UNIVERSITI TEKNOLOGI MARA

EXPLORATORY ANALYSIS USING MACHINE LEARNING OF PREDICTIVE FACTORS FOR FALLS IN OLDER ADULTS WITH AND WITHOUT TYPE 2 DIABETES

NURUL EARLIANA BINTI NORDIN

Thesis submitted in fullfillment
of the requirements for the degree of
Master of Health Sciences
(Physiotherapy)

Faculty of Health Sciences

October 2025

ABSTRACT

Falls remain a pressing public health concern among older adults, often resulting in significant physical, psychological, and financial consequences. The risk is notably higher among individuals with type 2 diabetes mellitus (T2DM) due to complications such as peripheral neuropathy, musculoskeletal impairments, and psychological distress. This study aimed to identify predictive factors for falls among community-dwelling older adults in Sarawak, with and without T2DM, using traditional statistical analysis and a machine learning approach specifically the Multilayer Perceptron (MLP) model. A cross-sectional dataset was collected from adults aged 60 and above, incorporating both intrinsic (e.g., balance, strength, fear of falling) and extrinsic (e.g., environmental hazards) risk factors. Data were pre-processed using normalization, outlier removal, and imputation techniques. Logistic regression and 10-fold cross-validated MLP models were applied to explore predictive patterns. Key results showed that the MLP model achieved higher prediction accuracy compared to traditional methods. Physically, lower extremity muscle weakness and impaired mobility (measured by TUG and HGS) were significant predictors. Psychologically, high fear of falling (FES-I) and low balance confidence (ABC Scale) were associated with increased fall risk. Older adults with T2DM displayed a distinct fall risk profile, marked by reduced proprioception and greater psychological concern. These findings highlight the need for tailored fall prevention strategies that consider both physical and psychological components, particularly in older adults with T2DM. Integrating machine learning into clinical assessments could enhance early identification and guide personalized interventions. This study contributes to the growing evidence supporting the use of AI-driven tools in geriatric care and establishes a foundation for future public health initiatives targeting fall prevention among high-risk populations.

ACKNOWLEDGEMENT

Firstly, I would like to express my deepest gratitude to God for giving me the strength, guidance, and opportunity to embark on this master's journey and to successfully complete my thesis despite the challenges along the way.

I would like to extend my heartfelt appreciation to my supervisor, Dr. Noor Azliyana Binti Azizan, and my co-supervisor, Prof. Madya Ts. Dr. Abdul Hadi Bin Abdul Razak, for their invaluable guidance, encouragement, and support throughout the development of this thesis. Their expertise and constructive feedback have been pivotal in shaping my research.

To my beloved family, especially my mother Puan , I am profoundly grateful for your unwavering love, patience, and encouragement throughout this journey. Your belief in me has been my greatest source of strength.

I am profoundly grateful to all my friends for their unwavering support throughout this journey. I would like to express my heartfelt thanks to Nor Azreen Omar, whose constant motivation and encouragement have been a driving force behind my efforts. I also extend my sincere appreciation to Chan Wen Sze, Mohd Aslam Bin Jamail, and Nor Hani Zaini, whose generous dedication of time and effort during the data collection process significantly enriched this project. Their collaborative spirit and invaluable assistance not only facilitated the smooth progress of my work but also made the entire experience more rewarding. Thank you all for your steadfast support and for being an integral part of this journey.

Finally, to everyone who has contributed to this journey in ways big or small, thank you for your kindness and encouragement. This achievement is a result of collective effort, and I am truly blessed to have had such incredible support along the way.

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CHAPTER 1
INTRODUCTION

1.1 Research Background

The global population is aging at an unprecedented rate, driven by advancements in healthcare, technology, and improved living conditions. By 2030, approximately 1.4 billion individuals worldwide will be aged 60 and above, representing 13% of the global population, with 80% residing in developing countries (Mitchell & Walker, 2020). By 2050, this number is expected to double to 2.1 billion, creating significant social and healthcare challenges (United Nations et al., 2017). Malaysia is not exempt from this trend, and by 2030, older adults will make up 15% of the national population, officially classifying Malaysia as an aging nation (Abdullah et al., 2024).

In Sarawak, the aging trend is also evident. According to the Department of Statistics Malaysia (2023), individuals aged 60 and above made up 9.6% of Sarawak's population in 2020, and this figure is projected to rise to 12.6% by 2028. Despite this demographic shift, there is a paucity of localized data on fall-related injuries and hospitalizations among older adults in Sarawak. However, studies indicate that falls are a significant concern among the elderly in Malaysia, with prevalence rates ranging from 4.2%) to 47%), depending on the setting. This underscores the need for targeted research and intervention strategies in regions like Sarawak.

As life expectancy increases, older adults become more susceptible to age-related health challenges, with falls representing a major public health concern. Falls in older adults lead to physical injury, emotional trauma, and economic burden (Vaishya & Vaish, 2020). They are a leading cause of disability and hospitalization, contributing to loss of independence and reduced quality of life. In Malaysia, the incidence of falls among older adults is approximately 8.5 per 100 person-years, with recurrent falls affecting 3.2 per 100 person-years (Ooi et al., 2021). These statistics underscore the urgent need for proactive and localized fall prevention strategies.

The consequences of falls extend beyond physical harm, encompassing psychological effects such as fear of falling, which may lead to reduced physical activity, social isolation, and increased dependency (Gavin et al., 2024). This fear