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Multimorbidity Patterns And Therapeutic Complexity In Adult Medical Practice: Implications For Polypharmacy And Patient-Centred Care

[1]Dr. Rajeev Kumar, [2]Mr. Ketan Sharma, [3]Dr. Shiv Kumar Gupta,

[1]Professor, Department of General Medicine, Saraswathi Institute of Medical Sciences, Hapur

[2]Prof Cum Vice Principal, Community Health Nursing (CHN), Saraswathi College of Nursing, Hapur

[3]Professor, Department of Pharmaceutical Chemistry, Saraswathi College of Pharmacy, Hapur

Abstract: Multimorbidity has become a characteristic problem of modern adult health care practise, especially in ageing societies and resource-limited health care. Polypharmacy, complicated pharmacological regimens, and increased susceptibility to adverse drug events, nonadherence, and functional impairment are often observed in the coexistence of a variety of chronic conditions. The article explores these issues: the patterns of multimorbidity and therapeutic complexity in adult medical practise will be studied using an integrative review of clinical, epidemiological, and systems-level evidence. Basing the analysis on primary and tertiary care, the findings have identified general disease clusters, the prescribing behaviour and the multidimensional predisposing factors that shape multimorbidity, such as behavioural risk factors, mental health issues, occupational exposures, social vulnerability and ageing. The review also addresses the clinical issues of guided care in complicated patients, focusing on the complexity of medication regimen, its suitability, and related morbidity and mortality risks. There is a special focus on vulnerable groups of people like older adults, women in occupations with high risks, tribal populations, and individuals with substance use and psychiatric conditions, which report disproportionate burden of therapy and worse outcomes. Other innovations addressed in the article, such as precision medicine, artificial intelligence, digital health tools, rehabilitation strategies, and patient empowerment models, are a set of potential outcome facilitators of more personalised and integrated care. On the whole, the synthesis highlights the necessity to no longer focus on disease-based models but rather on complexity-informed, patient-centred, and systems-integrated models of care as a way to effectively address multimorbidity and therapeutic complexity in adult medical practise**.**

Index Terms **-** Multimorbidity; Therapeutic complexity; Polypharmacy; Adult medical practice; Medication regimen complexity; Ageing; Mental health comorbidity; Patient-centred care; Digital health; Precision medicine**.**

INTRODUCTION

Multimorbidity which is generally described as the presence of two or more chronic diseases in a patient has become the most prominent issue in the practise of adult medicine. Being viewed initially as a geriatric medicine issue, multimorbidity is currently a common feature of adult populations because of population ageing, the epidemiological shift, and the rise in survival rates of potentially deadly diseases (Olson et al., 2018; Langenberg et al., 2023). The rising trend of multimorbidity has significant clinical implications of decision-making, safety of therapy, health care consumption, and sustainability of health systems. Single conditions have long been the traditional model of designing clinical practise guidelines and disease-specific models of care. Nevertheless, these methods are not always sufficient, and even dangerous, when used in patients with a combination of chronic illnesses. Prescribing on guidelines in multimorbid patients often leads to polypharmacy, growing regimen complexity, and rising the risks of adverse drug reactions, hospitalizations, functional deterioration, and death (Muth and Glasziou, 2015; Wimmer et al., 2016). Consequently, there is an increasing challenge among the clinicians in balancing evidence-based treatment with a personalised patient-centred care.

These patterns of multimorbidity have been shown to be not random, but are concentrated around some common biological processes, behavioural risk factors, and social determinants, as presented by epidemiological and clinical studies. The most common patterns that are reported in adult and older populations are cardiometabolic, neuropsychiatric, and musculoskeletal disease clusters (Mino-Leon et al., 2017; Forslund et al., 2021). Mental disorders, substance abuse, and persistent stress also increase the disease burden and treatment complexity especially among socially and economically disadvantaged populations (Ashifa, 2020; Elkin et al., 2025). In addition to biological factors, there are occupational exposures, gender roles, ageing, and health system constraints that contribute to multimorbidity to a large extent. Research in high-risk groups of women, tribe groups, and older individuals shows both compound disease burden and poor access to integrated care (Ashifa, 2019; Vettriselvan and Anto, 2018; Ashifa, 2022). These facts explain why an integrated, complexity-based solution that goes beyond disease-centred approaches is necessary. The article will discuss the trends of multimorbidity and therapeutic complexity within the adult medical practise especially with a focus on polypharmacy and patient-centred care. The review uses a compilation of evidence provided by epidemiological and clinical research, as well as systems-level scholarship, to identify new challenges and innovations that can be used to create safer, more organised, and more person-centred care to adults with multiple chronic conditions.

