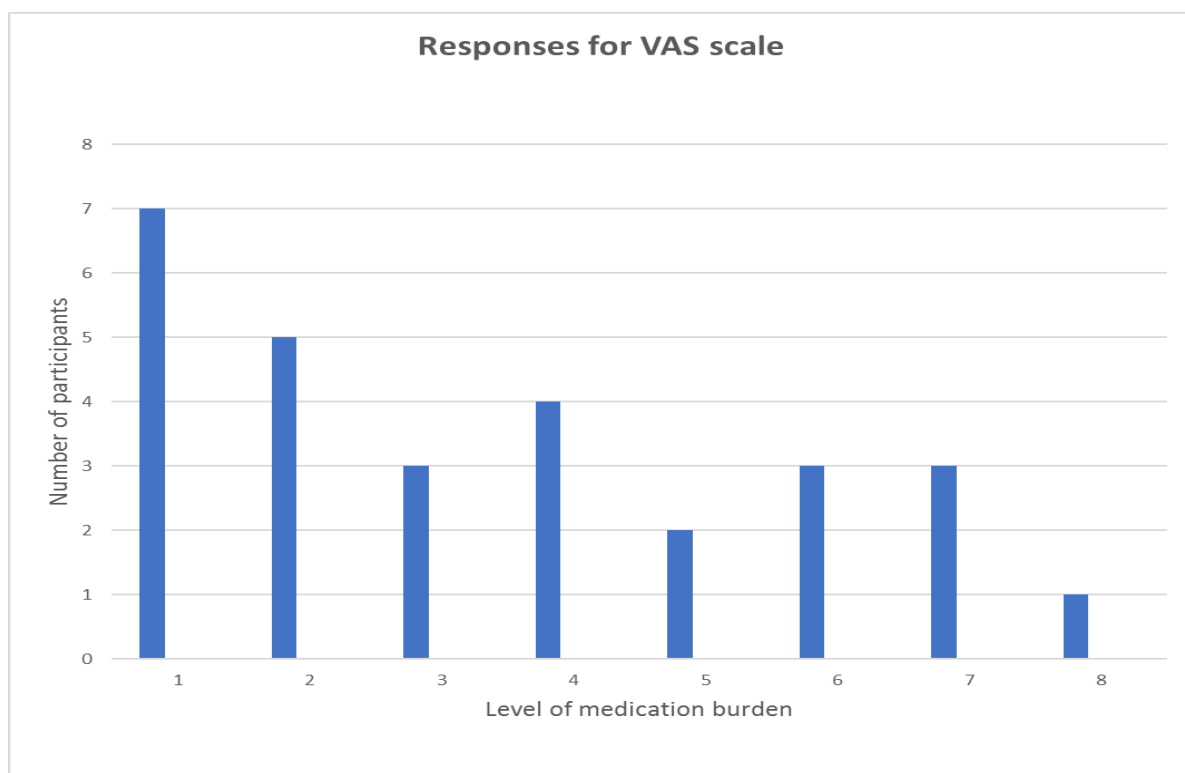

Figure 4. Visual analogue scale

Table 5

Statistical analysis for VAS

Title	Value
Mean	*3.375*
Medium	*3*
Minimum	*1*
Maximum	*8*
Range	*5*
Count	*28*

4.6.6 Analysis of data according to the gender

The analysis of polypharmacy related medication burden and the quality of life were considered separately between females and males. This was important because, female participants were known to have a poorer quality of life than males in relation to medication burden (Montiel-Luque et al., 2017; Silva et al., 2014; Tajvar et al., 2008). Also, female participation was usually considerably higher in national and international studies (Jamieson et al., 2018; Montiel-Luque et al., 2017; Tegegn et al., 2019).

4.6.7 Analysis of female responses and male responses related to quality of life questions

The majority of females (*n*=12, 63.15%) and 66.67% (*n*=6) of males agreed or strongly agreed with '' my medication allows me to live my life as I want,'' and nearly eighty percent (*n*=15) of females and 44.44% (*n*=4) of males strongly disagreed or disagreed with the question '' my medication interferes with my social or leisure activities,'' and same number of male participants agreed or strongly agreed with the above question.'' More than two third of females (*n*=15, 78.94%)) and more than a half of (55.56%, *n*=5) of male participants strongly disagreed or disagreed with '' taking medication causes me problems with daily tasks (such as work, house work).'' Also 68.42% (*n*=13) of females strongly disagreed or disagreed with ''my medications interfere with my social relationships'' while 44.44% (*n*=4) of the males held the neutral position. There were 77.78% (*n*=7) of male participants and 47.36%

(*n*=8) of female participants who disagree or strongly disagree with ''taking medication affects my driving'' while one third of female participants held the neutral position.

4.6.8 Analysis of female and male responses related to positive aspects of polypharmacy

There were 68.42% (N=13) of female participants and 77.78% (N=7) of male participants who agreed or strongly agreed with ''I'm satisfied with the effectiveness of medication'' as well as 68.42% (N=13) of females and 66.67% (N=6) of males agreed or strongly agreed with ''my medication prevents my condition getting worse.'' There were 68.42% (N=13) of females and 88.89% (N=8) of male participants who strongly agreed or disagreed with ''my medications are working.'' The majority of male participants (N=6, 66.67%) agreed or strongly agreed with ''the side effects are worth it for the benefits I get from my medication.'' However, 42.10% (N=8) of female participants held equal responses for strongly agree and disagree as well as the neutral position.

