



A REVIEW ON NCDs IN GERIATRICS WITH EMPHASIS ON POLYPHARMACY AND ITS COST BURDEN

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ABSTRACT

Globally, Non-communicable Diseases (NCDs) are the major reason for mortality. These have more of their prevalence in low and middle-income countries. Among NCDs cardiovascular diseases have the upper hand in contributing the mortality worldwide. These NCDs have slow progress and are of long duration and thus significantly contributing to treatment for a long time leading to higher expenses. Management of NCDs in geriatric patient is a challenge for physician since the geriatric population come across many co-morbidity conditions, where treating each and every condition leads to multiple drug use. It is very evident that multiple drug use leads to consequences, especially in geriatrics along with cost burden, low quality of life and even death. Thus, NCDs burden imparts a serious effect on development, both socially and economically across the world. Different strategies have been established to overcome NCDs and the multiple drug use (polypharmacy) in geriatric.

INTRODUCTION

Non-communicable Diseases (NCDs) are generally defined as the diseases which progress slowly and are of long duration. NCDs are the major cause of mortality and morbidity worldwide than from all other causes combined. According to a report by the World Economic Forum and the Harvard School of Public Health Dominant diseases in NCDs which are considered to have a strong link with mortality and morbidity are cardiovascular diseases (including heart disease and stroke), diabetes, cancer and chronic respiratory diseases (including chronic obstructive pulmonary disease and asthma) and mental illness. Cardiovascular diseases are a group of disorders of the heart and

blood vessels where 82% of mortality burden is due to, congestive heart failure (CHF), ischemic or coronary heart disease. 80% OF CVD Burden is due to behavioural risk factors such as physical inactivity, tobacco use and unhealthy diet. A major cause of mortality in India is cardiovascular diseases which are also a major cause of mortality globally. Currently, it was estimated that 2.7 million deaths occur due to CVD, which is predicted to rise to 4 million by 2030 and 25% of death is seen in the age range of 25-70 years. Diabetes is a chronic metabolic disorder where the pancreas does not produce sufficient insulin or when the body gets resistance to use insulin which it produces results in

fluctuations of sugar levels in the blood. Diabetes is of 2 types, type I and type II where Type II DM accounts for about 90-95% of all diabetes cases. Diabetes is a major risk factor for many other diseases which have a high mortality rate like cardiovascular diseases etc. Chronic Respiratory Disease refers to pathological chronic disease affecting the respiratory tract, structures of the lungs. Most common diseases which are included are asthma, chronic obstructive pulmonary disease (COPD), respiratory allergies, occupational lung diseases and pulmonary hypertension, which joint accounts for about 4.2 million deaths (7% death worldwide). Cancer is a chronic condition where there is rapid, uncontrollable growth and division of cells which can invade the surrounding tissues. There are many types of cancers and mortality due to cancer is estimated to rise from 12.9 million in 2009 to 17 million by 2020. Mental illness is a term which means a wide group of conditions which affect a person's mood, thinking, feeling, behaviour, daily functioning. According to WHO, globally 100 million people suffer from alcohol or drug abuse disorders, 25 million people from schizophrenia and over 100 million people suffered from alcohol or drug abuse disorders in 2002. Mortality due to Non-communicable disease has been increasing while from communicable disease mortality is decreasing due to Considerable changes which have been seen in last few decades of 20th century, in societal development, health and nutritional status as well as life expectancy, fertility and mortality rates which have taken place in India. Hence, noncommunicable diseases (NCDs) worldwide demands a large burden and According to WHO, out of 56.4 million global deaths in 2015, 39.5 million (70%), were due to non-communicable diseases (NCDs), and Regarding Estimates in India (2008), the mortality rate due to NCDs is about 53%.¹⁻⁵

The Risk factors associated with NCDs are tobacco use, alcohol use, unhealthy diet, poor physical activity. Assessing the burden of these risk factors can predict the burden of disease which can help in developing interventions.

