WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Effectiveness of Residential Medication Management Review (RMMR) Program in Selected Nursing Homes of Davao City

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A B S T R A C T

This study assessed the effectiveness of the Residential Medication Management Review (RMMR) program in optimizing medication use among elderly residents in selected nursing homes in Davao City. The RMMR program engages clinical pharmacists in systematically reviewing residents' medications to ensure appropriateness, safety, and therapeutic efficacy. A pre-post interventional design was employed, involving residents aged 60 and above from two long-term care facilities. Medication use was evaluated using the Medication Appropriateness Index (MAI), while drug-related problems (DRPs) were identified using the Pharmaceutical Care Network Europe (PCNE) classification system. Baseline assessments were conducted, followed by a comprehensive medication review led by a clinical pharmacist. One month post-intervention, follow-up assessments were carried out to measure changes in prescribing practices and DRP resolution. Results showed significant improvements in medication appropriateness, with MAI scores for effectiveness, directions, and drug-drug interactions all reduced to 0.00 ± 0.00 post-intervention, from initial values of 0.16 ± 0.53, 0.62 ± 0.77, and 0.58 ± 0.63, respectively. Cost-effectiveness scores remained unchanged (0.15 ± 0.31 to 0.15 ± 0.13), indicating that the improvements did not incur additional financial burden. PCNE assessment revealed a decrease in potential problems and unnecessary treatments, with most drug-related issues successfully addressed. The findings demonstrate that the RMMR program significantly enhances medication safety and appropriateness in elderly care without increasing costs. This supports the integration of pharmacist-led reviews as a vital component of multidisciplinary care in long-term care settings.

Keywords: Medication management, polypharmacy, geriatric residents, pharmaceutical care, long-term care facilities, program effectiveness

1. INTRODUCTION

Nursing homes frequently face significant difficulties in medication management, as the use of multiple medications, also known as polypharmacy, along with physiological changes linked to aging and the high prevalence of multiple chronic conditions in the elderly necessitate clinical skills, knowledge, and expertise beyond what regular caregivers or nursing home staff typically possess [1-3]. Due to polypharmacy, elderly individuals in nursing homes face increased risks and instances of medication inappropriateness and drug-related problems such as drug interactions, adverse reactions, etc. Furthermore, due to their limited training or lack thereof, many caregivers feel unprepared and ill-equipped to effectively address these issues and manage the complex medication regimens of their residents [4, 5].

Consequently, to overcome the aforementioned challenges commonly faced by nursing homes, various studies and healthcare initiatives were conducted about integrating pharmacists into the picture. Pharmacists bring a specialized skill set that includes expertise in pharmacodynamics, pharmacokinetics, medication safety, and management. Their involvement in nursing homes can contribute significantly to optimizing medication regimens, ensuring patient safety, and improving overall health outcomes [6, 7]. This is demonstrated in the medication review programs conducted in nations such as the United Kingdom [8] , the United States [9], Indonesia [10], Hong Kong [11, 12], Saudi Arabia [13], China [14] and particularly, Australia, a country that is well-recognized for their advanced healthcare system and has an already well-established government-funded model supporting the provision of medication review — the Residential Medication Management Review (RMMR) program [6, 15].

However, in the context of the Philippines, such systems are not as widely adopted in nursing homes. The healthcare infrastructure in the country often faces challenges, including limited resources, awareness, and integration of pharmacists into the multidisciplinary healthcare team in these settings and

such is also the case in Davao City [16]. The lack of pharmacist interventions contributes to potential gaps in medication safety and management like medication inappropriateness and drug-related problems which are remarkably detrimental to the geriatric residents [1-3].

Thus, in this study, the researchers intend to address these gaps by adopting the Residential Medication Management Review (RMMR) program, a government-funded and accredited system in the nursing homes of Australia that has already shown remarkable progress and results by encompassing key steps such as the identification of residents based on need, referral to the RMMR service provider, clinical medication review, and multidisciplinary collaboration with relevant healthcare professionals [15]. During this clinical medication review phase of this program, the researchers intend to employ validated tools such as the Pharmaceutical Care Network Europe (PCNE) Drug-related Problems Classification Form V 9.1 and Medication Appropriateness Index to measure parameters like resolution of drug-related problems and the overall quality of prescribing [17, 18].

The researchers believe that understanding the effectiveness of this program in this setting is critical for informing evidence-based practices, improving healthcare delivery, and ultimately enhancing the pharmaceutical care provided for the geriatric community in nursing homes/long-term care facilities. Through this research, we seek to contribute valuable insights into the importance of pharmacist integration in nursing homes that will not only benefit local healthcare providers and policymakers but also serve as a foundation for advancing geriatric care strategies in the broader context of the Philippines' healthcare system.

2. METHODS

2.1 Research Design

A quasi-experimental research design was utilized to explore the causal connection between the independent and dependent variables by collecting data before and after the intervention. Baseline data (pretest) for MAI were gathered from participants in the chosen nursing homes prior to the intervention [18]. On the other hand, through the items given in the PCNE Classification for Drug-Related Problems V9.1, recommendations, DRP status update, and physician acceptance were indicated, secondary to per patient medication data assessment by the clinical pharmacist [17].

The Residential Medication Management Review (RMMR) program was implemented for 1 month. Data were collected from both nursing homes using identical measures as the baseline assessment (posttest) following the intervention. Subsequently, a comparative analysis of the pretest and posttest results were conducted. In this study, the researchers acted solely in the capacity of investigators. The clinical pharmacist should not provide direct modifications of the medication regimen, only recommendations following his/her review. The physicians of the nursing home participants were the ones to make the decision of whether to accept or reject all kinds of recommendations provided by the clinical pharmacist. This distinction is crucial for maintaining transparency regarding the roles and duties involved in the study, thereby upholding the integrity and impartiality of the investigative process.

2.2 Research Locale

Fig. 1 - Geographical map of Davao City

This study was conducted in two selected nursing homes in Davao City, Davao del Sur Province, Philippines.These nursing homes served as the experimental group, reflecting our intervention, the Residential Medication Management Review (RMMR) intervention. We chose to implement our intervention in both nursing homes to ensure a diverse participant pool. With the diverse demographic composition and robust healthcare infrastructure of Davao City, the nursing homes chosen for this study served as a reflection of the broader healthcare environment within Davao City, offering valuable insights into medication management practices relevant to the region. The geographic location of Davao City within the Davao del Sur Province ensured accessibility and convenience for both researchers and participants, facilitating seamless data collection and collaboration between stakeholders involved in this study.

