# ASSESSMENT OF THE GENERAL MEDICATION ADHERENCE SCALE AND RELATION TO MEDICATION BELIEF AMONG GERIATRIC PATIENTS ATTENDING A PRIMARY HEALTHCARE CENTRE IN THE STATE OF NEGERI SEMBILAN, MALAYSIA

**PAYAL CHOUDHURY A/P PK CHOUDHURY**

**UNIVERSITI SAINS MALAYSIA**

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**by**

**PAYAL CHOUDHURY A/P PK CHOUDHURY**

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## LIST OF ABBREVIATIONS

| | |
|---|---|
| WHO | World Health Organisation |
| MPR | Medication Possession Ratio |
| EMP | Electronic Medication Packaging |
| MEMS | Medication Event Monitoring System |
| MAQ | Medication Adherence Questionnaire |
| MMAS-8 | 8-item Morisky Medication Adherence Scale (MMAS-8) |
| MARS | Medication Adherence Report Scale (MARS) |
| SEAMS | The Self-Efficacy for Appropriate Medication Use Scale (SEAMS) |
| BMQ | Belief about Medicines Questionnaire |
| DAI | Drug Attitude Inventory |
| GMAS | General Medication Adherence Scale |
| PBNA | Patient Behaviour Non-Adherence |
| CRNA | Cost-Related Non-Adherence |
| CMA | Continuous, Multiple Interval Measure of Medication Acquisition |
| CMG | Continuous, Multiple Interval Measure of Medication Gaps |
| CSA | Continuous, Single Interval Measure of Medication Acquisition |
| CSG | Continuous, Single Interval Measure of Medication Gaps |
| DOSM | Department of Statistics Malaysia |
| RM | Malaysian Ringgit (Ringgit Malaysia) |
| USD | United States Dollar |
| DM | Diabetes Mellitus |
| ADPB | Additional disease and pill burden |
| CSM | Common Sense Model |
| NMRR | National Research Register of Malaysia |
| MREC | Medical Research and Ethics Committee |
| OPD | Outpatient Pharmacy Department and Mother |
| NCD | Non-communicable Disease Unit |
| MCH | Child Healthcare Unit |
| CFA | Confirmatory Factor Analysis |
| ESKD | End Stage Kidney Disease |

| | |
|---|---|
| SPSS | Statistical Package for the Social Sciences |
| MOH | Ministry of Health |
| VAS | Value Added Services |
| MyUBAT | Medicines Supply Management System |
| SMS | Short Message Services |
| UMP | Postal Courier Delivery |

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**PENILAIAN SKALA PEMATUHAN UBAT-UBATAN AM DAN KAITAN DENGAN KEPERCAYAAN TERHADAP UBAT DALAM KALANGAN PESAKIT GERIATRIK DI KLINIK KESIHATAN DI NEGERI SEMBILAN, MALAYSIA**

## ABSTRAK

Kepatuhan pengambilan ubat adalah satu isu yang sangat membimbangkan khususnya untuk golongan pesakit geriatrik. Ia amat penting dan perlu diberi perhatian yang tinggi, terutamanya di negara membangun seperti Malaysia. Kepercayaan pesakit tentang ubat mereka adalah salah satu komponen penting untuk pesakit memilih sama ada untuk mengambil ubat atau tidak. Di Malaysia, maklumat mengenai penyelidikan kepatuhan pengambilan ubat yang memfokuskan kepada persepsi pesakit, khususnya di kalangan geriatrik adalah minima. Tujuan kajian ini dijalankan adalah untuk menilai prevalens kepatuhan pengambilan ubat di kalangan pesakit geriatrik dan menentukan faktor yang mempengaruhi pematuhan ubat diantara kalangan pesakit geriatrik yang menjalani rawatan di Klinik Kesihatan dibawah Kementerian Kesihatan Malaysia. Kepatuhan pengambilan ubat diukur menggunakan borang soal selidik Skala Pematuhan Ubat-ubatan Am (GMAS). Soal selidik tentang Kepercayaan terhadap Ubat-ubatan (BMQ) digunakan untuk memperoleh pemahaman yang lebih baik tentang kepatuhan dan kepercayaan terhadap ubat-ubatan. Rekod ubat pesakit telah disemak untuk mengumpul dan mengesahkan demografi, diagnosis dan rawatan pesakit. Statistik deskriptif digunakan untuk menganalisis data demografi yang dikumpul iaitu min dan sisihan piawai. Nilai alfa (α) Cronbach telah dinilai. Kepentingan berkaitan parameter yang berbeza telah dinilai menggunakan ujian Chi-square. Spearman rho dan analisis regresi multivariate digunakan untuk menganalisis perkaitan antara kepatuhan dan kepercayaan. Sejumlah 250 pesakit geriatrik terlibat