4.6.9 Analysis of female and male responses related to negative aspects of polypharmacy

There were 57.89% (*n*=11) of female participants and 66.67% (*n*=6) of male participants who strongly disagreed or disagreed with ''I worry that I have to take several different medications at the same time'' and 61.11% (*n*=11) of females and 55.56% (*n*=5) of males strongly disagreed or disagreed with '' I worry that my medications may interact with each other.'' There were 66.67% (*n*=12) of females and 63.63% (*n*=7) of males who strongly disagreed or disagreed that the side effects they get from their medication are bothersome. There were 57.89% (*n*=11) of females and 55.56% of males (*n*=5) who strongly disagreed or disagreed with'' the side effects I get are sometimes worse than the problem for which I take my medications.'' Nearly 58 % (*n*=11) of the females and 55.56% (*n*=5) of the male participants strongly agreed or agreed with '' I'm concerned about possible damaging long-term effects of taking my medication.''

4.7   The analysis of medications

 Not all medication contributes to adverse drug reactions (Dumbreck et al., 2015). An analysis of medications which have been mentioned by the participants might be advantageous to identify the most prevalent disease conditions and the most used drug groups among New Zealanders. According to the literature, prevalent medications relate to heart diseases, central nervous system,

gastrointestinal, and endocrine drugs in the UK (Guthrie et al., 2015) and many older people in New Zealand used anticholinergic and sedative medications which contributed to their drug burden (Nishtala et al., 2014). There were 22 participants who stated the medications that they used and there was one participant who mentioned the usage of over-the-counter medications. Ninety-four types of medications were listed, and four participants mentioned the disease condition rather than their medication. This means there would have been more than 94 types of medications classified into 43 drug classes. BNF was used to identify the group of drugs and to classified according to each drug classes. Twenty-two participants used drug classes related to cardiovascular system disorders. Pain medication was taken by thirteen participants, medication for diabetes was taken by seven, and seven participants took medication for insomnia. Five participants used sedative medications, and two participants used antipsychotic medications, but only one participant used clonazepam which belong to the benzodiazepine group. There was one participant who used herbal medications and there were three participants who used vitamins and supplements. There were three participants who used antidepressants. There was no medication used which belonged to the anticholeretic group which can cause significant adverse effects for the elderly in New Zealand.

4.8   Summary of the results

Of the participants 53.57 % were New Zealand European, 21.4 % were Asian, 10.7% were Māori, and 3.5% were Pacifica, and other ethnicities made up 10.6%. There was insufficient data to analyse the different ethnicities and the New Zealand European participants were the main contributors to the final results. Two thirds of participants of this study were females. According to the above data, most male and female participants were not worried about taking more than five different medications per day and they did not feel it was a burden at all. The responses of quality of life related questions showed that both male and female participants perceived that they had had a good quality of life. After analysis of both positive and negative aspects of polypharmacy related questions, many of them did not feel polypharmacy was a burden. The medication list which was provided by the participants showed that the majority of the participants used cardiovascular system related medications and all the participants used medications that belong to 43 drug classifications. The VAS showed that there was low burden related to medications. According to the definition of quality of life, these participants achieved a positive quality of life due to the minimum polypharmacy related burden they experienced.

Chapter 5: Discussion

5.1 Introduction

In this chapter, the survey findings are discussed and considered in relation to previous literature which has been carried out to investigate polypharmacy and quality of life, and medication related burden. The purpose of this study was to see how polypharmacy impacts on the quality of life among the older population in New Zealand. Few studies have been implemented to investigate the relationship between polypharmacy related quality of life (Montique et al., 2017) and there is a lack of research related to HRQoL and MRQoL to evaluate medication related quality of life (Tegegn et al., 2019). The quality of life can be evaluated by using various instruments and varied results may be partly due to these tools and diversity of the target population (Silva et al., 2014). In this study, the survey instrument was used to investigate the impact of polypharmacy on the quality of life. Though most of the worldwide literature showed that polypharmacy resulted in a negative impact on the HRQoL, polypharmacy can positively affect one's life too (Montique et al., 2017; Nishtala et al., 2014; Olsson et al., 2012; Tegegn et al., 2019). The results of this study did not support the hypothesis.

5.2 Quality of life related questions

By using the WHO definition for HRQoL, and the ADL and IADL scales, it can be seen that the participants experienced a positive HRQoL, even though they used polypharmacy to control diseases. Many participants perceived that they had a good ADL and IADL. Henderson et al. (2006) showed in their study a significant relationship between polypharmacy and the physical activity. In this study, the majority of the participants stated that taking medication did not affect their daily tasks or social relationships and the side effects of medication did not affect their wellbeing. Most of the participants did not believe that medication affected their driving and they believed that medication allowed them to live as they wanted. This means that the elderly people perception of quality of life mostly depends on the level of physical activities that they can be involved.

5.3 Positive aspects of polypharmacy

According to Nishtala et al. (2014), multiple medications may improve quality of life by reducing the disease progression and Olsson et al. (2012) showed that appropriate medication can increase the quality of life. However, for some polypharmacy was a problem. In this study, the majority of the participants were satisfied with the effectiveness of their medication as their medication was preventing their condition getting worse. Tordoff et al. (2010) found that many of the elderly people in Dunedin believed that having medications was a part of their life and they required them to control their disease symptoms. Most of them knew the reason for having medications and believed medications keep them alive.

5.4 Negative aspects of polypharmacy

Polypharmacy can be associated with the occurrence of frailty, depression, and falls (Rosted, et al., 2016) and some drug-drugs interactions related to the medications that are used for cardiovascular system related diseases (Tordoff et al., 2010), serotonin reuptake inhibitor, antidepressants and non-steroidal anti-inflammatory drugs can be more harmful than others (Dumbreck et al., 2015). In this study, cardiovascular diseases were prevalent among participants. Tordoff et al. (2010) found that the elderly people worried about side effects and the majority of participants had had advice regarding side effects. However, in my study, most of the participants were not concerned that their medications interacted with each other or that the side effects may be worse than the disease they were being treated for. Although, participants were not bothered about taking five or more medications per day, the majority of them were concerned about the long- term damage that may result from polypharmacy.