Given that the study was conducted outside the premises of SPC, the researchers were accompanied and guided by the employed clinical pharmacist, throughout the whole duration of the study.

2.3 Research Participants

The participant selection criteria was designed to ensure focused and representative samples that align with the research's objectives. Initially, informed consent was obtained from all General Practitioners (GPs) practicing in both nursing homes. Subsequently, once a GP agreed to participate, consent was

sought from all residents under their care, facilitated by a staff member from the respective nursing home. Residents can only be included in the study when both the resident (or their proxy) and their attending GP consented to participation. For a more specific basis, inclusion criteria include elderly individuals aged 60 and above, residents of chosen nursing homes, consented by their GP, with varied health conditions, are capable of providing informed consent, with the voluntary willingness to participate, and available for any follow-up assessments. If in the event that the participants, and/or legal representatives of the elderly residents of the chosen nursing homes, are unable to communicate and comprehend effectively the English language, their comfortable alternative languages were utilized. This may be Bisaya and/or Tagalog, considering the study's setting, for both the interview and the ICF. Along with that, their chosen language should be utilized by the researchers to answer any further inquiries of mentioned individuals. On the other hand, exclusion criteria are individuals below the age threshold, non-residents of nursing homes, not consented by their GP, with terminal illnesses, severe cognitive impairment, and life expectancy of less than 3 months impacting participation, individuals lacking capability of giving informed consents, those explicitly refusing to participate, and participants unavailable for any follow-up assessments. Moreover, considerations, such as severe cognitive impairment will be taken into account.

Table 1 - Inclusion and Exclusion Criteria

CRITERIA	INCLUSION	EXCLUSION
Age Range	≥ 60 years	< 60 years
Residency in Nursing Homes	Residents of nursing home	Non-residents of nursing home
Health Status	Varied health conditions	Terminal illnesses, severe cognitive impairment, life expectancy <3 months
Language	Participants are able to speak and understand at least one of the listed languages to be utilized by the researchers: 1. English 2. Bisaya 3. Tagalog	Participants are unable to speak and understand none of the listed languages: 1. English 2. Bisaya 3. Tagalog
Consent and Capacity	Capacity to provide consent	Lack of capacity and no legal representative
	Voluntary participation	Explicit refusal to participate

2.4 Research Instrument

The research utilized the validated tools pre and post intervention, namely: Medication Appropriateness Index (MAI), and the DRP Registration Form (PCNE Classification for Drug-Related Problems V9.1) to be employed by the clinical pharmacist for his/her medication reviews. The Medication Appropriateness Index (MAI), a validated tool, was utilized to assess the suitability of drug therapy and the overall quality of prescribing. It consists of 10 criteria for each prescribed medication: indication, efficacy, dosage, administration instructions, practicality, potential interactions, contraindications, duplication, duration, and cost. Each criterion is evaluated to determine whether the medication is appropriate (0 points), marginally inappropriate (1 point), moderately inappropriate (2 points) or severely inappropriate [60, 78-80]. These evaluations generate a weighted score, which serves as a concise measure of the appropriateness of prescribing (ranging from 0 to 18 per drug; higher scores indicating greater degrees of inappropriateness). A summated MAI score for each resident was then calculated by adding up the MAI scores for all of their medications [61]. Meanwhile, the DRP Registration Form (PCNE Classification for Drug-Related Problems V9.1) is a validated instrument that provides a framework for classifying interventions according to various dimensions, such as the type of intervention, the target of the intervention, and the outcome of the intervention. This enabled researchers to study the impact and effectiveness of pharmaceutical care interventions in different patient populations and healthcare settings.

2.5 Data Collection Procedure

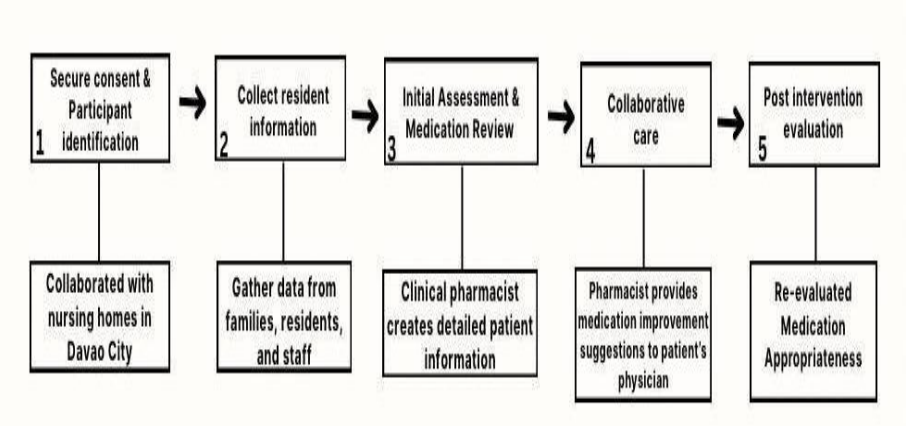

Fig. 2 - Flowchart for Data Collection Procedure

Outlined in this section were essential data gathering processes involved in the Residential Medication Management Review (RMMR) program which are laid out in distinct phases, each with its specific objectives and respective research instruments.

Securing informed consent & identification of eligible participants. The researchers partnered with two nursing homes in Davao City. After getting their approval to conduct research, the researchers coordinated with the nursing home administrators to obtain informed consents from all willing patients/nursing home residents, and ideally, also from their general practitioners (GPs) or prescribers. GPs are often the primary healthcare providers for residents in nursing homes, and they possess a deep understanding of their patients' medical histories, conditions, and preferences. To obtain their consent, in addition to the formal request letter addressed to them, which outlines the necessity for consent from both participants or their legal guardians alongside prescribers for the RMMR program to proceed, researchers also included letters of approval signed by the nursing homes and certification of approval from the ethics committee as attachments. This comprehensive approach was aimed to alleviate any concerns regarding ethical considerations and ensure prescribers' consent for participation in the RMMR program.

Every resident under the care of the nursing home was approached by the researchers for consent, preferably with a staff member from the nursing home or someone that is already familiar to the resident. Residents were enrolled in the study only if both they, or their authorized representative consented to participation. Exclusion criteria includes age being below 60 years old, terminal illnesses, severe cognitive impairments, and a life expectancy of less than 3 months. Moreover, for both phases and participants of the securing of the informed consent , along with the identification of the eligible participants, if in the event that they are unable to effectively comprehend the study and intervention through the English language, their comfortable chosen language were utilized. Considering the setting of this study, this may be English, Bisaya, and/or Tagalog.