Tobacco consumption

In India, Tobacco is available in varied forms like cigarettes, beedis or bidis, pan masala, gutkha, smokeless forms and other products. According to the third wave of India's National Family Health Survey (NFHS-3), 57% men and 11% women use tobacco in any form between age 15-49 and our country India is a third largest global consumer of tobacco. Tobacco consumption is strongly cited as the main risk factor for the development of NCDs like cardiovascular disease, COPD, Cancers. Approximately 1 million deaths are occurring because of tobacco consumption and is predicted to increase to about 1.5 million deaths annually.^{2,6}

Alcohol consumption

Alcohol consumption leads to the development of many diseases which include NCDs, neuropsychiatric disorders, fatal road traffic accidents and suicides. Nearly 62.5 million people in India were estimated to drink alcohol in India in 2004.^{2,6}

Improper diet and physical inactivity

Obesity is caused due to Improper Diet (high-calorie intake) and lack of physical activity. Obesity is well known for its contribution to cause diseases like diabetes, CVD, exacerbate symptoms of COPD. Consumption of unhealthy oils high in saturated and trans-fats, excess salt intake is linked to NCDs, particularly CVD any one of the contributing factors to causing NCDs is a sedentary lifestyle. According to WHO, 4.1 million annual deaths have been attributed to excess salt/sodium intake, 1.6 million deaths

annually can be attributed to insufficient physical activity.

Economic Burden of NCDs: According to the World Economic Forum and the Harvard School of Public Health, the following three are the distinct approaches which are used to compute the economic burden of NCDs:

- The standard cost of illness method
- Macroeconomic simulation
- The value of a statistical life

The burden of NCDs through Cost-of-illness approach (estimates of direct and indirect costs of NCDs) is showed in table1.²

Present efforts to combat NCDs

Health care system of India is majorly focused on acute care than the chronic care resulting in less adequate Caregiving at both primary and secondary care levels². However, India had laid down some National programs to Address NCDs which include national Cancer Control Program (NCCP), the National Trauma Control Program (NTCP), the National Program for Control of Blindness (NPCB), the National Mental Health Program (NMHP), the National Tobacco Control Program (NTCP), and the National Program for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS). National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS) was launched in 2007 in 10 states (Assam, Punjab, Rajasthan, Karnataka, Tamil Nadu, Kerala, Andhra Pradesh, Madhya Pradesh, Sikkim and Gujarat) with objective to assess the prevalence of risk factors of NCDs, Provide early diagnosis and appropriate management for high risk groups. In 2011, the name of the programme has been changed to National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and

Stroke (NPCDCS). In 2011, the National Programme for the Healthcare of the Elderly (NPHCE) has also been started.^{2,7}

POLYPHARMACY

Use of multiple drugs (>5 drugs) by one individual is well known as polypharmacy, which is majorly linked with co-morbidity⁸. The reasons for polypharmacy showed in table2. Co-morbidity refers to co-existence of two or more chronic diseases in one patient. Due to the presence of these multiple disease conditions, planning of therapeutic management for the individual patient has become difficult for health care professional leading to a negative impact on clinical health outcomes. Globally, the economic burden is also significantly rising due to multiple drug use. Since the recent decade Polypharmacy has been increasing and will continue to increase unless there is a decrease in unnecessary drug prescriptions and appropriate therapeutic management in patients with multiple disease conditions. Polypharmacy is strongly associated with consequences such as medication non-adherence, ADRs, drug resistance, increase the length of stay in the hospital, medication errors, drug interactions, increase in economic burden and even death⁹. Consequences of multiple drug use lead to decrease the therapeutic efficacy and further hospitalization. Hence polypharmacy and hospital stay are interrelated and vice-versa. WHO Defines polypharmacy as “administration of many drugs at the same time”. Polypharmacy is a significant contributor to morbidity but it is a preventable phenomenon, prevention can be possible with the clinical attention. Prevalence of polypharmacy is increasing day to day and is seen in 37.7% in older Australian adults, an increase from 24% to 39% (from 1999-2001 to 2011-2012) in Americans aged 65 years.¹⁰ Factors contributing to the development of poly pharmacy have been classified into three categories.