5.5 Neutral responses

It is notable that some questions had nearly one-third of neutral responses.   According to Croasmun and Ostrom (2011,) neutral options may reduce the bias as respondents are not forced to select answers in one way or the other way. The reason for these neutral positions might be the lack of knowledge related to medications and diseases (Bpacnz, 2014). Furthermore, some participants might lack experience in completing an online questionnaire or lack computer- based knowledge. Castle and Engberg (2004) stated that using scales such as five- point likert to conduct survey among elderly people may not very effective as they may become confused with many options. In Google Docs, the

Likert scale has five options marked as strongly agree on the left and strongly disagree on the right. The participants in this study may be confused with five options, because this study has many neutral responses.

5.6 Age related analysis

Age has a great impact on the occurrence of diseases and the severity of the diseases can increase with the age. Although Saum et al. (2017) showed that the polypharmacy can increase with the age. Henderson et al. (2006) showed that age did not significantly correlated with the medication usage and the relationship with age and medications did not showed a linear relationship (Katusiime et al., 2018). Polypharmacy can be a reason to the occurrence of dementia when ageing (Lai et al., 2012). In my study, fourteen participants were aged between 65 to 70 and five were in 70 to 75. The elderly people can be divided into three groups: young-old (65-74), middle- old (75-84) and old-old 85 and over. Nowadays the young -old group are happier, healthier and financially more stable than the previous generation (Little, 2016). According to Gilford (1988), functional impairments can increase with age when diseases such as hypertension, arthritis, or coronary artery diseases change to chronic with ageing. They found that 5% of the age group, 65-74 needed assistance for the basic ADL and by 85, 35% of needed assistance. The people who were in the age group of 60-74 experienced changes to their enjoyment by being involved in activities which they did not have time to perform prior to their retirement (Nedopil, Schauber, & Glende, 2013). When 75+, they tried to continue activities which belong to previous phase while compensating for age related and health related problems (Nedopil et al., 2013). Age and sex can be determinants of the occurrence of several diseases such as dyslipidemia, obesity and hypertension and these conditions are more prevalent among males from the age 25 years and these conditions start 20 years later among the female population (Violán et al., 2014). Although participants in my study used polypharmacy for multiple diseases, they did not feel using the polypharmacy as a burden or reduced quality of life because the majority of participants were young old. According to the previous studies, the short duration of a disease and the low severity of the disease can be reasons for the participants having a good HRQoL (Montique et al, 2017; Saum et al, 2017).

5.7 Gender based analysis

Literature showed that female participations were higher than male participations in their studies (Park et al., 2017; Veronese et al., 2017). Montique et al. (2017) found that females perceive their health to be poorer than males. More females were prone to the occurrence of some diseases such as dementia than males (Lai et al, 2012) and the prevalence of polypharmacy and DBI were also higher among females than males (Nishtala et al., 2014; Rosted et al., 2016). This research also had two thirds of female participation. In this study, however, both females and males perceived good quality of life.

5.8 Ethnicity and polypharmacy related quality of life

In New Zealand, European participation in the studies was higher than other ethnicities (Jamieson et al., 2018) and DBI was more prevalent among Māori than non- Māori (Nishtala et al., 2014). Although, New Zealanders health status has considerably worsened since 2011/12 to now, non- Māori had better health status compared to Māori and Pacific older people (MOH, 2019). More than half of the participants were New Zealand Europeans and their attitudes towards polypharmacy and the HRQoL contributed highly to the final results. There were three Māori respondents in this study and the sample size was insufficient to interpret meaningful results. Furthermore, there were fewer participants of Pacifica and Asians who contributed to the final results.

5.9 Medication and disease related analysis

According to Kriska et al. (2019), not all medications contributed to adverse effects. However, Nishtala et al. (2014) found that most of the older people in New Zealand used anticholinergic and sedative medications which contributed to DBI related polypharmacy. This is consistent with Tordoff et al. (2010) who found that cardiovascular diseases were prevalent among the New Zealand elderly population. This explains why the medication classification for the participants of this study used polypharmacy for many disease conditions and heart diseases were prevalent among them. According to Mujica-Mota el al. (2015), multi morbidities did not contribute to the reduced quality of life of older people however, multi morbidities contributed to the reduced quality of life among young people. Brettschneider et al. (2013) stated that greater morbidity and higher age can contribute to the reduced quality of life among the elderly population. Both studies found different diseases which contributed to the reduced quality of life. The conditions such as severity of diseases, time period of having diseases, lower expectations in health and the ability to adapt to the novel life -style changes can

influence the perception of the quality of life (Mujica-Mota el al., 2015). Henderson et al. (2006) showed that medication usage was not associated with the HRQoL in their study. This means that regardless of polypharmacy, diseases severity can be associated with HRQoL (Montiel-Luque et al., 2017; Saum et al., 2017). In my study, no question was asked to measure the severity of participants' disease conditions. It is difficult to get a clear idea related to HRQoL and chronic diseases, because the perception of HRQoL can be varied according to the chronic diseases with various stages (Megari, 2013). According to the medication categories, two thirds of participants used cardiovascular system-related medications. There were participants who used medication categories related to diabetes, cancer, kidney diseases, depression, psychotic disorders, gout, respiratory system related disease, digestive system-related diseases, arthritis, thyroid disorders, epilepsy and some participants took medication for pain and insomnia along with their other medications. in this study, one of the participants used benzodiazepines and none of them used anticholinergic medications both of which can produce significant side effects. This may be one of the reasons that the participants perceived a good quality of life even though they used polypharmacy. Another important factor which did not measure was the medication non-adherence, because Tordoff et al. (2010) found that the quarter of participants forgot to take medication at the correct time or misses doses and the most of them were males. Due to this reason, it was difficult to agree with the participants' responses related to the questions such as side effects, and medication burden.