Gathering of resident data. After identifying the eligible participants, the employed clinical pharmacist with extensive experience in medication reviews and pharmacotherapy started gathering resident information from the GPs, the resident, family or next of kin, aged care facility staff member, and resident's case notes. These information may include demographic and/or personal information (e.g. date of birth, gender, weight, height, body mass index), relevant social history (e.g. previous occupation, lifestyle, cultural factors), patient history (medical, surgical and/or specialist history, current conditions or comorbidities, pathology and/or radiology investigations and results, allergies, previous adverse drug reactions), and resident assessment (e.g. status regarding frailty, vision, hearing, balance, cognition, memory, mood, gait, mobility, dexterity and rehabilitation, swallowing, oral and dental care, psychological status, nutrition and hydration, skin care and management of pain, continence, behavior, sleep).

Baseline Assessment & Medication Review. Next, the clinical pharmacist created an individualized profile for each resident, incorporating clinical information obtained from the general practitioner or prescription data retrieved from the nursing home's medication records. The level of indicators, according to the Medication Appropriateness Index (MAI) protocol were identified. The MAI was utilized for its dedicated purpose which was the assessment of prescription appropriateness. The filling up of DRP Registration Form (PCNE Classification for Drug-Related Problems V9.1), as outlined in the Research Instrument, was conducted, and utilizing this information, the clinical pharmacist conducted a comprehensive medication review for intervention nursing homes and suggestions for treatment optimization were developed.

Multidisciplinary collaboration with GPs and nursing home staff. The medication review report was then communicated thoroughly with the GP or prescriber who either accepted or rejected the recommendations. Proper documentation of the clinical pharmacist's recommendations and the responses of the GP as a result of their discussion were also in place. Upon the approval of the general practitioner, the suggestions proposed by the clinical pharmacist were put into action. Subsequently, participants or their legal representatives, and the nursing home staff were briefed on alterations to the residents' medication management. During this process, the clinical pharmacist furnished medicine-related information and guidance to nursing staff and caregivers, outlining the necessary steps for safe and accurate administration of medications. The provided information should address any concerns from staff or residents, mitigate confusion, and encourage the safe and proper use of medications while adhering to prescribed regimens. Additionally, guidance on therapeutic device usage, storage, drug preparation and drug administration were included.

Post-intervention Assessment. After a month, the researchers utilized the Medication Appropriateness Index (MAI) to evaluate the medication appropriateness after the intervention. The PCNE V9.1 tool was then utilized to assess the status of the recommendations and which DRPs were resolved. Finally, the researchers compared and analyzed the gathered data and determined the effectiveness of the RMMR program in the nursing homes.

Special Considerations. Given the vulnerability of the participants under study, it was imperative to approach guidance and support with utmost sensitivity. The clinical pharmacist and nursing staff adopted a compassionate and empathetic approach when interacting with residents, recognizing and respecting their individual needs and preferences.

There was a possibility that residents may be given a new drug alternative for the medication they were previously taking, depending on the coordinated judgment of their healthcare providers — the clinical pharmacist and their prescribers. For residents who may experience discomfort or confusion due to changes in their medication regimen, measures were implemented to ease their transition. This could involve providing clear and concise explanations of the reasons for the changes, offering reassurance and support during medication administration, and addressing any questions or concerns they may have. Additionally, regular communication and follow-up assessments helped monitor their progress and ensure that any adverse effects or difficulties are promptly addressed.

In addition to supporting individual residents, it is important to consider the broader impact of research findings on the community. Measures were put in place to mitigate any potential negative consequences, including issues related to stigma, sensitivity to cultural traditions, and community involvement in decisions. This involved engaging with community stakeholders, such as local healthcare providers, advocacy groups, and policymakers, to foster open dialogue and provide accurate information about the study and its implications. Transparency about the potential impact of research findings and efforts to address community concerns also helped foster trust and collaboration.

Furthermore, the SPC-REC had the authority to oversee the advancement of this study, ensuring conformity with ethical guidelines and adherence to the sanctioned protocol. Monitoring endeavors encompassed routine evaluations of study documents, on-site inspections, and interactions with the research team. This oversight was geared towards protecting participant rights, preserving data integrity, and maintaining the utmost ethical standards during the course of the research. Any detected concerns or deviations from the approved protocol were promptly addressed in cooperation with the research team, aiming to minimize potential repercussions on the community and uphold the study's credibility.

2.6 Data Management Plan

The purpose of this data management plan was to outline the procedures and protocols for handling, accessing, and protecting data relevant to this study. The plan was aimed to ensure the privacy, confidentiality, and security of patient health records while facilitating research endeavors. To ensure confidentiality and security, access to clinical data, including medical records and case notes, were restricted solely to authorized personnel, including the clinical pharmacist and other healthcare providers directly involved in the study. Meanwhile, researchers were provided only with de-identified data derived from pre- and post-assessments, preserving the anonymity of patients and their personal information. To further bolster security, all data, encompassing both patient health records and research data, were securely stored in encrypted electronic databases with separate access restricted to authorized personnel, and regular backups were conducted to mitigate the risk of data loss. After the completion of the study, data sharing with the participants, other researchers, and stakeholders for academic or public health purposes involved only de-identified information, adhering to institutional policies and regulations on privacy and confidentiality. Additionally, data were only retained for a specified period as required by institutional policies and regulations. After the retention period, data were securely archived or disposed of in accordance with data protection guidelines. The researchers guaranteed that all data management procedures had complied with ethical guidelines and regulations, including obtaining informed consent from participants and protecting their privacy rights. Any breaches of data privacy or confidentiality were promptly reported and addressed according to institutional protocols. Furthermore, this data management plan was periodically reviewed and updated as needed to reflect changes in regulations, technology, or project requirements. Any revisions to the plan were communicated to relevant stakeholders and implemented promptly. By adhering to this data management plan, we aimed to safeguard the privacy and confidentiality of patient health records while facilitating research activities related to Residential Medication Management Review (RMMR) in nursing homes in Davao City.