WHO predicted, "By 2050, the world's population aged 60 years and older is expected to total 2 billion, up from 900 million in 2015". This increase in the population of elderly people creates new challenges for healthcare team, as these people are subjected to use an inappropriate number of drugs and the probability of occurrence of medication-related problems due to polypharmacy are increased in older age due to the ageing process. Aging alters all the pharmacokinetic processes which include absorption, bioavailability, first pass metabolism, distribution, protein binding, clearance. Therefore, a change in pharmacokinetic parameters contributes to an increased risk of Adverse drug reactions. The risk of an ADE is supposed to be 13% with the use of two drugs, but when five medications are used, it increases to 58% and If 7 or more medications are used, the incidence raised to 82%. So, the number of drugs prescribed forecast the number of ADE and also the drug interactions.¹¹⁻¹³

Evidence shows that at least one drug that is not medically necessary is being consumed by greater than 50% of elderly patients, nearly 40% of elderly patients consume more than 5 prescription medications and about 20% take more than 10 drugs. Moreover, approximately half of the elderly population consumes at least one over the counter drug or nutritional supplement along with prescribed drug.¹⁴ Poor mastery in the understanding of the cause of certain conditions makes prescribing of drugs more complicate and treating such less understood disease surely increase the risk of inappropriate multiple drug use¹². It is critical in patients with co-morbidity conditions to recognize appropriate polypharmacy (treating conditions like chronic pain, Diabetes mellitus, Hypertension) and inappropriate polypharmacy.¹⁵ Beers et al., developed the following criteria for classifying a drug

as inappropriate for use in elderly patients:¹⁶

- Specific medications or classes of medications that should not be used routinely in elderly persons. This may be due to lack of proven drug effect, a high likelihood of adverse drug effects, the potential for severe adverse effects, or a high potential for interaction with another drug or class of drugs.
- Excessive dosages of medications used in elderly patients. Some medications for elderly patients are safe when used in lower doses, but increase the risk of problems when used in higher doses.
- Excessive dosing frequencies that would make compliance difficult for elderly patients. Because elderly patients tend to take multiple medications, it is best to prescribe medications that have once-daily dosing when possible.
- Extended duration of use of medications that were intended to be used for a limited time. Some medications, prescribed initially for a limited time, become unnecessary and therefore inappropriate if taken for the long term.

Attaining appropriate polypharmacy can be done through right drug prescription under right circumstances to treat the right disease. Ensuring appropriate polypharmacy is significantly important because of the potentially inappropriate prescribing which is extensively highly in older people and the Problem of inappropriate polypharmacy is predicted to raise hereafter due to the introduction of new drugs, learning of new uses for old drugs, growth in old population, increased risk of chronic disease conditions.¹⁷ Thus inappropriate poly pharmacy obviously lead to unacceptable health and economic outcomes.

S.No	NCD	Expenditure In 2010(USD)	Expected Expenditure In 2030(USD)
1	Cancer	290 Billion	458 Billion
2	CVD	863 Billion	1.04 Trillion
3	COPD	2.1 Trillion	4.8 Trillion
4	Diabetes	500 Billion	745 Billion
5	Mental illness	2.5 Trillion	6 Trillion

Table1: Burden of NCDs

Individual/Patient factors	Increasing Age, Female gender White Ethnicity /Race Lower Socioeconomic Status Poor self-Reported Health Multiple chronic conditions Decrease cognitive capacity Self-medication (OTC drugs)
Prescriber factors	Lack of education, High patient workload Prescribing habit (Adherence to multiple medical guidelines) Improper Medication reconciliation Multiple prescribers
System-level Factors	Different Electronic Medical Records system Poor prescriber-patient communication

Table2: Reasons for poly Pharmacy

Consequences of polypharmacy

Negative consequences are associated with polypharmacy, where the burden of consuming multiple medications is significantly linked to higher health care cost, high risk of adverse drug events (ADEs), medication non-adherence, Drug interactions, decreased functional capacity, multiple geriatric syndromes.