Moreover, HRQoL surveys are better to be implemented with a number of questions which can assess specific areas such as symptom burden, depression, or physical functioning (Theofilou, 2013). Diabetes together with other comorbidities showed that diabetes brings many negative effects such as the impaired vision, ambulation capabilities, emotion and pain, and discomfort which affects HRQoL. Heart disease and stroke can affect mobility and arthritis can be painful. There are some factors which contribute to improved quality of life among elderly people: patients being treated earlier for diabetes, obesity and coronary artery bypass grafting (CABG) among patients with left ventricular dysfunction (Megari, 2013**).** This might be another reason that participants did not feel the reduction of quality of life-related to polypharmacy. HRQoL studies that have been conducted worldwide showed that different diseases affect the reduction of quality of life among different ethnicities. Among Chinese patients, depression and osteoarthritis highly influenced their reduction of QoL while Europeans experienced a reduction in QoL due to cerebrovascular/neurologic conditions, renal disease, and musculoskeletal conditions (Megari, 2013). Therefore, the perception of the quality of life of older people in New Zealand may vary according to the disease and the medication that they use.

5.10　Impact of Health literacy and computer -based knowledge towards final results

In 2013, access to the internet among non-Māori (83.8%) was higher than Māori (69 %) internet access (MOH, 2018). Some studies found that the elderly population believe that the computer usage belongs to the younger generation and Japanese elderly females were less familiar with IT and digital technology compared to Japanese males (Koch & Hagglund, 2019). However, females were more likely to search online health related information that was not related to their clinical visit than males. A significant number of Chinese elderly females use the internet. In general, the usage of internet among 50+ in other countries was comparatively low (Koch & Hagglund, 2019). According to the Eurostat data in 2012, the age group of 65-74 elderly people who lived in European countries showed that 55% of them did not prefer internet usage, 27% of them thought that they did not need the internet, 19% of them did not have a computer, and 15% of them had a lack of knowledge of using computers (Iancu & Iancu, 2017). The response rate can be dependent on the cost of internet and the connection time provided by various service providers and some other factors such as slow speed of the modem, and unreliable connections can also discourage the participation in a web- based survey (Couper, 2000). Internet usage can be different according to the age and the preference of using internet can decline when people are ageing (Choi, & DiNitto,2013). Although elderly people in the USA claimed that they have had experience of anxiety and some issues when working with technology, the usage of internet technology is on an increase. More than 50% of the elderly currently log onto the internet to find health-related information which was the third most popular activity (Dhillon, Wünsche, & Lutteroth, 2016).

In this research, 19 questions related to polypharmacy and quality of life had five options: Strongly agree, agree, neutral, disagree and strongly disagree. In an attitude scale it is difficult to assess the responses due to the unavailability of objective standards to know the accuracy of the responses. Although a five-point scale provides more information, respondents might lose their capability to distinguish among categories and they lose meaning. Another method is to use multiple questions, different wordings and formats to measure the same concept (McLafferty, 2003). The lack of interest for the internet might be a reason for the lower older people participation in this survey (Perez, Nie, Ardern, Radhu, & Ritvo, 2013). Females were more knowledgeable about medications than males and used more medications than males in New Zealand. Moreover, female participation in surveys was higher than male in New Zealand (Stewart et al., 2010). Therefore, this could be a reason to have more female participants in this study and the fewer respondents for the online survey.

Many of the Māori population had poor knowledge related to health literacy compared to non- Māori and they also had poor knowledge related to cardiovascular diseases (Crengle et al., 2018).

Furthermore, there were limitations to having useful data due to the older people who had a lack of knowledge about drugs. According to Stewart et al. (2010), half of participants in his study did not know the term '' generic medicine''. People who were New Zealand European, professional and aged between 16-64 visit the pharmacy more regularly and had better knowledge about generic medicines (Stewart et al., 2010). The elderly people in New Zealand need more education related to generic medications that are used for their chronic diseases (Stewart et al., 2010).

5.11 Reliability and the validity of the data

Snowball sampling can be identified as both a formal and informal way to find a target population for a study. However, the snowball sampling method is known to have an inherent bias. This method may be more biased towards the people who have many inter-relationships with or are coupled to a number of people. Multiplicity sampling means that the individual may ask his family members or those who are related to his family to participate in the study and this is called a one-wave sampling method (Snijders, 1992). Snijder (1992) stated that there is a need to address in the inclusion criteria about the participation of same family members and their mutual relationship that can affect the reliability of the data. In this research, it was noticeable that there were four participants who filled in the online survey on the same day within the same time period, and they had the same postal codes. There was some similarity in data such as frequency of medications and they mentioned the same ethnicity. Although, they mentioned they used polypharmacy, they did not provide a complete medications list. A study found that some participants may browse the web- based questionnaire due to the curiosity and provide useless data without thinking deeply (Aust et al., 2013). One postal code which was mentioned did not exist. Tordoff et al. (2010) excluded home address and postal code which did not mentioned in the directory. However, Perez et al. (2013) stated that removing these kinds of responses were difficult because of reasons such as lack of time and interest to complete a survey, economic disadvantages, lack of adequate (and literacy appropriate) information related to the survey, communication barriers, urbanicity, and a distrust of researchers. However, in my research, these data removed from the data set and analysed to protect the validity and the reliability of the research. Although the snowball survey method can reach hidden populations, there is not a way to know whether the responded population actually had the quality of inclusion criteria (Bagheri & Saadati, 2015). This research allowed assistance in filling in the form when an elderly person did not know how to do it and the same link to the research could be used multiple times for multiple participants. Although the anonymity of a survey can increase the respondents rate and improve the openness (Healey, Baron, & Ilieva, 2002), and lower social anxiety and social desirability can impact