2.7 Data Analysis

Data analysis held a crucial role in deriving meaningful insights, ensuring precision, and providing informed evaluations. This process guided decision-making and improved pharmaceutical care for elderly residents. The following tests were used to conduct the data analysis phase of this study:

Paired/Dependent T-test. A statistical technique used to assess whether there is a significant difference between the means of two correlated groups. The different groups that are compared are connected or matched between the results of both data sets. This entails measurements that are taken on the identical subjects at different times.

$$t = \frac{\bar{d}}{s_d / \sqrt{n}}$$

Fig. 3 - Formula for dependent samples t-test

2.8 Ethical Considerations

In conducting research on the effectiveness of Residential Medication Management Reviews (RMMR) in nursing homes, it is imperative to uphold ethical principles that prioritize the rights, well-being, and autonomy of all participants. This section outlines the ethical considerations guiding our study, placing significant emphasis on benefit/risk balance, confidentiality, integrity, and respect for the individuals involved. By adhering to these ethical standards, we

aim to conduct research that is both rigorous and ethically sound, contributing to advancements in medication management practices while safeguarding the dignity and rights of nursing home residents.

Protection of Vulnerable Populations. Nursing home residents are often considered a vulnerable population due to factors such as age, cognitive impairment, and health conditions. To protect their rights and well-being, rigorous protocols that are comprehensive and detailed were implemented. This involved:

Informed Consent. Ensure that all participants, or their legally authorized representatives, provide informed consent before participating in the study. Clearly explain the purpose, procedures, risks, and potential benefits of the study in a language and format understandable to participants. Assure them of their right to refuse or withdraw from the study at any time without consequence. Fair Recruitment and Selection. Ensure that the recruitment process is fair and transparent, and that all eligible individuals have an equal opportunity to participate. Avoid coercion or undue influence in recruiting participants, particularly those who may be vulnerable due to cognitive or health-related impairments. Privacy and Confidentiality. Safeguard the privacy and confidentiality of participants' personal and health information by strictly adhering to the data management plan. Use de-identification techniques when reporting results to prevent individuals from being identified. Store all data securely and ensure that access is only limited to authorized personnel. Minimization of Harm. Take measures to minimize any potential harm or discomfort to participants. Participating in the study does not automatically mean the participant will be enrolled in a new drug therapy or will be given a new medication. However, in the event that the clinical pharmacist's medication review would prove that changes to the medication regimen like dosage adjustments, alternative or replacement of the previous drugs, addition of a new medication, or removal of medication that may cause drug-to-drug interaction and contraindication, are necessary; they will be provided so. All the medication changes will only be implemented after the approval of the prescriber or physician.

The participants may find it different than how it used to be and may feel uncomfortable about these changes. There could also be patient safety risks, if these changes are not implemented carefully. Thus, to mitigate these risks, participants must be closely monitored throughout the study and provided with appropriate support and resources, including access to healthcare services if needed. In the instance that the participants will experience any untoward events or become ill during the duration of the study, the researchers will shoulder the medical expenses and ensure that they are given adequate support and care throughout their treatment. Mitigation of risks may include measures such as thorough medication reconciliation, close monitoring of medication changes, staff training and education, and continuous communication strategies with the healthcare team, the participants themselves, as well as, their family members, to ensure continuity of care. Beneficence and Non-maleficence. Ensure that the study benefits outweigh any potential risks to participants. Strive to maximize the potential benefits of RMMR while minimizing any potential harm. Adhere to ethical principles of beneficence (acting in the best interest of participants) and non-maleficence (do no harm). Respect for Autonomy. Acknowledge and respect the freedom of all participants by providing them the opportunity to make decisions about their involvement in the research study. Encourage participants to actively participate in the decision-making process by respecting their preferences and choices. Obtain consent from legally authorized representatives when participants lack decision-making capacity. Equality. Ensure fair distribution of benefits of the research among the participants. Prevent exploitation and rectify any disparities that may emerge during the research. Consider the involvement of diverse characteristics of individuals within the community to improve the applicability of research results. Respect for Cultural and Diversity Considerations. Consider the cultural, religious, and linguistic diversity of participants when designing and conducting the study. Ensure that all participants are treated with respect and sensitivity to their individual backgrounds and beliefs.

Community involvement. Involve nursing home staff, residents, families, and other stakeholders in the design, implementation, and dissemination of the study. Foster open communication and collaboration to ensure that the research addresses relevant concerns and priorities of the community. Professional competence. Ensure that the researchers and healthcare professionals participating in the study possess the required skills and expertise to effectively collaborate with the geriatric participants. Transparency and Integrity. Conduct the study with honesty, integrity, and transparency. Report findings accurately and objectively, regardless of whether they support the hypothesis or desired outcomes. Disclose any conflicts of interest or potential biases that may affect the integrity of the research. Continuous ethical monitoring. Established a process for ongoing ethical review and monitoring of the research to maintain ethical standards consistently. Regular evaluations are conducted to ensure continuous compliance with ethical guidelines.

3. RESULTS AND DISCUSSION

This chapter presents the overall data from the survey phase of the study that address the increased risk of medication-related issues among the geriatric population within nursing homes, which can potentially lead to adverse health events and outcomes. This study specifically examines the implementation of the Residential Medication Management Review (RMMR) program in nursing homes within Davao City, aiming to assess its effectiveness in enhancing medication safety and appropriateness for elderly residents.

PCNE CLASSIFICATION

Table 2 presents the assessment of drug-related problems encountered by respondents using the Pharmaceutical Care Network Europe (PCNE) form. The table outlines different types of problems (P) and their associated scores/frequencies, along with the causes of drug-related problems (C), planned interventions (I), acceptance of intervention proposals (A), and the status of the drug-related problem (O).

Table 2.1 - Type of Problem (P) and their scores/frequency (%)

Type of Problem (P)	Scores/Frequency (%)
Potential Problem	4.76
Manifest Problem	95.24
P1. Treatment Effectiveness	
No effect of drug treatment despite correct use	4.76
Effect of drug treatment not optimal	90.48
Untreated symptoms or indication	0
P2. Treatment Safety	
Adverse drug event (possibly) occurring	0
P3. Others	
Unnecessary drug-treatment	4.76
Unclear problem/complaint. Further clarification necessary (please use as escape only)	0

The findings from the Pharmaceutical Care Network Europe (PCNE) V9.1 classification form highlight two major extents of DRPs: potential problems (4.76%) and manifest problems (95.24%). According to the recorded data, “potential problem” accounts for a significantly smaller percentage of a score of 4.76% suggesting fewer cases involving risks without immediate manifestations. While the most prominent issue observed is a “manifest problem” with a resulting score of 95.24%, indicating that nearly all recorded DRPs are not just risks but active concerns having clear and evident impact on residents that would require immediate intervention. This aligns with previous research indicating that nursing home residents frequently experience DRPs due to the complex nature of their medication regimens, age-related pharmacokinetic and pharmacodynamic changes, and underlying comorbidities [26-28, 83]. Consequently, the high prevalence of “manifest problem” reinforces the need for regular medication reviews and pharmacist-led interventions [33-35, 39-40], such as the RMMR.