dalam kajian ini. 49.6% pesakit mempunyai kepatuhan yang tinggi, manakala 26.8% mempunyai kepatuhan pengambilan ubat yang baik. Purata skor GMAS adalah 28.4 (SD=5.3), menunjukkan tahap pematuhan ubat yang baik. Majoriti pesakit mempunyai kepercayaan tinggi yang berlebihan terhadap penggunaan ubat berlebihan umum (*general-overuse*) (52.7%) dan kemudaratan umum (*general-harm*) yang dianggap majoriti kepercayaan rendah (75.2%). Purata umur pesakit adalah 64.27 tahun (SD=7.32). Majoriti pesakit diberi lima jenis ubat dan mempunyai purata sekurang-kurangnya tiga penyakit. . Analisis chi-square menunjukkan terdapat hubungan yang signifikan antara pematuhan ubat dengan jantina (p=0.034), pendapatan keluarga (p=0.023), status keluarga (p=0.049), kesedaran mengenai penyakit (p=0.054), dan penggunaan ubat yang terjejas oleh Covid-19 (p=0.021). Analisis chi-square juga menunjukkan terdapat hubungan yang signifikan antara kebimbangan 'kemudaratan' ubat dan pendapatan keluarga (p=0.04). Di sisi lain, antara kebimbangan 'berlebihan' ubat dengan etnik (p=0.02), status pendidikan (p=0.01), status keluarga (p=0.03) dan bilangan ubat (p=0.04).. Nilai alfa (α) Cronbach untuk GMAS(0.741) dan BMQ(0.775) adalah dalam kategori boleh diterima. Terdapat hubungan yang lemah atau tiada hubungan di antara 'berlebihan' umum (g*eneral-overuse*) dan 'kemudaratan' umum (*general-harm*) dengan kepatuhan pengambilan ubat. Hubungan pekali (*coefficient*) antara kedua-dua GMAS dan BMQ adalah negatif. Kesimpulannya, kadar kepatuhan pengambilan ubat adalah baik di kalangan pesakit geriatrik di Klinik Kesihatan. Majoriti pesakit berada dalam kumpulan kepatuhan tinggi. Disarankan agar skala ini digunakan untuk mengenal pasti kepatuhan pesakit terhadap ubat dan melakukan intervensi yang sesuai untuk meningkatkan kepatuhan terhadap ubat di kalangan pesakit geriatrik.

**ASSESSMENT OF THE GENERAL MEDICATION ADHERENCE SCALE AND RELATION TO MEDICATION BELIEF AMONG GERIATRIC PATIENTS ATTENDING A PRIMARY HEALTHCARE CENTRE IN THE STATE OF NEGERI SEMBILAN, MALAYSIA**

## ABSTRACT

Medication adherence is a specific worry in older adults. It imposes a more outstanding obligation for health care, particularly in developing nations such as Malaysia. It's also one of the most intriguing and perplexing behaviours displayed by patients, despite being critical in attaining good health outcomes. In Malaysia, there is a lack of information on treatment adherence research that focuses on patient perceptions, particularly in the elderly. The study aims to assess the General Medication Adherence Scale (GMAS) and its relation to medication belief among geriatric patients undergoing treatment in a primary health clinic setting. A cross-sectional study design was used. The GMAS was used to measure medication adherence, and the Beliefs about Medicines Questionnaire (BMQ) was used to assess medication beliefs. Descriptive statistics were applied to analyse the demographic data collected, namely mean and standard deviation. Cronbach's alpha (α) value was assessed. The significance of the associations of different parameters was evaluated using the Chi-Square test. Spearman's rho and multivariate regression analysis were used to analyse the association between adherence and belief. A total of 250 geriatrics patients were recruited where 49.6% of the respondents had high adherence, while 26.8% had good adherence. The mean GMAS score was 28.4 (SD=5.3), indicating good medication adherence. General-overuse perceived majority high belief of overuse (52.7%) and the general-harm perceived majority of low belief (75.2%). The mean age of the participants was 64.27 years (SD=7.32).

The majority of patients were given five types of medication with an average of three illnesses. Chi-square analysis revealed a significant association between medication adherence and gender (p=0.034), family income (p=0.023), family status (p=0.049), awareness of illness (p=0.054) and medication use affected by Covid-19 (p=0.021) Chi-square analysis revealed a significant association between general 'harm' and family income (p=0.04). On the other hand, between general 'overuse' and Ethnicity (p=0.02), education status (p=0.01), family status (p=0.03) and number of medications (p=0.04). Cronbach's alpha coefficients for GMAS (0.741) and BMQ (0.775) were acceptable. There was weak or no association between general 'overuse' and general 'harm' with medication adherence. The coefficient relationship between both GMAS and BMQ is negative. This study concludes that the GMAS is a reliable and valid tool for assessing medication adherence among geriatric patients attending primary healthcare centers. It is recommended that healthcare professionals use this scale to identify patients with poor medication adherence and provide appropriate interventions as well as address it accordingly to improve medication adherence among geriatric patients.

# CHAPTER 1

# GENERAL INTRODUCTION

## 1.1 Introduction

The elderly population in Malaysia is experiencing a steady growth like in other developing countries. The ageing process involves a progressive and irreversible decrease in organ function, which occurs over time even in the absence of injury, illness, or poor lifestyles such as unhealthy diet, lack of exercise, abuse of substances, and many others. The population thrives because of longer life expectancy, better health care facilities, and a greater awareness of a healthy lifestyle, especially in developing countries like India, China, Korea, Brazil, and Pakistan.

Medication adherence is a specific worry in older adults. However, multiple uses of medications among the elderly are widespread in treating various illnesses such as diabetes mellitus, hypertension, and dyslipidemia, as well as prolonging life expectancy, and improving quality of life (Gellad et al., 2011).