CONCEPTUALIZING MULTIMORBIDITY AND DISEASE PATTERNS

Multimorbidity is now understood as a non-random, complex phenomenon, which has patterns of disease clustering, and cannot be seen as a mere disease accretion. Initial conceptualisations considered multimorbidity in a more numerical sense of the number of diseases. Nevertheless, the modern studies focus on the need to comprehend underlying patterns, common pathophysiological pathways, and contextual determinants according to which disease co-occurrence is organised (Olson et al., 2018; Sturmberg et al., 2021). Recurrent patterns of multimorbidity prevalence in adult populations have been demonstrated repeatedly in epidemiological studies with the use of cluster analysis and population-based designs. The most common and clinically important patterns include cardiometabolic clusters, including hypertension, diabetes mellitus, dyslipidemia, and cardiovascular disease that can be associated with high healthcare utilisation and risk of dying (Mino-Leon et al., 2017; Lu et al., 2021). Neuropsychiatric clusters, such as depression, anxiety, schizophrenia, and cognitive impairment, are often comorbid with physical conditions of chronic nature, which makes it more difficult to adhere to the treatment regimen and achieve functional outcomes (Ashifa, 2020; Langenberg et al., 2023). Metabolic and mental health disorders are also common causes of the muscle skeletal and pain conditions that lead to disability and impaired life quality.

Multimorbidity patterns are also further explained using medication-based analyses in terms of prescribing patterns. Scholarly research in primary and secondary care indicates that there are unique clusters of medications that are indicators of underlying disease groupings, and polypharmacy is not only a manifestation of therapeutic complexity but also a cause (Guisado-Clavero et al., 2019; Forslund et al., 2021). The above findings highlight the interdependence between disease clustering and treatment burden. The concept of

ageing is central in defining the patterns of multimorbidity. Not only do older adults have more chronic conditions, but interdependence of diseases between each other is also increased due to accumulated biological wear, immune dysregulation, and functional deterioration (Aggarwal et al., 2020; Roller-Wirnsberger et al., 2020). Nevertheless, the case of multimorbidity does not concern the elderly only. Complex disease clusters tend to arise at the earlier stages of life among populations which are affected by substance use, occupational stress, or even social disadvantage (Ashifa, 2020; Vettriselvan and Rajan FSA, 2019). Multimorbidity configurations are also affected by social and environmental determinants. Studies in tribal communities, women in high-risk jobs, and socio-economically vulnerable groups prove that low access to preventive care, work environments that are hazardous, and chronic psychosocial stresses lead to specific patterns of diseases that are often more severe (Ashifa, 2021; Vettriselvan and Anto, 2018). These observations underscore the shortcomings of biomedical models exclusively and they support the argument of contextual frameworks. On the whole, pattern-based and complexity-informed conceptualization of multimorbidity offers a better description of clinical reality. These views play a critical role in informing risk prioritization and influencing therapeutic decision-making and developing integrated care models with biological and social aspects of chronic disease.

THERAPEUTIC COMPLEXITY AND POLYPHARMACY IN MULTIMORBID ADULTS

The clinical issue that has one of the most impactful effects on adult medicine is therapeutic complexity as a result of multimorbidity. With the accumulation of several chronic conditions, patients are being prescribed many drugs, and these are usually prescribed in accordance with disease-specific clinical guidelines that fail to consider the coexisting diseases. This often leads to polypharmacy that is often defined as the use of five or more drugs at the same time, which is nowadays regarded as a trademark of multimorbid care (Aggarwal et al., 2020; Roughead et al., 2011). Treatment methods suggested by the guidelines are evidence-based in single ailments but cause unintended effects when used in combination with other conditions in complex patients. As Muth and Glasziou (2015) show, the strong compliance with various clinical guidelines may result in the overload of medications, drug-drug interactions, and contradictory therapeutic priorities. Polypharmacy and complexity of regimen has always been associated with negative clinical outcomes. The evidence provided by population-based cohort studies indicates that greater complexity of medication regimen correlates with all-cause mortality, hospitalisation, falls, and functional loss in elderly people (Wimmer et al., 2016). In a similar line, the authors of studies on older patients with cancer note that, in addition to the severity of the disease, functional status, comorbidity, and social support contribute to the complexity of treatment, indicating the multidimensionality of the treatment burden (Oliveira et al., 2024).