The data above presents an analysis of different types of drug-related problems categorized into treatment effectiveness, treatment safety, and other concerns. In the treatment effectiveness category, the most frequent concern is that the effect of drug treatment is not optimal scoring 90.48% highlighting that while the medication may have some impact, it does not achieve the desired therapeutic outcomes aligning with studies indicating that suboptimal medication effects are common in clinical practice due to factors such as individual variability in drug metabolism, adherence issues, or inappropriate drug selection [89].

A small percentage of the population with a score of 4.76% experienced no effect from the drug treatment despite its proper use, which may be attributed to pharmacogenetic differences or resistance to certain therapies [92]. The absence of untreated symptoms or indications scoring 0%, suggests that all patients in the sample received some form of intervention. Regarding the treatment safety, no adverse drug events were reported with a score of 0% which is an unusual finding as adverse drug events are a well documented concern in pharmacotherapy, with literature suggesting that they occur in up to 30% of hospitalized patients [91]. The other category includes unnecessary drug treatment with a score of 4.76%, which could reflect prescribing practices where medications are used without clear indications that aligns with global concerns about overprescription and polypharmacy, especially among elderly populations [90]. Notably, there were no unclear problems requiring further clarification, suggesting that all reported concerns were sufficiently categorized.

Table 2.2 - Cause of DRP (C) and their scores/frequency (%)

CAUSE OF DRP (C)	Scores/Frequency (%)
C1. Drug selection	
Inappropriate drug according to guidelines/formulary	0
No indication for drug	0
Inappropriate combination of drugs, or drugs and herbal medications, or drugs and dietary supplements	66.67
Inappropriate duplication of therapeutic group or active ingredient	0
No or incomplete drug treatment in spite of existing indication	0
Too many different drugs/active ingredients prescribed for indication	4.76
C2. Drug form	
Inappropriate drug form/formulation (for this patient)	0
C3. Dose selection	
Drug dose too low	0
Drug dose of a single active ingredient too high	0
Dosage regimen not frequent enough	0
Dosage regimen too frequent	0
Dose timing instructions wrong, unclear or missing	0
C4. Treatment duration	
Duration of treatment too short	0
Duration of treatment too long	0
C5. Dispensing	
Prescribed drug not available	0
Necessary information not provided or incorrect advice provided	0
Wrong drug, strength or dosage advised	0
Wrong drug or strength dispensed	0
C6. Drug use process	

Inappropriate timing of administration or dosing intervals by a health professional	90.48
Drug under-administered by a health professional	0
Drug over-administered by a health professional	0
Drug not administered at all by a health professional	0
Wrong drug administered by a health professional	0
Drug administered via wrong route by a health professional	0
C7. Patient related	
Patient intentionally uses/takes less drug than prescribed or does not take the drug at all for whatever reason	0
Patient uses/takes more drug than prescribed	4.76
Patient abuses drug (unregulated overuse)	0
Patient decides to use unnecessary drug	4.76
Patient takes food that interacts	0
Patient stores drug inappropriately	0
Inappropriate timing or dosing intervals	4.76
Patient unintentionally administers/uses the drug in a wrong way	0
Patient physically unable to use drug/form as directed	0
Patient unable to understand instructions properly	0
C8. Patient transfer related	
Medication reconciliation problem	0
C9. Other	
No or inappropriate outcome monitoring (incl. TDM)	0
Other cause; specify	0
No obvious cause	0

The findings indicate that the most prevalent cause of drug-related problems (DRPs) is improper timing of medication administration by healthcare professionals, observed in 90.48% of cases. This highlights significant issues in medication management, such as errors in scheduling, miscommunication among staff, and deviations from standard protocols [83]. Medication administration errors can compromise drug efficacy, especially in elderly patients with complex treatment regimens. A related concern is the inappropriate combination of drugs, including interactions with herbal remedies and dietary supplements, which were present in 66.67% of cases. In the Philippines, particularly in Davao, the elderly population commonly relies on herbal

supplements alongside prescribed medications, believing them to be natural and safer alternatives [96]. However, these interactions can alter drug metabolism, either reducing medication efficacy or increasing toxicity risks due to pharmacokinetic interactions [4,5, 26-28].

Several patient-related issues were also seen which includes patients taking more medication than prescribed (4.76%), taking unnecessary drugs (4.76%), and failing to follow the correct dosage instruction which results in 4.76% of cases. Findings from similar studies corroborate that in some cases, patients were prescribed too many medications for the same condition which raise concerns about potential overmedication [4-9]. Moreover, given that incorrect dosing instructions and taking several combinations of drugs are the most prominent problem [35, 39, 40], healthcare professionals should prioritize enhancement of proper administration of medication. Addressing these issues are particularly relevant in nursing homes, where medication regimens tend to be more complex due to multimorbidity among elderly residents [33-35].

Table 2.3 - Planned Intervention (I) and their scores/frequency (%)

PLANNED INTERVENTION (I)	Scores/Frequency (%)
I0. No intervention	0
I1. At prescriber level	
Prescriber informed only	4.76
Prescriber asked for information	9.52
Intervention proposed to prescriber	80.95
Intervention discussed with prescriber	4.76
I2. At patient level	
Patient (drug) counselling	0
Written information provided (only)	100
Patient referred to prescriber	0
Spoken to family member/caregiver	0
I2. At drug level	
Drug changed to	0
Dosage changed to	0
Formulation changed to	0
Instructions for use changed to	95.24
Drug paused or stopped	4.76
Drug started	0
I4. Other intervention or activity	
Other intervention (specify)	0
Side effect reported to authorities	0

As shown in the table above, most interventions targeted prescribers, with 80.95% involving direct recommendations, suggesting a proactive approach to optimizing therapy. However, prescribing is a complex, high-risk task, and new prescribers may lack confidence, highlighting the need for structured support. Thus, pharmacists and medication review processes play a key role in addressing prescribing gaps [5, 7]. At the patient level, all interventions involved written information (100%), with no direct counseling, prescriber referrals, or caregiver involvement. While written instructions help, they cannot replace personalized counseling, which improves adherence and understanding. Medication review, aimed at optimizing medicine use, could enhance patient engagement and minimize medication-related problems [93-95].