### 1.1.1 Medication Adherence

The World Health Organisation (WHO) defines medication adherence as "the extent to which an individual's medication-taking behaviour, diet schedule following or implementing changes in their routine consistent to the approved suggestions from a healthcare professional (Wolff, 2002). In addition, the term compliance to medicine is defined as "the extent to which a patient acts per the prescribed interval and dose of the dosing regimen" reported as a percentage of prescribed doses taken at the specified time interval (Sabate, 2003).

According to a study by WHO, medication adherence in developed nations was approximately 50%, primarily among chronic illness patients (Sabate, 2003). This may result in poor treatment outcomes, higher morbidity and mortality rates, and

unnecessary healthcare costs. On the contrary, medication adherence, where recommended drugs are taken at the correct portions and times in the way determined, has appeared to improve well-being results and decrease healthcare costs. On the contrary, non-adherence is strongly associated with treatment adequacy and sickness improvement with the consequent danger of risk of medication reactions.

Although many treatment decisions are available, only one-third of persistent illnesses adhere to their medication regimen. Medication adherence is a common problem in deciphering viable treatments in clinical practice research settings (Schubert, 2006). Depending on the complexity of the recommended medication regimen, 40% of patients largely fail to comply with their medication (Boustani, 2003). When complex medication regimens with different needs, such as lifestyle changes, were combined, medication non-compliance was rated at 70% (Qato, 2008).

### 1.1.2 Geriatric

In 2019 United Nations stated that there were approximately 703 million people aged 65 and above throughout the world. Eastern and South-Eastern Asia (260 million) had the majority of the elderly population in the world, followed by Europe and Northern America (over 200 million) (United Nations, 2019). Ageing is an unavoidable process usually assessed chronologically by a person 65 years old and above. Therefore, they are commonly also known as 'elderly' or 'geriatrics.' Geriatrics is a subspecialty of internal medicine that promotes health in older adults. According to the National Health Policy for Older Person defines that those aged 60 and above are under the geriatric category in Malaysia (NPOPs, 2011).

People aged above 60 in the global population is projected to increase by 2050 to 2 billion, up from 2015, which was 900 million. It is believed that 125 million individuals are above the age of 80 now. China will have almost as many people (120

million), and the globe will have 434 million individuals in this age category by 2050. 80% of the world's elderly will be living in low- and middle-income nations (WHO, 2015).

Globally, the rate of population ageing is also rapidly increasing. While the transition in population distribution toward older ages began in high-income nations, it is primarily now taking place in low- and middle-income countries. For example, between 2000 and 2015, people aged 60 or older grew by 54% in developing nations, compared to 61%. (United Nations, 2015). On the other hand, Brazil, China, and India will have little more than 20 years to adjust (WHO, 2015).

In Malaysia, the elderly population reached 28.3 million in 2010 and 38.6 million in the following 30 years. It is estimated that 70% of the total elderly population will increase by 2020. More than 10 million more are older adults; seven of the 15 countries, including Malaysia, are developing countries. In addition, it is estimated that by 2050 Malaysia will have more than 43 million people (15.8% of the total population) for more than 60 years, as opposed to and as of now 11.6 million (6.5% of the total population).

Today, the tendency of people to live longer and the declining birth rate can lead to an increase in the adult population. These circumstances have led to chronic illness and higher treatment costs. People who accommodate the elderly need to consider the fundamental changes when planning health programs. Geriatric Education Centers are government-funded projects to train medical service providers for older adults in the United States. The majority of the ageing population lives in developing countries (60% of the 580 million worldwide) (Ruscin, 1986).

Older adults affect their families and communities in a variety of ways. The scope of these effects is determined mainly by one factor: health. Suppose individuals

enjoy these additional years of life in excellent health and live in a positive environment. In that case, their potential to perform the things they did will be unique from a younger person and can be the source of teaching and learning process to a younger generation. On the other hand, if physical and mental problems drive these additional years, the repercussions for older individuals in the communities will be more damaging.

### 1.1.3 Measurement of Medication Adherence

Assessment of medication adherence is essential based on factors designed to improve medication adherence in individuals. However, imprecise estimation of medication adherence can lead to various issues, which can be expensive and alarming. A precise need to measure medication adherence is clear. Thus, there is a need for the accurate evaluation of medication adherence to successfully improve medication adherence. Current practices for measuring medication include direct measures such as drug assays of blood or urine as well as indirect measures of medication adherence such as pill count, electronic monitoring devices, and the use of big data such as review of prescription records and claims (Zang et al., 2016, Lam et al., 2015).

Reliable assessments of medication adherence will give more significant evidences on the repercussions, predictors/risk factors, and measures to increase medication adherence. On the other hand, evaluating medication adherence can be difficult because the acceptable adherence parameters must be carefully defined and customised to each scenario.

Numerous tools are available to measure adherence with validity, reliability, and sensitivity to changes. The approach used to assess medication adherence should focus on the individual's characteristics and the study's or clinical setting's goals and

resources. Unfortunately, a gold standard cannot yet be established for any available methods; hence a mixture of methods is recommended (Farmer, 1991).

Adherence can be evaluated using a variety of methods categorised as indirect objective and subjective methods and direct methods (George et al., 2008, Jimmy et al., 2011). Table 1.1 summarises the strength and weaknesses of the methods.