Increased healthcare costs

When comes to economic implications due to polypharmacy, in 2014 about \$3 trillion was estimated to have spent by the United States (US) on total national health care expenditures, of which 9.8% (\$294 million) was spent on prescription drugs. The US Center for Medicare and Medicaid Services (CMS) states that polypharmacy has been estimated to cost US health plans over \$50 billion annually, with respect to medication discrepancies and patient adherence, if patients took all

appropriate medications exactly as prescribed, it is estimated it would save 13% (\$290 billion) of total US healthcare expenditures due to avoidable medical costs¹⁴. Both Patient and health care system are affected by polypharmacy in terms of increased health care cost. In a retrospective cohort study, they found the association of polypharmacy with an increased risk of consuming a potentially inappropriate medication, increased risk of the outpatient visit, and hospitalization with an approximate 30% hike in drug cost. Another study conducted in Sweden reported that those consuming more than 5 medications had an increase in prescription drug expenditure of about 6.2% and those consuming more than 10 medication had 7.3% increase.¹⁸

Adverse drug events

In 2005, Over 4.3 Million health care visits were estimated to attribute to an ADE and have been reported that nearly 40% of

hospitalized and 35% of outpatients experienced ADE. In a population Based study, when comparing the risk of experiencing ADE between outpatients using more than 5 medications and those taking fewer medications, the one using more than 5 medications have increased the risk of 88% to experience ADE.¹⁸ Adverse drug events (ADEs) which occur due to polypharmacy in a hospital setting, in turn, increase the likelihood of morbidity, length of stay (LOS), and the cost of care. A multicenter retrospective cohort study, which was conducted in six community hospitals showed that ADEs are correlated with an increased adjusted average hospitalization cost of \$6910 and increased length of stay of 5 days. Increased cost and length of stay are associated with severity of ADEs.¹⁴

Drug interactions

Older populations with Polypharmacy are majorly predisposed to Drug interaction. In a prospective cohort study of older adults (hospitalized) who were on 5 or more medications, the prevalence of a potential hepatic cytochrome enzyme-mediated, drug-drug interaction was 80%. Drug-drug Interaction is a common cause of preventable ADEs and medication-related hospitalization. The probability of Drug-drug interaction increases with number of medication use. Specifically, a patient taking 5-9 medications had a 50% probability, whereas the risk increased to 100% when a patient was found to be taking 20 or more medications. Thus, practitioners should consider the possibility of a drug-drug interaction in when prescribing drugs. One study has reported that the prevalence of drug-disease interactions is 15-40% in elder patients. The risk of drug-disease interactions should be a concern for healthcare providers.¹⁸ Thus, the drug-drug, drug-disease and drug-food interactions are the major issues for their health improvement as well as economy.

Medication non-adherence

Non-adherence is defined as the improper intake of medication. Complicated medication regimen and polypharmacy are strongly associated with Non-adherence in the older population. The relationship between medication adherence and complexity of medicine regimen is inversely related. Non-adherence rates in community-dwelling elderly adults have been reported to be between 43-100%. In one study, the rate of patient non-adherence was 35% when a patient was taking 4 or more medications¹⁹. Medication non-adherence is associated with potential disease progression, treatment failure, hospitalization, and ADEs, all of which could be life-threatening

Functional status

Functional decline in older patients has been associated with polypharmacy. It is may due to the Drug-Drug Interactions (DDIs), Medication Errors (MEs), Adverse Drug Reactions (ADRs) or polypharmacy may causes to the existing of any one or more DRPs in older patients. A study using data from the conducted a Women's Health and Aging Study reported that multiple drug use (5 or more medications) is associated with instrumental activities of daily living (IADLs). In a prospective study of community-dwelling older adults, increased prescription medication use had an outcome of diminished ability to perform instrumental activities of daily living (IADLs) and decreased physical functioning. In Women's Health Initiative Observational Study, Disability in Older women was reported due to polypharmacy. In a prospective cohort study with approximately 300 older who were consuming more than 10 or more medications had decreased functional capacity and trouble performing daily activities. Prescribers should consider the risk of a decrease in functional ability in patients taking multiple medications.²⁰⁻²³