Moreover, at the drug level, most interventions (95.24%) involved modifying instructions, with a small portion (4.76%) pausing or stopping a drug. No changes were made to dosage, formulation, or new drug initiation. This suggests prescribers relied on medication reviews for clarity rather than making major modifications [3, 4]. No adverse drug reactions (ADRs) were reported, raising concerns about underreporting. Since medication review aims to detect and prevent medication-related problems, strengthening its role in ADR reporting could improve pharmacovigilance.

Overall, these findings underscore the value of integrating medication review into prescribing practices to enhance safety and effectiveness. While prescribers were receptive to recommendations, the lack of direct patient counseling and caregiver involvement presents an opportunity to expand patient-centered strategies, improving adherence and treatment outcomes [95].

Table 2.4 - Acceptance of the Intervention Proposals (A) and their scores/frequency (%)

ACCEPTANCE OF THE INTERVENTION PROPOSALS (A) (Tick one box only)	**Scores/Frequency (%)**
A1. Intervention accepted	
Intervention accepted and fully implemented	57.14
Intervention accepted, partially implemented	0
Intervention accepted but not implemented	0
Intervention accepted, implementation unknown	0
A2. Intervention not accepted	
Intervention not accepted: not feasible	0
Intervention not accepted: no agreement	0
Intervention not accepted: other reason (specify)	0
Intervention not accepted: unknown reason	0
A3. Other	
Intervention proposed, acceptance unknown	42.86
Intervention not proposed	0

The data shows a relatively high acceptance rate of 57.14% which makes it a majority of the suggested interventions. This highlights a decent level of cooperation between the healthcare providers and the DRPs. Additionally, there were no cases where interventions are either only partially implemented, accepted but not implemented, nor accepted with implementation status unknown. This shows that there was a clear decision-making process with regards to the interventions. Furthermore, none of the interventions were outrightly rejected regardless of the reasons, albeit, due to feasibility issues, lack of agreement, or other reasons which definitely highlights the practicality and relevance of the proposed interventions. However, despite the promising results, a non-majority but still significant portion of the proposals falls under “Intervention proposed, acceptance unknown” which is at around 42.86%. This shows that almost half of the interventions have had an uncertain outcome, either because of the decisions from the prescribers, families, or the patients themselves. Despite such implications, no interventions were left unproposed which is at around a 0% occurrence which suggests that there were significant attempts in trying to address the DRPs, of which, the decision of accepting and fully implementing the concerns falls to the decision of the prescribers, patients’ families, and the patients themselves.

With such outcomes, it should be highlighted that cooperation and collaborations between the pharmacists, physicians, patients, and their families plays a huge role in the acceptance and implementation of proposed interventions [85, 86, 87]. The findings of a study [85] highlighted the importance of mutual respect and established communication channels between pharmacists and physicians in resolving DRPs. Prescriber-pharmacist collaboration definitely plays the biggest role in the implementation of DRP proposals as described in two 2023 studies [87, 88] where the involvement of pharmacists in inappropriate medications were highlighted, which emphasized the significance of the collaboration between these healthcare professionals since it plays a key role in the acceptance and implementation of the intervention. Another factor that should be taken into consideration is the prevalence of DRPs involving herbal supplements of the patients in this study which is at around 66.67% which makes another 2023 study [86] relevant as it highlighted the importance of patient and family education in managing potential interactions with regards to herbal supplement consumption and their potential drug interactions which also implies that families and the patients themselves played a role in the acceptance of the interventions as well, since interventions do involve the consent of the families and the patients themselves for ethical reasons.

Table 2.5 - Status of DRP (outcome of the intervention) and their scores/frequency (%)

STATUS OF THE DRP (O)	Scores/Frequency (%)
O0. Problem status unknown	0
O1. Problem totally solved	100
O2. Problem Partially solved	0
O3. Problem NOT solved	0
Lack of cooperation of patient	0
Lack of cooperation of prescriber	0
Intervention not effective	0
No need or possibility to solve problem	0

From the previous tables presented, the pre-assessment generally reveals several potential and manifest problems encountered by the nursing home residents. These problems include issues related to treatment effectiveness, safety, unnecessary drug treatment, and unclear complaints. Additionally, causes of drug-related problems range from inappropriate drug selection and dosage to patient-related factors such as intentional or unintentional misuse of medication. These findings are consistent with existing literature, which indicates that polypharmacy and co-morbidities are significant contributing factors to the increased risk of DRPs in elderly populations [4-9, 26-28, 35].

However, based on the table above, it was observed that 100% of drug-related problems (DRPs) were reported as totally solved, despite only 57.14% of the pharmacist interventions being confirmed as accepted and implemented. This apparent discrepancy can be explained by examining the multifaceted dynamics of pharmaceutical care in long-term care facilities [#]. In the selected nursing homes, the pharmacist often engaged directly not only with the patients but also with caregivers and nursing home staff. These established lines of communication can facilitate the informal implementation of proposed interventions, even in the absence of formal documentation. As a result, some interventions that were categorized as "intervention proposed, acceptance unknown" (42.86%) may have been implemented by the staff based on verbal recommendations or routine discussions, contributing to the successful resolution of DRPs. Similar observations were made in recent literature highlighting the complexity of interprofessional communication in medication management, where informal channels play a significant role [98-100].

Additionally, the outcome classification of "totally solved" is partly subjective and may depend on the pharmacist's clinical judgment. In the absence of rigorous follow-up, pharmacists may rely on indirect indicators such as patient improvement, caregiver reports, or absence of further complaints to determine whether a DRP has been resolved. In nursing homes where direct follow-up data may be limited, this pragmatic assessment can influence outcome reporting, sometimes optimistically [101].

Documentation bias also plays a role in this discrepancy. The manual documentation processes in the PCNE system leave room for inconsistencies. Pharmacists under time constraints may default to recording DRPs as solved based on perceived or reported patient outcomes, particularly when formal feedback loops are lacking. This kind of bias has been noted in the study of Hamada et al., analyzing intervention reporting and pharmaceutical care outcomes [102]. This is particularly relevant in this study, considering that the follow-up has been shortened to just a month due to time constraints.

Ultimately, while the PCNE system offers a structured approach to identify, categorize, and address DRPs, its effectiveness depends on timely communication and accurate feedback among all healthcare providers involved. The discrepancy between low confirmed intervention rates and high problem resolution underscores the need for stronger interprofessional collaboration and better documentation practices. Despite these challenges, the observed results may still reflect genuine improvements in patient care driven by both formal and informal healthcare processes.

Overall, Table 2 provides a comprehensive assessment of drug-related problems encountered by respondents, their causes, planned interventions, acceptance of interventions, and the status of these problems following intervention efforts.