on the responses for an online survey in a different way compared to non-anonymous participants who completed paper and pencil survey (Joinson, 1999). Especially females were more open when participating in online surveys than paper pencil surveys and online survey can useful to measure sensitivity issues such as people with depression (Davis, 1999). And elderly can become emotionally stressed due to the lack of health literacy, length of the survey and educational reason such as difficulty in reading while completing an online survey (Aust et al., 2013). Due to that some participants ignored questions, provide unclear answers or provide false answers for studies (Allison, 2001). It was noted in this survey that one of the female participants held the neutral options for three positive aspects of polypharmacy related questions and three negative aspects of polypharmacy related questions. She missed one of the negative aspects of polypharmacy related questions and responded 8 for the VAS scale. These responses showed that the participant had a lack of knowledge related to the impact of medications or may have misunderstood the neutral option as a higher or lower option for agreement or disagreement. These kind of measurement errors (deviation of the answers from true values) can occur in self-administered surveys when the respondent of lack of motivation to complete a survey, understandability of survey questions, and intended misinterpretation (Couper, 2000). Trained interviewers can explain each instrument while doing a face to face survey and can minimise the measurement errors, but it cannot be done in an online survey (Couper, 2000). All of these can impact on participant response rate and the quality of the survey. The main weak point of snowball sampling was that of the assumption of initial random sampling. The available sample may be different to the initial sample that is required for the snowball sampling. Because of this, it is hard to find the sample related to the inclusion criteria (Snijders, 1992). Heckathorn (2011), claimed that initially, the sample can be an availability sample with a bias of unidentified sample size. Then that bias can be combined in unknown ways because the sample extends from wave to wave. Therefore, as applied to hidden population, the Snowball sampling method is limited for the availability sampling method because a study with sensitive issues may have lower respondent rates or less reliable responses when used known email addresses (Couper, 2000). In this research, the initial sample was almost all found from sending emails and posting on the Facebook pages.

5.12   The quality of the research

Due to some issues related to the validity and reliability as well the small sample size, research quality is needed to be address. When it comes to the quality of research, research design and data analysing methods are important (Wester et al., 2013). The research design was based on previous

literature and observing same kind of research design and methods which successfully implemented and generated valid and reliable results. A validated questionnaire was used to collect data and descriptive statistics performed to interpret the results. The survey instrument which was used to collect data was validated therefore, there was no instrument related issues to decline the research quality. However, not all questions of validated LMQ3 were used to collect data for my HRQoL research. According to Tavares et al. (2017), deviation from such a validated version can lead to uncertainty of the results as it is unable to compare with another research that used the original version of the questionnaire. Moreover, a questionnaire should be used among the population which has been developed and validated (Bener, Ehlayel, & Bener, 2014). LMQ3 was validated against the EuroQol and New Zealand was one of the members of EuroQol group who tested their questionnaire among New Zealanders (Katusiime et al., 2016). Therefore, there was no impact to reduce the quality of my research due to the instrument.

5.13   Limitations

There were some limitations occurred when implementing this survey by online and among the elderly population. Limitations in the quality of life related studies such as heterogeneity, and the participants who were in various phases of their illnesses were common (Megari, 2013). There was no question or a scale to evaluate the participants disease burden. Therefore, the participants who were in different disease burden were equally considered for the study by using the same questionnaire. In this research, limited demographic data such as age, gender, ethnicity and postal code were collected. According to Montiel-Luque et al. (2017), the quality of life related studies require a wide variety of demographic data, because those factors individually can influence the perception of the quality of life of each person. There were no data collected in this research to relate socio-economic status, education, social support or other demographic factors as this research only focused on older people's attitudes regarding the impact of polypharmacy and the HRQoL. The relationship between social support and functioning was positive and significant and social support can help to cope with the diseases by believe in curability or controllability (Scharloo et al., 1998). Good support from family and friends, personal income security, the safety of the street and environment in which a person lives, and good health care can be contributed to perceive good QoL (Şahin, Özer, & Yanardağ, 2019). Low education is also known to contribute to the increased usage of medication among elderly people (Henderson et al., 2006). Therefore, the results of this research might have had an impact from the above factors to perceive the increased quality of life, although they used polypharmacy. Another limitation was that it was difficult to get older people to complete an online survey. Although, the computer usage has been increased among all age groups, it was difficult to recruit sufficient older

participants from an online survey within the data collection time period. There was no specific instrument to investigate the polypharmacy related quality of life. Therefore, these findings were difficult to compare with other studies which used different instrument and methods. A lack of New Zealand studies related to this subject was the main barrier to being unable to compare the results. While doing a survey online, practical difficulties occurred: knowing the correct medication list, or the correct disease condition that they were being treated for. The missing data related to medication list and the participants who mentioned the disease condition showed that they have a limited knowledge related to medication. Therefore, it is difficult to show the participants actual status related to above conditions which seems to be highly influential for the final results. A considerable number of participants held neutral options for several questions which may be a reason due to a lack of knowledge related to responding an online likert scale survey. This means that older people may require some other type of survey instrument or a qualitative method to collect accurate data. The small sample size can be a limitation for a quality of life study (Megari, 2013). Katusiime (2017) recommended sample size of 100. Another study that was carried out to investigate the Community-dwelling older people's attitudes towards deprescribing in Canada, stated that 92 participants were needed to meet sufficient statistical power in a quantitative study (Sirois, Ouellet, & Reeve, 2017). Accuracy always increases with the sample size and a benefitted sample size can lie between 150 and 200 (Fowler, 2008). Tajvar, Arab, and Montazeri (2008) also stated that the small sample size can affect the final results and could not generalise the results with whole elderly population in Iran. The overall results of this study rejected the hypothesis; this suggests the sample size may have affected for the final outcomes. This survey was conducted online by the snowballing method; the majority of participants were selected through contacts of the main research supervisor and the researcher, and more than half of the participants from Hawke's Bay region. Therefore, these results may not represent New Zealand as a whole.