Another important issue in multimorbid populations is medication appropriateness. Deprescribing has been a broadly studied issue in adults with more than one chronic condition, with inappropriate prescribing (unnecessary prescribing, inappropriate dosage, and lack of deprescribing) being the most frequently reported (Guisado-Clavero et al., 2019; Ioakeim-Skoufa et al., 2025). The latter are especially evident among individuals with neuropsychiatric illnesses, drug addictions, and chronic stress that combines with an overlapping pharmacotherapy and increases the likelihood of adverse effects and low adherence (Ashifa, 2020; Elkin et al., 2025). In addition to pharmacological factors, the complexity of the therapeutic process is determined by system-level and patient-level determinants. The inability to handle complex treatment regimens is complicated by cognitive impairment, poor health literacy, financial limitations, and disjointed care routes (Wallace et al., 2015). Research with socially vulnerable populations, such as tribal communities, informal occupation women and older adults alone, shows how social disadvantage enhances the treatment burden and impacts on effective self-management (Ashifa, 2021; Ashifa, 2022). Complexity science can provide a useful perspective to reexamine therapeutic decision-making in the practise of multimorbidity. This approach focuses on flexibility, sensitivity to specific context, and collaborative relationships between patients and clinicians instead of considering complexity as a problem that can be simplified (Sturmberg et al., 2021). In this perspective, the best care is associated with balancing possible benefits and harms, focusing on patient objectives, and acknowledging uncertainty as one of the characteristic features of multimorbid care. New technologies are offering hopeful opportunities in the treatment of therapeutic complexity. Precision medicine methods use clinical data and bio markers to manage treatments more efficiently, which can

minimise useless medications (Devi et al., 2025). Medication review, adherence monitoring, and shared decision-making can be facilitated by the digital health tools and machine learning applications, which would increase safety and coordination of complex care settings (Catherine et al., 2025; Swadhi et al., 2025). Overall, therapeutic complexity and polypharmacy are the key issues in adult multimorbid care, and they have far-reaching consequences on patient safety, quality of life, and sustainability of the health system. To overcome these challenges, prescribing must change away from a guideline-based, disease-focused approach to a patient-focused and complexity-based approach to therapeutic interventions.

DETERMINANTS OF MULTIMORBIDITY

Multimorbidity is not only a result of biological ageing but rather is a product of a complex or constellation of demographic, psychosocial, occupational and environmental determinants that interact throughout life. Age is still one of the most powerful predictors of multimorbidity, and physiological wear, dysregulation of the immune system, and diminishing functional reserves put people at risk of developing various chronic diseases (Aggarwal et al., 2020; Roller-Wirnsberger et al., 2020). Nonetheless, modern evidence underlines that ageing is not the only factor that can be used to explain the heterogeneity of multimorbidity patterns in adults. Mental health has a very significant role in the creation and further evolution of multimorbidity. Physical diseases like diabetes, cardiovascular disease, or musculoskeletal disorders are often accompanied by depression, anxiety, schizophrenia, and chronic stress, and form a two-way path of disease escalation (Ashifa, 2020; Langenberg et al., 2023). Research shows that patients with mental health patients tend to have a high rate of poor treatment adherence, unhealthy coping behaviours, and a faster rate of functional degradation, which lead to an increase in therapeutic complexity and healthcare use (Elkin et al., 2025; Zahoor et al., 2025). Cognitive impairment and attentional deficits caused by chronic stress also exacerbate the self-management of multimorbid patients (Ranganathan et al., 2024).

The social determinants have a strong impact on the trajectories of multimorbidity. There is the role of socio-economic disadvantage, low educational attainment, restricted healthcare access, and social isolation in the earlier development and increased severity of a number of chronic conditions. Studies carried out with tribal communities and marginalised groups prove that the impact of structural inequities and insufficient preventive care leads to the development of advanced disease manifestation and multimorbidity (Ashifa, 2021). On the same note, research centred on older adults in the COVID-19 pandemic reveals the harmful impacts of social isolation and broken support networks on physical and psychological health (Ashifa, 2022). Another very important and yet underestimated determinant of multimorbidity is occupational factors. The women working in informal, risky, or physically challenging jobs are more exposed to occupational stressors, environmental toxins, and unfavourable working conditions which cause increased clustering of chronic diseases (Ashifa and Ramya, 2019; Vettriselvan and Anto, 2018). Occupational health research also indicates that the workload forces, shift work, and emotional labour are also actively subjecting healthcare workers to multimorbidity related to stress (Gayathri et al., 2025a; Gayathri et al., 2025b).