Nutrition

Polypharmacy has been linked to influence a patient's nutritional status. A prospective cohort study reported that malnourished and risk of malnourishment was about 50% in patients consuming 10 or more drugs.²³

Strategies to prevent polypharmacy;

Evidence-based interventions have been developed to reduce polypharmacy, patient non-adherence, inappropriate prescribing. Many of the developed strategies focus on elder population and includes as follows.¹⁴

- Deprescribing
- Patient education
- Promote better medication reconciliation

Deprescribing: Medication withdrawal and deprescribing were the targets to generate evidence which shows their effect on reducing the polypharmacy. Deprescribing can be referred as a process of withdrawing inappropriate medications, under the supervision of healthcare professionals with the aim of managing polypharmacy and obtaining better, positive health outcomes. However, Deprescribing is best & successful in reducing the medication burden.¹⁴ Moreover, there is an emerging evidence that the outcomes of the patients have been improved due to deprescribing strategies which target specific population and medication class. Canadian Deprescribing Network, which is newly formed is targeting on building deprescribing guidelines for specific medications. An Algorithm was proposed by the Australian Deprescribing Network to decrease polypharmacy by guiding the deprescribing procedure. Appropriateness of prescribing can be evaluated using computerized clinical decision support systems. Consuming of the drug to treat a disease is necessary, but extra or unnecessary prescribing of medicines to

the patient increases load for the patient and even increases the risk of negative outcomes and increase non-adherence. The prescription can be simplified by evicting drug duplication, decrease dose, frequency, reducing unnecessary drug prescription, cost of therapy, avoid self-medication.²⁴ Clinical pharmacist have a great role in this area, he could contribute to making a decline in ratios of polypharmacy by reviewing the prescription of the patient and if any interventions are noted is then communicated with healthcare professionals regarding withdrawal of drug and provide the alternate choice which will be cost-effective and decreases the negative outcome due to therapy.

Patient education: The patient usually does not have an education about his medications prescribed nor he has an understanding of his disease and drug therapy duration. Healthcare professionals are the integral elements who can contribute to making the patients and caregivers understand the treatment needs and the importance of patient adherence to therapy to get a desired clinical outcome. The Potential intervention the for reducing the rates of polypharmacy is implementing a patient education which is one of the responsibilities of a clinical pharmacist to educate patients regarding the disease, drug, medication adherence using educational packets, patient information leaflets. These Educational packets or patient information leaflets, which are specially designed to improve outcomes and effectively manage polypharmacy. Patient education is a patient-centred procedure aiming to support and overcome medication cessation barriers. So, Direct patient education can effectively improve prevention of consequences of multiple drug use.

Medication reconciliation: Emerging of medication errors and other adverse events had led the Joint Commission to identify

medication Reconciliation as a National Patient Safety Goal in 2005. Medication Reconciliation can be simply explained as ensuring a friendly atmosphere to communicate any changes in medication and the reason for the change between patients and primary care team. There are direct and indirect effects on the clinical outcome when interventions are used to improve medication reconciliation. A Systematic Review and meta-analysis of medicine Reconciliation published in 2016 found that there is a decrease in adverse drug events due to medicine reconciliation.²⁵ Mekonnen and colleagues performed a meta-analysis of pharmacist-led medication reconciliation programs on clinical outcomes in the hospital and the Result was the medication reconciliation had a greater impact in reducing medication discrepancies and was thought to be the best effective strategy.¹⁴

CONCLUSION

By implementing strategies, we can be successful in reducing the occurrence of NCDs by controlling the associated risk factors, managing the patient with co-morbidity condition by providing appropriate drugs and by increasing the ratio of prescription. The clinical pharmacist is apt at helping the prescriber regarding the management of NCDs in a geriatric patient with co-morbidity by providing optimized individual patient management and care.

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