5.14   Missing data and fewer respondents

In this research there was missing data that was very important for the final results. Some participants did not write the medication list or some of them did not write the number of medications that they mentioned at the beginning of the survey. Alison (2001) stated that the pattern of missingness can be random and it is unpredictable from other data variables which have been collected. The missing responses directly affect the collected or requested data as my study was related to treatment effect. Age for this study was essential data, however, some participants did not mention their age. According to Alison (2010), some people did not want to report their real age and for some participants did not have any understanding of the meaning of some questions such as how old are? and income which

were important variables for researchers. Data such as age could be missing completely at random (MCAR) or missing at random (MAR) and there is no standard method to test the hypothesis based missing data which the researcher is unable to recover (Kaambwa et al., 2012). Therefore, mean, and median age were calculated with the available data. Research involved in these hard to reach population can create biased results (Bagheri & Saadati, 2015).

Online surveys may not facilitate to reach large proportion of participants who belongs to the inclusion criteria and also the respond rates for online surveys have been declining (Couper,2000). Although Facebook is useful to recruit people who are aged 60 years or older (Bagheri, & Saadati, 2015), It was difficult to find 65 or older population for the study. Bagheri, and Saadati (2015) showed that large number of respondents can be found when respondents may refer to a large social network with similar characteristics. One of the reasons might be the design of the survey and the topic which contained the word ''polypharmacy'' which could be an unfamiliar word that can be ignored by the Facebook users. This study was shared on Facebook pages which belonged to all age groups by asking them to share on their wall to find respondents and the survey displayed on Facebook pages in a formal way rather than using colourful background nor attractive pictures. Colourful background, keyword targeting and wording specifically chosen for Facebook advertisements can attract the attention of people compared to blank and white advertisements (Cowie & Gurney, 2018).

5.15   Future research

This research findings showed that the older people in New Zealand perceived they had positive HRQoL through polypharmacy. These findings were opposed to the worldwide literature and the reason may be small sample size and the lack of knowledge related to the term polypharmacy among older people in New Zealand. In this research, many participants held a neutral position for many questions. There are lack of studies related to polypharmacy and the quality of life both nationally and internationally. Therefore, it is difficult to compare these findings with other studies and also these results cannot be generalised for whole New Zealand. More research related to polypharmacy and the quality of life are needed in the future because older population is on increase and live with multiple diseases. Implementation of the quality of life studies related to polypharmacy among older people is difficult because there are many other individual, social, and demographic factors which determine the quality of life of older people and make more difficult to interpret the results precisely. In order to get precise results, research needs to be addressed through a multidimensional approach and with a large population. Both qualitative and quantitative techniques need to use to evaluate the research outcome. Furthermore, research is needed to evaluate the knowledge related to diseases,

medications and side effects because; it seems to be that some older people in New Zealand do not have sufficient knowledge. There are lack of studies to identify this issues. Most of the literature review were done by having national and international old journal articles. The participants who involved in those researches came from different cultural background, socio-economic background and the educational level. Therefore, there is doubt that all findings of those studies can be compared with New Zealand context and was a problem with the relevancy to the current situation.

Chapter 6: Conclusion

The purpose of this study was to investigate how polypharmacy impacts on the quality of life of older people in New Zealand. The older population is increasing worldwide and they may live with multiple diseases which require multiple medications to control the disease severity. Because of this, many older people use polypharmacy or hyper-polypharmacy. Both national and international studies reveal that polypharmacy and hyper-polypharmacy can bring a number of adverse outcomes for older people when they use on a long-term basis. Although, not all medication brings adverse outcomes, drug-drug interaction can bring more adverse outcomes than drug-disease interactions. There are some drug classes that can bring side effects. Some literature showed that many older people in New Zealand used polypharmacy and are prone to the occurrence of side effect due to drug burden. Therefore, a validated survey questionnaire was implemented online to investigate the association between polypharmacy and HRQoL.

Descriptive statistics were performed to analyse the survey questionnaire and other demographic factors. The findings showed that the majority of the participants were female which is consist with the most of international and national studies found. Most of the participants did not feel using more than five medication as a burden, and also most of them stated that the using multiple medication did not affect their day-to-day routines. However, most of the participants were concerned about the long-term damage that could occur due to the prolonged usage of medications. The findings from the descriptive statistics revealed that the older people in New Zealand perceived good HRQoL, although they used polypharmacy. VAS scale showed that the older people feel lower drug burden, although they use polypharmacy.

International studies showed that the quality of life cannot be measured with an individual factor and the term quality of life can be shaped by many other factors such as age, sex, heterogeneity, socio-economic background, the disease severity, and the instrument which used to evaluate the quality of life. Therefore, future researches may need to be implemented in a multidimensional approach.

There were many limitations which affected the final research outcomes. Fewer elderly participants were the main limitation for the study which had limited time to collect data from online. Because of few participants, polypharmacy related quality of life could not be addressed based on ethnicity. The research also needed a scale or a specific question to identify the disease severity. Limited data were collected for demographic factors and this did not capture the socio-economic and educational status of the participants. The results cannot be generalised to the New Zealand population.

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Appendix 1 Ethical committee approval letter

Our Ref: **PG19/21**

12th September, 2019

Dear Nadeeka,

Thank you for your application for your research project *"**How does polypharmacy impact on the quality of life in older New Zealanders?" – our Ref PG19/21,** received by the Research Ethics and Approvals Committee.

I am pleased to inform you that your research application has been approved.

As you continue with your research, please refer to the EIT Code of Research Ethics. As a reminder, if your proposal changes in any significant way, you must inform the Committee. Please quote the above reference number on all correspondence to the Committee. Please send all correspondence to REACapprovals@eit.ac.nz.