LEVEL OF INDICATORS

Table 3 presents the mean levels of indicators according to the Medication Appropriate Index (MAI) for the implementation of the Residential Medication Management Review (RMMR) program in nursing homes, comparing pretest and posttest scores. The items evaluated include various aspects of medication use such as indication, effectiveness, dosage correctness, correctness of directions, practical directions, drug interactions, unnecessary duplication, therapy duration, and cost-effectiveness.

Table 3 - Mean Level Of Indicators In The Implementation RMMR Program in Nursing Homes, In Terms Of Medication Appropriateness Index (MAI)

INDICATORS	Scores	
	Pretest	Posttest
Is there an indication for the drug?	0.00±0.00	0.00±0.00
Is the medication effective for the condition?	0.16±0.53	0.00±0.00
Is the dosage correct?	0.00±0.00	0.00±0.00
Are the directions correct?	0.62±0.77	0.00±0.00
Are the directions practical?	0.00±0.00	0.00±0.00
Are there clinically significant drug-drug interactions?	0.58±0.63	0.00±0.00
Are there clinically significant drug-disease/condition interactions?	0.00±0.00	0.00±0.00
Is there unnecessary duplication with other drugs?	0.00±0.00	0.00±0.00
Is the duration of the therapy acceptable?	0.00±0.00	0.00±0.00
Is this drug the least expensive alternative compared to others of equal utility?	0.15±0.31	0.15±0.13

***Generally a score equal to or greater than 3 indicates an inappropriate medication.**

The MAI indicators were assessed using a scale ranging from 0 to 3, where 0 indicated no issues with the medication, 1 represented minor concerns that may not significantly affect patient outcomes but warrant review, 2 signified substantial issues requiring clinical review, and 3 indicated critical issues that could lead to significant harm if unaddressed [60, 78-80].

Results from the pretest and posttest scenarios showed that most items remained at 0.00±0.00 in the posttest, indicating no significant issues. However, the pretest scores for "Was the medication effective for the condition?" (0.16±0.53), "Were the directions correct?" (0.62±0.77), and "Were there clinically significant drug-drug interactions?" (0.58±0.63) indicated initial concerns. These scores suggested a "Marginally Inappropriate" level of appropriateness [78-80], with room for improvement, particularly in medication effectiveness, directions, and drug interactions. Similar concerns have been documented in previous studies, such as those by Kalia et al. [81] and Holmes et al. [82], who noted that elderly patients often face challenges with medication adherence and inappropriate drug combinations.

By the posttest, these concerns had been resolved, with scores improving to 0.00±0.00, reflecting a shift to an "Appropriate" level [78-80]. This improvement aligns with findings from Clyne et al. [84], who reported that structured medication reviews can significantly enhance the accuracy of prescriptions and reduce the risks associated with polypharmacy. Additionally, the item concerning cost-effectiveness—"Was this drug the least expensive alternative compared to others of equal utility?"—remained relatively stable, with a slight decrease from 0.15±0.31 in the pretest to 0.15±0.13 in the posttest. This stability suggests that while cost-effectiveness was considered, it did not emerge as a major concern in this intervention, supporting the idea that addressing medication appropriateness does not always result in significant changes to medication costs, as indicated by van der Stelt et al. [83].

These results imply that the implementation of the RMMR program effectively addressed and resolved key issues related to medication management in nursing homes, particularly in the correctness of directions and significant drug-drug interactions, thereby enhancing the overall medication safety and appropriateness for residents.

STATISTICAL SIGNIFICANCE

Table 4 presents the statistical analysis testing the significant difference before and after the implementation of the Residential Medication Management Review (RMMR) program in nursing homes. The test variables include the mean scores and standard deviations (SD) for pretest and posttest conditions, along with the calculated T value and P value.

Table 4 - Testing The Significant Difference Before And After The Implementation Of Rmmr Program In Nursing Homes

Test variables	Mean	SD	T value	P value	Remarks*
Before	0.17	0.27	1.772	.120	Not significant
After	0.00	0.00			

***Calculation was performed at .05 level of significance**

Before the RMMR program implementation, the mean score was 0.17 with a standard deviation of 0.27. After the implementation, both the mean and standard deviation dropped to 0.00. The T value calculated for this difference is 1.772 with a P value of 0.120.

Despite the decrease in mean scores post-implementation, the P value exceeds the threshold of 0.05, indicating that the difference is not statistically significant at the 5% level of significance. However, the practical implications of these results suggest that the RMMR program effectively addressed critical issues in medication management, as evidenced by the reduction in scores to 0.00 post-implementation, signifying an improvement in medication safety and appropriateness in nursing homes. In short, the p value indicating that the difference was not statistically significant does not automatically mean the RMMR program is ineffective compared to the current practice but that it must have been due to the limitations of our study design.The lack of statistical significance might be attributed to (a) the small sample size (n=28), in comparison to other studies [50, 67] with a sample size of usually 50 and above, (b) the baseline MAI scores being already relatively low, leaving little room for improvement, or (c) the very short duration of the intervention or follow-up which is only 1 month [87, 97].

In the light of the results, our findings still align with several studies that have reported mixed outcomes regarding the efficacy of RMMR interventions. For example, Verrue et al. found significant improvements in medication appropriateness [50], whereas the study of Mahlknecht et al. observed no significant changes [67], similar to our study. These discrepancies highlight the variability in response to RMMR interventions and suggest that other factors may influence the outcomes. Notably, both studies have significantly higher numbers of participants where there were 200 initial participants in [50], and around 120 in [67] which differs significantly to our participants of just 28 residents from 2 nursing homes. This means that the low number of participants in this study may have also contributed to the statistically insignificant outcome. The reduction in mean MAI scores however, despite not being statistically significant, is clinically relevant and suggests that the RMMR intervention may still offer benefits in improving medication appropriateness. This underscores the importance of considering clinical significance alongside statistical significance, particularly in studies with small sample sizes.

EFFECT SIZE

Table 5 displays the effect size before and after the implementation of the Residential Medication Management Review (RMMR) program in nursing homes. The table includes the mean scores, standard deviations (SD), and Cohen's D values, which measure the effect size of the program implementation.

Table 5 - Effect Size Before And After The Implementation Of RMMR Program In Nursing Homes

Test variables	Mean	SD	Cohen's D	Remarks
Before	0.17	0.27	0.83	High
After	0.00	0.00		

Before the RMMR program was implemented, the mean score was 0.17 with a standard deviation of 0.27. After the program's implementation, both the mean score and standard deviation dropped to 0.00. The Cohen's D value calculated for the effect size is 0.83, which indicates a large effect since Cohen [70] suggested that d = 0.2 be considered a "small" effect size, 0.5 represents a "medium" effect size and 0.8 a "large" effect size. This indicates that if the difference between two groups means is less than 0.2 standard deviations, the difference is negligible, even if it is statistically significant [70, 71].