Other life-course factors that lead to multimorbidity risk include early marriages, substance abuse, and digital addiction. There is a relationship between early-life social stressors and unhealthy behaviours with long-term morbidity and lack of resilience in adulthood (Vettriselvan et al., 2025; Ashifa, 2020). The new evidence regarding smartphone and internet addiction indicates that there are more mental and physical health consequences that can add to the existing disease burden (Vettriselvan et al., 2025). In general, multiple morbidity represents the effect of ageing, mental health, social inequalities, and occupational exposures. These determinants should be identified in order to come up with preventive mechanisms, clinical intervention programmes, and patient-centred models of care that consider the medical and situational aspects of health.

INNOVATIONS, PATIENT-CENTRED CARE, AND SYSTEM RESPONSES

The increasing rates of multimorbidity and complexity in patient therapy have led to the rise of interest in new patient-centred, innovative, and system-level solutions that go beyond the conventional disease-centred models of care. Modern strategies focus on the concepts of coordination, personalization, and empowerment as the main aspects in the management of complex chronic conditions in adult-based medical practise. Patient centred care has become a paradigm of managing multimorbidity. Instead of focusing on disease-specific targets, patient-centred approaches put a strong focus on individual goals, functional ability, quality of life, and shared decision-making. It has been indicated that patient treatment planning can increase adherence, decrease the use of unnecessary medications, and boost treatment satisfaction, especially in individuals with complicated treatment plans (Wallace et al., 2015; Ioakeim-Skoufa et al., 2025). Community and self-help programmes among the aged also show how social engagement and peer support are useful in facilitating active ageing and lessening the reliance of the formal health services (Rasi & Ashifa, 2019). The response to multimorbidity in a system is becoming more and more influenced by digital transformation and artificial intelligence (AI). Patient engagement, medication adherence, and care coordination using machine learning-based tools have provided a solution to the challenge of complex care delivery, which is scalable (Catherine et al., 2025; Swadhi et al., 2025). Precision medicine models utilise clinical data and network-based analytics to better customise interventions thus streamlining redundancy in therapeutics and maximising the outcome of multimorbid populations (Devi et al., 2025).

Another dimension of innovation that is significant is rehabilitation and assistive technologies. Recent achievements in rehabilitation robotics, adaptive motion planning, and patient education models have been reported to be beneficial in enhancing functional recovery, autonomy, and long-term quality of life of individuals with chronic and disabling illnesses (Venice et al., 2026; Vettriselvan et al., 2026). The long-term effects of multimorbidity can be reduced by empowerment of the patients with the help of organised education and rehabilitation processes and decrease the need of patients to turn to high-intensity medical services. Organisational and workforce strategies are essential at a systems level in maintaining patient-centred care. Studies in the field of healthcare management reveal that occupational health, working-life balance, and enabling organizational cultures are significant in ensuring resilience and quality of care in the workforce (Gayathri et al., 2025a; Gayathri et al., 2025b). Other factors such as strategic partnerships, online marketing, and innovativeness-based healthcare models also add to the adaptability and sustainability of the system (Vettriselvan, 2025; Vijayalakshmi et al., 2025). These innovations, combined, highlight the importance of multifaceted, technology-driven, and patient-centred systems that could help to deal with the complexities of multimorbidity, and therapeutic complexity in adult care.

CONCLUSION

Adult medical practise has developed into multimorbidity and therapeutic complexity, which have destabilised conventional disease-focused models of care. It is emphasised that patterns of multimorbidity are influenced by linked biological, psychological, social, occupational factors, which lead to heterogeneous disease clusters and increasing treatment burden. Polypharmacy and complexity of medication regimen can be considered a significant effect of guideline-based care in multimorbid populations, especially to patient safety, functional outcomes, and health system sustainability. The solution to these problems is a paradigm shift to patient-centred, complexity-informed care which puts the personal goals, contextual elements, and shared decision-making at the forefront. Digital health, artificial intelligence, precision medicine, rehabilitation and patient education are some of the promising tools that can be used in supporting more coordinated and personalised therapeutic approaches. Nevertheless, the technological solutions have to be incorporated into just, ethically controlled, and systems supported by the workforces. Finally, multimorbidity management in adult medical care requires a collaborative solution between clinical practise, social support, and healthcare innovation at a system level, which would provide safer, responsive, and sustainable healthcare services to patients with more than one chronic condition.

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