The Committee wishes you well for the project.

Yours sincerely

Catherine Hines
Secretary - Research Ethics & Approvals Committee

Appendix 2 Information for the study participants

Information for study participants

How does polypharmacy impact on the quality of life in older New Zealanders?

The aim of this study is to investigate how taking lots of different medications (polypharmacy) can affect older people, and how it impacts on their quality of life. We want to use this information to help educate those who prescribe and monitor medication use in the elderly, and also to educate older people regarding their medications.

Many older people suffer from chronic diseases and need medication to keep them well. However, there can be problems if certain combinations of drugs are given, or drugs that are no longer required continue to be prescribed.

There has been very little research done in New Zealand that looks at whether there are problems related to inappropriately prescribed medications, or if people who take over-the-counter medications in addition to their prescribed medications experience problems. This study aims to collect information from elderly people throughout New Zealand to try and investigate this.

The questionnaire consists of 19 tick-box questions, where you will be asked about how your medications affect you. You will also be asked which medications you take (or what you take medications for if you don't know the names of your medications), you age, gender and ethnicity, and asked how many medications you take and how often. The questionnaire should take you approximately 15 minutes to complete.

Information will be collected through the completion of an anonymous questionnaire, which means that individual participants cannot be identified. If you wish to be sent a copy of the results once the study has been completed, please email Nadeeka on nads7001@gmail.com. You do not have to participate in the survey to request a copy of the results.

Appendix 3 The survey questionnaire

Thank you for your interest in taking part in this research project. We are looking at how taking lots of different medications can affect older people. We want to use this information to help educate those who prescribe and monitor medication use in the elderly.

If you would like to see more details about this project, please click on the link;

https://drive.google.com/file/d/1phvfgnbmzi-IWnzrdHM8vnxUfxp0ioBV/view?ts=5d89baf5 FIND OUT MORE ABOUT RESEACH PROJECT.

We are recruiting older adults (age 65+) **who are living independently in the community to complete a short survey about their medication use.** The questionnaire should take about 15 minutes to complete.

To be able to take part, you need to:

- live in New Zealand
- live independently in the community
- take five or more different medications a day (including tablets, creams, inhalers, injections, liquid medicines and eye drops, but not supplements)

To work out how many different medications you take a day, count all those that you take every day that are prescribed, as well as any that you have bought yourself over-the-counter. 'Medications' include tablets, capsules, creams, inhalers, liquid medicines and eye drops.

Please do not include any supplements (such as iron, calcium or vitamin D tablets or protein supplements) even if your doctor has prescribed them.

If you think this questionnaire will be too difficult to fill out on your own, it is okay to ask someone to help you with it.

If you know of anyone else who might be interested in taking part in the study, we would be very grateful if you could pass the link to the questionnaire on to them.

This survey is anonymous. No one, including the researcher, will be able to associate your responses with your identity. Your participation is voluntary.

- ➢ Are you 65 years old or older?　　　　　**Yes** ☐　　**No** ☐
  (If **No**, you cannot participate in this research)

- ➢ Do you live independently and live in New Zealand?　**Yes** ☐　　**No** ☐
  (If **No,** you cannot participate in this study)

- ➢ Are you taking **five** or more medications a day?　**Yes** ☐　　**No** ☐
  (If **No,** you cannot participate in this study)

Please tick the box below to show that you have understood what this survey is about and that you agree to be part of this research;

- ➢ **I understand what this survey is about, and I consent to participate in this survey.**

  Yes ☒　　　　　　**No** ☐

Ethical approval has been granted by the Eastern Institute of Technology Research Committee (PG19/21).

This research project is being conducted by Nadeeka Weerasinghe, Master of Nursing Science Student at the Eastern Institute of Technology / Te Ahoa a Māui, under the supervision of Dr Karen Munday, Principle Academic, School of Nursing.
Any questions regarding this study can be directed to Nadeeka Weerasinghe at;
nads7001@gmail.com or Dr Karen Munday at; kmunday@eit.ac.nz.
If you would like to be sent a summary of the results once the study has been completed, please email Nadeeka on nads7001@gmail.com and ask to be sent them.
This survey will close on 15th November 2019.

Please tell us a little more about yourself:

- **Are you**: ☐Male ☐Female

- [ ] **What is your age years?**

- **Which ethnic group do you identify with?** (Please tick one box only)

  ☐NZ European ☐Māori ☐Pacifica ☐Asian
  ☒ Other (please specify)

- **Please tell us your full postcode** [ ]

  (This is to help us understand how people in different areas answer the survey. We will not be able to identify you and will never contact you or pass your details on to anyone else.)

Please tell us about your medications:

- How many prescription and over-the-counter medications do you use each day?

  Please write the **TOTAL** number of medications here: [ ]

- **How often do you need to take your medications?**

  ☐Once per day ☐ Twice per day ☐Three times per day

  ☐More than three times per day ☐ Other, please

  specify……………………………………………

Please read each statement carefully and tick the response box that is closest to your personal opinion. Please tick only one box for each statement. Please think about ALL your medications when completing this questionnaire.