**Table 1.1 Summary of methods used for assessment of medication adherence**

| No | Method | Strength | Weakness |
|---|---|---|---|
| **Direct Method** | | | |
| 1 | Biomarkers Laboratory test/ Bioassay/ Detection of chemical in body fluid | • Evidence that medication was taken.<br>• Accurate<br>• Verification of recent use of medication | • Expensive and biased (white coat adherence)<br>• Invasive procedure involved<br>• Interactions with other drugs or food<br>• Qualified staff is required to perform the procedure. |
| **Indirect Subjective Method** | | | |
| 2 | Measuring involving clinician assessments and self-report questionnaire, interviews, and diaries | • Economical, Simple, Easy, and Practical<br>• Belief and barriers to adherence pattern identified.<br>• Validated well | • Bias response<br>• Patients' ability to recall past adherence related behaviour reduces accuracy<br>• Validity varies with the quality of the questionnaire and communication skills of the interviewer |
| **Indirect Objective Method** | | | |
| 3 | Pill Count | • Economical, Simple, Easy, and Practical<br>• It does not rely on patient's memory<br>• It can be used in several models<br>• Precise | • It depends on patients to bring in medication<br>• Information about adherence problem not provided<br>• Pill counting takes time and records the data<br>• Early replenishment causes underestimation. |

**Table 1.1 Continued.**

| No | Method | Strength | Weakness |
|---|---|---|---|
| 4 | Medication Possession Ratio (MPR)/ Prescription Refill | • Records quantity and frequency of medications received by the patients.<br>• Provide data on the average level of adherence over time<br>• Enables evaluation of multidrug adherence | • Fail to detect partial adherence and barriers for the detected non-adherence<br>• Depending on a completed pharmacy record/database<br>• It may is not accurate as assumptions are made as medication taken by the patient is not confirmed |
| 5 | Measures involving Electronic Medication Packaging (EMP) devices<br>E.g., Medication Event Monitoring System (MEMS) | • High accuracy<br>• Convenient<br>• Data about adherence pattern provided, including partial adherence (measuring of medication-taking time) | • Expensive<br>• Technical assistance is necessary.<br>• Medications taken by the patient cannot be confirmed.<br>• Pressure to patients<br>• If there is interference from patients or other devices, the results will be misleading. (e.g., Place the medicines in a different container. ) |

### 1.1.3(a) Direct Method

Direct measures include measuring the concentration of the drug or its metabolite in body fluids such as urine samples, saliva, or blood and evaluating the presence of a biomarker correlated with medication adherence. Although direct measures are considered the most accurate and can be used as physical evidence to confirm the patient has taken the medication, they just produce a Yes/No result without indicating any pattern of non-adherence or its reasons (Lam et al., 2015).

### 1.1.3(b) Indirect Subjective Method

This method involves a number of methods that assesses medication adherence by depending on the patient's self-report. Their everyday use in clinical practice is due to their affordability, flexibility, practicality, convenience, and actual feedbaExamplesmples of indirect methods are structured interviews, online evaluations, written questionnaires, voice response systems, and diaries. Indeed, the disadvantages of this kind of method must not be overlooked. Inaccurate information provided by patients, intentionally or accidentally, or poor communication skills and questions prepared by interviewers and the sampling procedure, can all contribute to the low accuracy and precision (Lam et al., 2015). Furthermore, negative questions, suggesting that patients do not administer their prescription, may also contribute to research biasness. Table 1.2 summarises of self-report questionnaire and scales.

**Table 1.2 Summary of self-reported questionnaires and scales**

| Scales | Target Population(s) | Function(s) | Advantages | Disadvantage(s) |
|---|---|---|---|---|
| Medication Adherence Questionnaire (MAQ) | • All validated conditions | • Adherence Barriers | • Validated in various illnesses/disease states and low literacy individuals<br>• The fastest way to assess | • Appropriate for initial screening |
| 8-item Morisky Medication Adherence Scale (MMAS-8) | • All validated conditions | • Adherence Barriers<br>• Medication administration behaviour | • Higher validity and reliability in individuals with chronic illnesses than MAQ | |
| Medication Adherence Report Scale (MARS) | • Chronic mental illness (especially Schizophrenia) | • Adherence Barriers<br>• Belief of adherence | • Simple Scoring<br>• Strong positive correlations compared to DAI and MAQ | • Generalisation is limited |
| The Self-Efficacy for Appropriate Medication Use Scale (SEAMS) | • All validated chronic conditions | • Adherence Barriers | • High internal consistency in high or low literacy individuals | • Time-consuming |
| Brief Medication Questionnaire | • Depression<br>• Diabetes | • Adherence Barriers<br>• Medication administration behaviour | • Assess Multidrug regimen<br>• Self- administered | • Time-consuming |
| Hill-Bone Compliance Scale (Hill-Bone) | • Black patients<br>• Hypertension | • Adherence Barriers<br>• Medication administration behaviour | • High internal consistency | • Generalisation is limited. |
| General Medication Adherence Scale | • All validated conditions | • Adherence Barriers<br>• Medication administration behaviour | • High validity and reliability<br>• Measures patient behaviour, pill burden, and cost-related non-adherence | |

### 1.1.3(b)(i) Questionnaires and Scales.

These subjective methods were initially developed to reduce the shortcomings of existing self-report tools by standardising the measurement of medication adherence. (Farmer, 1991, Lam et al., 2015). Such questionnaires are often verified against other subjective and objective measures and come in various formats to fit multiple situations, such as a wide range of diseased populations or in many languages. Patients or caregivers should be completing the self-report questionnaires. Patients with low literacy levels, on the other hand, may find questionnaires challenging to complete. Adherence beliefs are linked to personal worries about medication safety or the necessity of adhering to the prescribed regimen. Most of the scales analysed have a permissible limit. The classification is justified or based on clinical outcomes or the researcher's knowledge.