Therefore, it indicates high remarks for both mean and standard deviation due to the fact that the values of both dropped to 0.00 post intervention and Cohen's D value of 0.83 signifies a large effect size as it measures the difference between two means divided by the pooled standard deviation [71]. A value of 0.83 indicates that the mean difference is substantial compared to the variability of the scores as Cohen's guidelines indicate SMDs of 0.20, 0.50, and 0.80 as "small", "medium", and "large", respectively [72]. Therefore, the results suggest that the implementation of the RMMR program had a large

impact on improving medication management in nursing homes. The decrease in mean scores to zero post-implementation highlights the program's effectiveness in addressing and resolving critical issues related to medication safety and appropriateness, demonstrating a meaningful improvement in the quality of care for nursing home residents [73, 74, 75].

4. SUMMARY, CONCLUSION & RECOMMENDATIONS

4.1 SUMMARY

This study aimed to assess the effectiveness of the Residential Medication Management Review (RMMR) program in improving medication management in selected nursing homes in Davao City. A quasi-experimental research design with pretest and posttest measures was used to explore the impact of the program on medication practices. Despite statistical insignificance due to the small sample size and short duration, the findings suggested that the RMMR program led to improvements in medication directions, reduced medication errors, and overall enhanced patient safety in the participating nursing homes. The program facilitated better communication between healthcare providers and residents, which helped in creating a comprehensive understanding of the medication needs and potential risks for elderly patients. Active involvement from clinical pharmacists, doctors, nursing staff, and researchers played a significant role in the program's implementation, ensuring that medication reviews were thorough and effectively addressed potential issues. As a result, patients expressed gratitude for the improvements in how their medications were managed, reporting noticeable health benefits. Participants also provided valuable feedback on ways to improve the program, including recommendations to increase the frequency of medication reviews, offer additional training for staff, and strengthen communication between healthcare providers and residents. These recommendations aimed at enhancing the effectiveness of the program, improving the overall medication management, and ensuring a better quality of care for elderly residents in nursing homes. In conclusion, the positive improvements in medication management practices highlight the potential of the RMMR program to contribute to better patient outcomes in nursing homes. The study recommends expanding the program to more nursing homes in Davao City and implementing continuous monitoring and evaluation to further optimize its effectiveness. By incorporating feedback and enhancing collaboration among healthcare professionals, the RMMR program could play a crucial role in improving the medication management and well-being of elderly residents in the region.

4.2 CONCLUSION

The purpose of this study is to assess the effectiveness of the Residential Medication Management Review (RMMR) program in enhancing medication management practices in selected nursing homes in Davao City. A quasi-experimental research design, involving pretest and posttest assessments, was used to explore the relationship between the RMMR program's implementation and its impact on medication management. While the results did not show statistical significance, largely due to the small sample size and brief study duration, improvements were noted in areas such as medication instructions, adherence to prescribed schedules, reduction in medication errors, and overall patient safety. The program's attainment was mainly by the active participation and cooperation of nursing home staff, doctors, clinical pharmacists, researchers, and patients, fostering a better understanding of medication needs and associated risks. Moreover, participant feedback recommended increasing the frequency of medication reviews, offering more training for staff, and improving communication between healthcare providers and patients. These recommendations are expected to further enhance medication management and improve the health outcomes of elderly residents. In conclusion, the study highlights the potential of the RMMR program to optimize medication regimens, prevent adverse drug reactions, and improve patient outcomes in nursing homes. In conclusion, the findings of this study suggest that expanding the program, along with continuous monitoring and evaluation, could further enhance its effectiveness in improving the quality of care for elderly residents in Davao City’s nursing homes.

4.3 RECOMMENDATIONS

Based on the findings of the study, several recommendations can be made to enhance the effectiveness of the Residential Medication Management Review (RMMR) program in nursing homes in Davao City. Firstly, it is recommended to expand the RMMR program to all nursing homes in the city to ensure a wider population of elderly residents can benefit from optimized medication management. Additionally, regular training and professional development for clinical pharmacists should be prioritized to keep them updated on the latest best practices in geriatric pharmacotherapy. Strengthening collaboration between clinical pharmacists and other healthcare professionals, such as physicians, nurses, and geriatricians, is also essential to ensure a holistic approach to patient care. Furthermore, implementing a robust system for continuous monitoring and evaluation of the RMMR program will help track its outcomes and identify areas for improvement. Moreover, RMMR should be integrated in both the local and national level of healthcare systems and is recommended to be studied and integrated in the clinical pharmacist profession in itself along with relevant parties such as the patients, caregivers, and the prescribers. Lastly, educating residents and their caregivers about the importance of medication management and the role of clinical pharmacists can increase their engagement and adherence to prescribed medication regimens, ultimately enhancing the overall effectiveness of the program. By implementing these recommendations and building upon the positive outcomes observed in this study, nursing homes in Davao City can further improve medication management practices and ultimately enhance the quality of care provided to their residents.

4.4 Acknowledgements

The researchers extend their deepest and most heartfelt gratitude to their research adviser, Dr. Erwin M. Faller, whose unwavering support, expert guidance, and patience have been instrumental throughout the course of this research. They are also sincerely thankful to their esteemed panelists—Dean Fatima May Tesoro, Dr. Joseph Querequincia, and Dr. Angela Telesforo—for their thoughtful insights, constructive critiques, and genuine support that helped refine this study into its best form. To Mr. Venchie Badong, their statistician, the researchers are grateful for his unwavering support and precision

in helping them make sense of their data. His expertise made a complex process more manageable and insightful. The researchers would also like to thank Ms. Mel Acas, clinical pharmacist, for her dedication and willingness to accompany them during nursing home visits. Her clinical perspective and compassionate presence enriched the research process in ways beyond measure. Deep thanks are also extended to the prescribers whose cooperation and openness contributed significantly to the study's success. To the nursing home administrators and staff, thank you for welcoming the researchers with open arms and for the support you extended in building rapport with the residents. Your kindness and trust created a meaningful environment for this research. Most of all, the researchers are deeply grateful to the residents, whose willingness to share their time and participate brought life and purpose to this study. Lastly, to their families and friends, thank you for being the constant source of strength, motivation, and understanding. Your presence reminded the researchers to keep going, even in the most challenging moments.

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