		Strongly Agree	Agree	Neutral Opinion	Disagree	Strongly Disagree
1.	I am satisfied with the effectiveness of my medication.	☐	☐	☐	☐	☐
2.	I worry that I have to take several different medications at the same time.	☐	☐	☐	☐	☐
3.	I am concerned about possible damaging long term effects of taking my medication.	☐	☐	☐	☐	☐

		Strongly Agree	Agree	Neutral Opinion	Disagree	Strongly Disagree
4.	My medication prevent my condition getting worse.	☐	☐	☐	☐	☐
5.	I am concerned that I am too reliant on my medication.	☐	☐	☐	☐	☐
6.	I worry that my medications may interact with each other.	☐	☐	☐	☐	☐
7.	My medication interfere with my social or leisure activities.	☐	☐	☐	☐	☐
8.	The side effects I get are sometimes worse than the problem for which I take my medication.	☐	☐	☐	☐	☐
9.	The side effects I get from my medication interfere with my day-to-day life (e.g. work, housework, sleep).	☐	☐	☐	☐	☐
10.	Taking my medication affects my driving.	☐	☐	☐	☐	☐

		Strongly Agree	Agree	Neutral Opinion	Disagree	Strongly Disagree
11.	The side effects I get from my medication are bothersome.	☐	☐	☐	☐	☐
12.	I am concerned that my medication Interacts with alcohol.	☐	☐	☐	☐	☐
13.	My medication allows me to live my life as I want to.	☐	☐	☐	☐	☐
14.	My medications interfere with my social relationships.	☐	☐	☐	☐	☐
15.	Taking my medication causes me problems with daily tasks. (such as work, housework).	☐	☐	☐	☐	☐

16. The side effects I get from my medication adversely affect my well-being.	☐	☐	☐	☐	☐
17. My medications are working.	☐	☐	☐	☐	☐
18. The side effects are worth it for the benefits I get from my medication.	☐	☐	☐	☐	☐
19. My life revolves around using my medication.	☐	☐	☐	☐	☐

The question below seeks your **OVERALL OPINION** about ALL your prescribed and over-the-counter medications.
Please **mark on the line with an 'X'** at the position that best reflects your opinion.
Overall, how much of a burden do you feel your medicines are to you?

No burden at all   Extremely burdensome
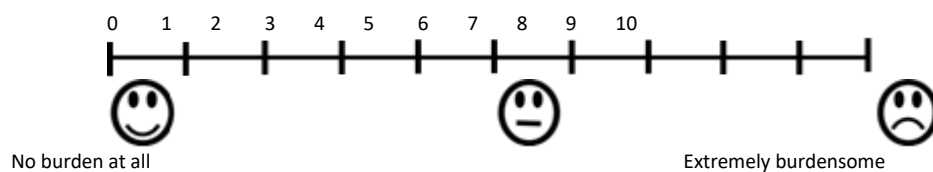
Please list here all the medications that you are using currently. If you are not sure of their correct names, please state for what conditions you are taking those medications for (such as sleeping pills, heart problems etc.). Please state if you buy the medication yourself (over-the-counter) rather than it being prescribed.

Thank you for taking the time to complete this questionnaire.
If you need any copy of this research, do not hesitate to contact me on the email below:
 Name:- Nadeeka Weerasinghe
 E mail address: - nads7001@gmail.com

Appendix 4 Responses for the survey questions

Survey questions	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Q1) I'm satisfied with the effectiveness of medication	8 (28.57%)	10 (35.71%)	5 (17.85%)	4 (14.28%)	1 (3.57.%)
Q2) I worry that I have to take several different medications at the same time	5 (17.85%)	5 (17.85%)	3 (10.71%)	10 (35.71%)	5 (17.85%)
Q3) I'm concerned about possible damaging long-term effects of taking my medication.	7 (25%)	9 (32.14%)	4 (14.28%)	3 (10.71%)	5 (17.85%)
Q4) My medication prevents my condition getting worse.	10 (35.71%)	7 (25%)	9 (32.14%)	2 (7.14%)	0
Q5) I'm concerned that I'm too reliant on my medication	6 (21.42%)	8 (28.57%)	8 (28.57%)	3 (10.71%)	3 (10.71%)
Q6) I worry that my medications may interact with each other.	1 (3.57%)	4 (14.28%)	8 (28.57%)	9 (32.14%)	6 (21.41%)
Q7) My medication interferes with my social or leisure activities	1 (3.57%)	7 (25%)	2 (7.14%)	13 (46.42%)	5 (17.85%)
Q8) The side effects I get are sometimes worse than the problem for which I take my medications	4 (14.28%)	6 (21.41%)	2 (7.14%)	8 (28.57%)	8 (28.57%)
Q9) The side effects I get from my medication interferes with my day-to-day life (eg. Work, housework, sleep)	4 (14.28%)	5 (17.85%)	4 (14.28%)	7 (25%)	8 (28.57%)
Q10) Taking medication affects my driving	1 (3.57%)	4 (14.28%)	7 (25%)	4 (14.28%)	12 (42.85%)
Q11) The side effects I get from my medication are bothersome	2 (7.14%)	5 (17.85%)	3 (10.71%)	8 (28.57%)	10 (35.71%)
Q12) I'm concerned that my medication interacts with alcohol	4 (14.28%)	6 (21.41%)	10 (35.71%)	5 (17.85%)	3 (10.71%)
Q13) My medication allows me to live my life as I want to	9 (32.14%)	8 (28.57%)	9 (32.14%)	2 (7.14%)	0
14) My medications interfere with my social relationships	2 (7.14%)	3 (10.71%)	6 (21.41%)	7 (25%)	10 (35.71%)

Question					
Q15) Taking medication causes me problems with daily tasks (such as work, house work)	0	5 (17.85%)	3 (10.71%)	10 (35.71%)	10 (35.71%)
Q16) The side effects I get from my medication adversely affects my well-being	0	8 (28.57%)	5 (17.85%)	6 (21.41%)	9 (32.14%)
Q17) My medications are working	12 (42.85%)	9 (32.14%)	4 (14.28%)	3 (10.71%)	0
Q18) The side effects are worth it for the benefits I get from my medication	5 (17.85%)	11 (39.28%)	9 (32.14%)	3 (10.71%)	0
Q19) My life revolves around using my medication	1 (3.57%)	10 (35.71%)	7 (25%)	4 (14.28%)	6 (21.41%)