***Brief Medication Questionnaire***

The Brief Medication Questionnaire evaluates a patient's medication-taking habits and medication adherence challenges. Because the abbreviation of BMQ commonly refers to the Belief about Medicines Questionnaire, the Brief Medication Questionnaire is not written as BMQ. The Brief Medication Questionnaire consists of three sections: a 5-item regime screen, a 2-item belief screen, and a 2-item recall screen. It is a popular questionnaire among healthcare professionals as it assesses patients' medications taking patterns (Lam et al., 2015). However, it was first proposed for depression and diabetes treatment, and ideally, it evaluates the patients' prescription regime before administration. As a result, the whole procedure may take more time than other questionnaires, making it difficult to assess at the point of service. (Lavsa et al., 2011, Lam et al., 2015).

### *Hill-Bone Compliance Scale (Hill-Bone)*

Hill-Bone has a limited generalisation to assess patients' medicine-taking habits and challenges to adherence because it is specific to patients on antihypertensive medication. The assessment is scored on a 4-point Likert-type scale and includes three subscales: sodium consumption, medication-taking behaviour, and appointment-keeping skills. It was tested in various populations where it has been validated for the urban black and community-dwelling older adults for both 14-item and 9-item. (Lavsa et al., 2011, Lam et al., 2015). Therefore, this instrument has been identified as a good fit for hypertension studies in a primarily black community.

### *Medication Adherence Questionnaire (MAQ)*

The Morisky Adherence Questionnaire (MAQ) is often referred to as the Morisky Scale and the 4-item Morisky Medication Adherence Scale (MMAS-4) (Lam et al.,2015). It is the fastest to administer and assess, but due to the length of time takes to complete it, the tool can only highlight challenges to adherence. (Lavsa et al., 2011, Lam et al., 2015). In addition, the closed-ended questionnaire design with a "yes-saying" tendency allows for the reporting of non-adherence (Lavsa et al., 2011, Tan et al., 2014). Finally, since it is verified in the larger spectrum of illness and low literacy individuals, it is the most used scale for research (Lavsa et al., 2011, Culig et al., 2014).

### *Eight-Item Morisky Medication Adherence Scale (MMAS-8)*

Morisky et al. created this 8-item MMAS (MMAS-8) in 2008 based on the MAQ. The first seven items are Yes/No answers, while the last item is a 5-point Likert answer. The newly added items in MMAS focus on medication-taking behaviours, particularly concerning medication underuse, like forgetfulness, and better detect

adherence barriers (Tan et al., 2014, Lam et al., 2015). Hence, it is suggested to serve as a measurement tool for validated illnesses in clinic settings.

***The Self-Efficacy Appropriate Medication Use Scale Scale (SEAMS).***

This 13-item, 3-point Likert-type questionnaire focuses on self-efficacy in chronic disease management while still assessing barriers to medication adherence. The SEAMS may be challenging to evaluate due to its length. However, it has been proven accurate in many chronic diseases. As a result, SEAMS is regarded as a proper self-report method for assessing medication adherence in treating chronic illnesses (Lavsa et al., 2011, Tan et al., 2014).

***Medication Adherence Report Scale (MARS)***

MARS evaluates both beliefs and barriers to medication adherence (Nguyen et al., 2014, Tan et al., 2014). It is based on the Drug Attitude Inventory (DAI), a widely used psychiatric adherence questionnaire. It aims to address DAI's limitations by integrating questions from MAQ. As a result, this measure is only appropriate for people with chronic mental illness.

***The General Medication Adherence Scale (GMAS)***

GMAS is an 11 items 4-point Likert-type questionnaire. The GMAS was first developed to evaluate patient adherence to factors such as cost, co-morbidity, and pill burden, which affect medication adherence (Naqvi et al., 2018a, Naqvi et al., 2019a). The GMAS is used to evaluate medication adherence across three categories, which are patient behaviour non-adherence (PBNA) (unintentional and intentional), cost-related non-adherence (CRNA), and co-morbidity and pill burden-related non-adherence (ADPB) (Naqvi et al., 2018a, Naqvi et al., 2019a). Medication adherence is recorded

separately for each category and in the overall total. It is thus recommended as a measuring tool for verified illnesses in clinical settings. GMAS psychometric testing was performed on 196 individuals with various chronic diseases (including diabetes mellitus, hypertension, chronic obstructive pulmonary disorder, asthma, chronic kidney disease, liver diseases, etc.) (Naqvi et al., 2019a). The GMAS was shown to be a stable instrument with high internal consistency, according to the study's findings.

#### 1.1.3(b)(ii) Patient-kept Diaries

It is the only self-report tool requiring consistent documentation on how the patient follows their prescribed regime. Nevertheless, overestimation, unreliability, and the inability to evaluate if the patient does not return the diary or the reported "false" increase in the patient's adherence rate is highly prevalent (Lam et al., 2015).

#### 1.1.3(b)(iii) Patient Interviews

It is a direct patient-centred strategy to assist patients in understanding and overcoming uncertainty so that adaptive responses are facilitated. Health professionals interviewing patients is a convenient, low-cost subjective technique of assessing patient adherence. Patients may be asked to evaluate their medication behaviour, miss dose, knowledge about medication, including drugs' name, indication, and schedule. Then their adherence level is assessed and determined by the healthcare professionals (Lam et al., 2015).

### 1.1.3(c) Indirect Objective Method

#### 1.1.3(c)(i) Measures Involving Secondary Data Analysis

Indirect objective methods include pill counts, pharmacy refill record data, and electronic adherence monitoring. Adherence to refills considers that patient medication refill patterns correlate to the patient's medication-taking behaviour. Moreover, these

calculations assume that the prescription is taken as advised. Consequently, these evaluations cannot identify partial adherence, in which patients merely take a portion of their medicine within a given time (Lam et al., 2015).

***Medication Possession Ratio (MPR)***

MPR is the amount (or percentage) of days' supply received during a refill period, where the last refill is the endpoint or a fixed refill when a specific timeframe is given. It is applied in Human Immunodeficiency Virus (HIV) or depressed patients, though it is often used to evaluate the occasional use of asthma, medication, or allergies, and many more. Unfortunately, variability in the denominator of period makes MPR impractical for extensive population analysis. Thus, relevant correlation and standard would be needed to alter total adherence values. Therefore, elevated adherence values are obtained because the calculation technique ignores the intervals between refills, and multiple prescriptions are required for continuous therapy (Barner, 2010, Lam et al., 2015).

***Dichotomous Variable***

It assesses a cut-off value to identify partial adherence, adherence, and non-adherence. Compared to the continuous variable, it has lesser sensitivity, maybe because of its absence of pharmacological justification for determining the cut-off value. It significantly influences test findings' sensitivity and specificity (Barner, 2010, Lam et al., 2015).

***Continuous Multiple Interval Measure of Medication Acquisition (CMA).***

CMA is determined as the total day supplied received over a period divided by total days from start to end of the research period. The total CMA of all participants

represents the evaluation of the adherence-to-drug relationship and the adherence value of the whole research period (Barner, 2010, Lam et al., 2015).

***Continuous, Multiple Interval Measure of Medication Gaps(CMG).***

CMG assessments are generated by the number of days in therapy gaps divided by the period of interest to identify any time frames without drug exposure. Every negative result would be 0. It determines non-adherence levels for total durations without accounting for an early refill or overfilling (Barner, 2010, Lam et al., 2015).

***Continuous, Single Interval Measure of Medication Acquisition(CSA)***

The CSA is estimated by measuring the days of supply received in each interval by the total number of days in the timeframe. When a patient gets more than one refill per day or when a refill time is nearing the day of completion, biasness arises because excess medicine cannot be carried over from one refill period to the next since adherence is capped at each refill interval. Each refill episode is computed separately; individuals with just one prescription to refill do not have the same cumulative weight as those who fill several prescriptions (Barner, 2010, Lam et al., 2015).

***Continuous, Single Interval Measure of Medication Gaps (CSG)***

CSG recognises intervals when it is unlikely that a patient will administer medicines. It is measured by dividing the number of days without taking any medicine by the number of days in the timeframe. CSG, like CSA, is appropriate for short-term medication exposure, such as individuals who only have one prescription, and the short-term medication exposure is linked to clinical results (e.g., serum drug levels) or pharmacological physiologic effects (Barner, 2010, Lam et al., 2015).

***Measures Involving Electronic Medication Packaging (EMP) Devices***

"Adherence-monitoring devices integrated into the packing of a prescription medication" are what EMP devices are (Checchi et al., 2014). There are various options accessible, and they all have a few things in common: following dosage timing audiovisual reminders, recorded dosing events and adherence logs stored, real-time monitoring, adherence performance feedback, and digital displays. The most used EMP device in medication adherence study is The Medication Events Monitoring System (MEMS). It can determine if non-adherence is occasional or frequent, and it may provide information on the number of daily doses in any partial adherence condition. Practical concerns include the difficulty of scheduling refills with outpatient pharmacies and the necessity to educate patients to utilise the cap correctly. Patients may be falsely classified as non-adherent if the MEMS container is misused (Checchi et al., 2014, Lam et al., 2015).

### 1.1.3(c)(iii) Pill Count

This indirect, objective metric measures the number of dose units taken between two planned clinic visits or appointments. The adherence ratio would then be calculated by comparing the number to the total number of units received by the patient. Although pill counting has been demonstrated to be more accurate than other subjective approaches, MEMS has now substituted pill counting as a reference standard for evaluating other adherence measurements (Checchi et al., 2014, Lam et al., 2015).

### 1.1.4 Medication Belief

Medication beliefs correlate with medication adherence, which shows that medication beliefs can offer greater predictability than any other health or social factors. The elderly patient population is at a greater risk of adverse health consequences poor health outcomes, leading to death. A recent study indicates that common ideas can

differentiate people's 'perspective' towards medications (Horne et al., 2004). Some individuals have unfavourable views about medication, which are often linked with the belief that medications' ingredients or artificial origins are harmful and that alternative therapies are more "natural" and safer (Horne et al., 2009). As a result, these ideas impact the patient's initial perspective toward medicine adherence (Shahin et al., 2020). Patients are affected by their opinions on medications and their personality sensitivity to the medicines' effects, and their ideas if the medication would harm or benefit them when deciding to administer them. Hence, adherence and management may be less than optimal. Therefore, it's critical to assess the effect of general medical beliefs on medication adherence, as these views may affect treatment choices, treatment strategies, and medication adherence (Shahin et al., 2020). This is measured by the Beliefs about Medicines Questionnaire (Horne et al., 1999).

## 1.2 Problem Statement

The Department of Statistics Malaysia (DOSM) states that 7% of the Malaysian population are those aged 60 years or more in 2005, and by 2030 United Nations predicted Malaysia's elderly population to reach 15% (DOSM, 2018). The older adults aged 65 and above are projected to increase in 2010 from approximately 524 million to around 1.5 billion in 2050. (WHO, 2011). The ageing process includes progressive and irreversible deterioration in organ function that transpires over time. Because of higher life expectancy, improved healthcare facilities, and more understanding about healthy lifestyles, the world's ageing population increases, especially in developing countries (United Nations, 2015). There is an increasing global concern to improve the health care delivery systems because of the gradually increasing elderly population requiring special care, particularly against chronic and recurrent illnesses that occur more commonly during later life.

Pharmacologic therapy is an essential component of chronic illness management. However, about half of patients with chronic illnesses do not take their medications as recommended (Sabate, 2003). Poor medication adherence is typically associated with poor clinical outcomes, drug-related side effects, and higher societal health care expenditures in chronic illnesses that need long-term therapy (Ownby RL, 2006).

Evidence suggests that medication belief is associated with medication adherence. Patients' beliefs about their medicine significantly impact how they administer it. Patients' expectations or resistance to administering their medications may affect prescription choices in certain circumstances. Many studies stated that patients' strong beliefs in medications, expectancies, and unwillingness to change significantly impede inappropriate medication prescribing in the elderly (Clyne et al., 2017). Patients' concerns, opinions, and medications vary with time; therefore, health care professionals must be mindful of it (Barnett et al., 2009). Thus, patients are more likely to engage in illness management, make better choices, communicate with their doctors, and follow through with the therapy. In Malaysia, patients spend just RM1 (USD 0.30) for all services, including medication. Hence, it is the first point for treatment for most Malaysian, and their beliefs toward prescribed medicines and medication adherence may differ according to time (Manan et al., 2014). However, most of these research have focused on a single category of medication or a type of illness, with very few investigations performed on attitudes on prescribed medications among elderly patients in primary care. Considering the essential role beliefs may play in medication use, it is crucial to explore patients' beliefs about medication adherence.

The purpose of this cross-sectional study is to gain information on medication adherence and examine the relationship between medication belief and other demographic and clinical factors in elderly patients in a primary health care facility.

### 1.3 Rationale of the Study

Medication adherence is a significant component in ensuring therapy efficacy and reducing mortality and morbidity. There are two limitations in various research evaluating medication adherence. The limitations are external validity, where the findings' summary of the population overall and secondly selection bias due to the selected respondents were only from the hospital environment (Jose et al., 2010). It might be different among the community itself, where some may be more concerned about their health and adherent to their medication. For this reason, investigating the factors for medication adherence among elderly who undergo follow-up in primary health institutions may produce a better description of these issues.

Ageing with associated physiological and pathological changes places individuals at a higher risk of multimorbidity and treatment-related complications. Polypharmacy is described as the appropriate or inappropriate use of five or more medications. (Clyne et al., 2017). Polypharmacy, a severe and frequent drug-related issue, presently arises due to this multimorbidity in the older population. In Malaysia, the polypharmacy prevalence range in the elderly population was between 20.3% to 100%, where more than 50% showed medication non-adherence compared to studies from Europe and the United States ranged from 6.7% to 69.6% (Chen et al., 2012). Hence, multiple medication use can be associated with medication adherence.

Medication adherence is one of the most intriguing and perplexing behaviours displayed by patients, despite being critical in attaining good health outcomes. Non-adherence, on the other hand, seems to be more dangerous in older populations since it

worsens health, leading to hospitalisation and unnecessary healthcare expense. (Barat et al., 2001). Medication non-adherence is estimated to amount to the United States up to $100 billion each year. Many parameters are believed to influence medication adherence in older patients, which may be classified as unintentional due to cognitive impairment, lack of awareness and knowledge of dose schedule, and intentional related to medication beliefs and difficulty handling many medications. Despite years of research on the reasons for poor adherence and development solutions, researchers vary on the concept of medication adherence and how it should be evaluated.

Furthermore, contradictory causes for non-adherence to medicine have been discovered. Each approach has benefits and disadvantages, and experts differ on the optimal way in assessing medication adherence. (Wong et al., 2017).

Patients' beliefs about their medicine is one of the essential components of choosing whether to take their medication. Medication belief is perceived according to the necessity of prescribed medication for controlling their disease or their concern about potential consequences of taking it. Beliefs about medicines are potent predictors of medication adherence other than sociodemographic and clinical parameter factors. It was theorised that adherence is higher for patients whose recognised necessity exceeds their concern and lower under reverse conditions (Horne et al., 1999).

More studies have been done on chronic illnesses such as diabetes and hypertension. Limited studies have been conducted on medication adherence and belief in the local settings on the elderly population. It is a primary focus to maintain optimum therapy outcomes and good quality of life for this population. Previous studies on the elderly have shown moderate and low medication adherence levels using MMAS and negative beliefs about using BMQ (Fadzilah, 2013; Saliza, 2017). There are no studies in Malaysia using GMAS as a tool for assessing medication adherence. GMAS is

appropriate for the population of the developing nations since it was created and developed as a joint effort by scholars from countries such as Pakistan and Malaysia for chronic disease patients (Naqvi et al., 2018).

Morisky's Medication Adherence Scale (MMAS) (Shalansky et al., 2004), Adherence to Refills and Medications Scale (ARMS) (Nordstrom et al., 2013), and Brief Medication Questionnaire (Nori et al., 2014) had been used before. However, studies have reported that no scale could be considered a standard for measuring adherence (Forbes et al., 2018; Naqvi and Hassali, 2018). The MMAS and BMQ were reported to be too difficult for patients while the Shea scale lacks adherence measurement based on patient behavior. The authors accurately pointed out the limitations of these scales, such as inaccuracy, over-estimation of adherence, the complexity of scale, and the cost associated with the license agreement of MMAS (Shalansky et al., 2004; Nori et al., 2014; Forbes et al., 2018; Naqvi and Hassali, 2018). MMAS scale is quite expensive to use as well. Besides, none of the scales measure CRNA (Forbes et al., 2018; Naqvi and Hassali, 2018). Since all the above-mentioned scales originated in developed countries, the absence of CRNA measurement is logical as most patients in those countries do not have to bear out-of-pocket medical expenditures.

Despite social, cultural, socioeconomic, and healthcare system determinants impacting treatment adherence, it is patients' engagement with prescribed medications that are most crucial in enhancing adherence. In Malaysia, there is a lack of information on treatment adherence research that focuses on patient perceptions, particularly in the elderly. The BMQ is a valid and reliable tool that was developed to obtain a better understanding of patients' perception of medicine to improve cognitive representations of medication (Horne et al., 1999). Patients' perceptions of medicine's good and harmful

outcomes have been shown to be highly connected with their choice to take medication (Horne et al., 2013; Tan et al., 2018).

Therefore, The geriatric population is at a higher risk of chronic diseases and comorbidities, which often require the use of multiple medications. Poor medication adherence among geriatric patients can lead to adverse health outcomes, including hospitalization, increased healthcare costs, and decreased quality of life. Medication non-adherence is a complex issue that can be influenced by several factors, including age-related changes in cognition, functional limitations, polypharmacy, and medication beliefs.

The GMAS has been widely used in clinical and research settings and has been shown to have good internal consistency and test-retest reliability and BMQ has been widely used in Malaysia. Additionally, the GMAS is a brief and easy-to-administer tool that can be completed by patients themselves or with the assistance of healthcare professionals. Therefore, understanding medication adherence among geriatric patients from a disease perspective is crucial for healthcare professionals to optimize medication therapy and improve health outcomes.

By conducting this study, healthcare professionals can gain insights into the medication adherence patterns of geriatric patients and identify factors that contribute to poor medication adherence. This knowledge can help healthcare professionals design interventions that address the unique needs of geriatric patients and improve medication adherence, leading to better health outcomes and a higher quality of life for this vulnerable population. Furthermore, the findings from this study can inform policymakers about the importance of addressing medication adherence among geriatric patients to reduce healthcare costs and improve the overall health of the population.

Overall, the GMAS is an appropriate tool for this study as it enables the

assessment of medication adherence among geriatric patients taking multiple medications, has good psychometric properties, and has been validated in various populations in different countries.

## 1.4 Study Objectives

The general objective of this study was to assess the prevalence of medication adherence among geriatric patients using the General Medication Adherence Scale (GMAS) in an ageing population in Seremban.

The specific objectives are as stated below:

1. To determine the medication adherence level of geriatric patients.
2. To evaluate the demographic factors associated with medication adherence and belief on medication among geriatric patients.
3. To evaluate the association between medication adherence and beliefs on medication among geriatric patients.

## 1.5 Significance of the Study

The significant of this study is closely related to the advantages that may be obtained from the study results. The analysis of medication adherence prevalence and distribution among the elderly population will help the doctors and decision-makers understand the scope of the issue. The awareness and outcomes will aid healthcare professionals in strengthening their strategies to increase adherence. In addition, this research may benefit healthcare professionals in better understanding patients' attitudes about their medications and developing interventions that are customised to their specific requirements.

Furthermore, the information is crucial for stakeholders and healthcare professionals to identify and implement or maintain the appropriate interventions for better management in planning and allocating the health resources of the elderly population. Apart from that, the study's findings may encourage policymakers and health care providers to be more vigilant in conducting their daily professional service.

## 1.6 Study Hypothesis

The study hypothesis is summarised in the table below.

**Table 1.3 Study Hypothesis**

| Name | No | Size |
|---|---|---|
| **Hypothesis 1** | $H0^1$ | There is no relationship between medication adherence and demographic characteristics and clinical parameters |
| | $Ha^1$ | There is a relationship between medication adherence and demographic characteristics and clinical parameters |
| **Hypothesis 2** | $H0^2$ | There is no relationship between medication belief and demographic characteristics and clinical parameters |
| | $Ha^2$ | There is a relationship between medication belief and demographic characteristics and clinical parameters |
| **Hypothesis 3** | $H0^3$ | There is no correlation between medication adherence and medication belief |
| | $Ha^3$ | There is a correlation between medication adherence and medication belief |