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# DEVELOPMENT AND EVALUATION OF MEDICATION ADHERENCE PILL (MAP) ORGANIZER FOR VISUALLY IMPAIRED PATIENTS IN THE CITY OF KORONADAL, SOUTH COTABATO

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## ABSTRACT

Visually impaired individuals face unique challenges when it comes to managing their medications; thus, the researchers developed a Medication Adherence Pill (MAP) organizer for the visually impaired patients to improve their medication adherence. This study employed a quasi-experimental research design and pre-test and post-test interventions were conducted. The findings indicated that the use of MAP organizers significantly helped the respondents in enhancing their level of knowledge. The intervention may have provided them with valuable information, reminders, or educational resources that effectively improved their understanding of medication-related topics. Moreover, the result showed that the organizers were effective in increasing the patients' level of knowledge. On the other hand, the statistical analysis revealed no significant difference ( $p > 0.05$ ) in medication adherence before and after the intervention among visually impaired patients. This means that the use of MAP organizers did not have a substantial impact on improving the patient's overall medication adherence.

## INTRODUCTION

According to a 2012' report by the World Health Organization (WHO), around 285 million individuals worldwide have visual impairments, including 39 million who are blind and 246 million who have low vision. Globally, cataracts continue to be the major cause of blindness, followed by glaucoma and age-related macular

degeneration as secondary causes, while uncorrected refractive errors are the largest cause of visual impairment. People with visual impairments are categorized according to the nature of their disability, such as partial blindness or total blindness. Depending on the individual, blindness can be caused by unfortunate incidents, medical disorders such as cataracts, or even old age, regardless of the individual's gender or race.

As a highly specialized market, the demands of the visually impaired are sometimes disregarded when it comes to product design; hence, items developed are not typically customized to their specific requirements. Due to their disability, they are adapting to poor medication adherence - which could be under-dosing, overdosing, inconsistent dosing, or costly medications, which might decrease internal validity and create safety concerns. For example, if a treatment regimen is effective, lack of adherence may lower the actual effect size. Consequently, poor drug adherence can result in undesirable outcomes such as disease progression and death.

The study aimed to help visually impaired patients take their medications by reminding them when and where their medications are. For the reason that visually impaired patients are oblivious time or place of their medications, they must be reminded regularly unless they have a caretaker. If the patient does not have access to a caregiver, it is a crucial issue because it may result to taking wrong medicine or take the medicine at the wrong time. The researchers added a more innovative system and solution to the problem by using various techniques used in previous innovations and focusing on economical solutions.

## **METHODS**

The researchers used a quasi-experimental research design to perform this study. It focuses on the Medication Adherence Pill (MAP) Organizer for Visually Impaired Patients. Through the City Social Welfare Development Office (CSWDO) in the City of Koronadal, the researchers were able to identify participants for this research undertaking. The pretest and post test questionnaire was made for the participants to know their visual impairment status and to know the result of using the intervention . In this study, the researcher had strictly adhered to research ethics, including the confidentiality, privacy rights, and safety of the participants.

## RESULTS AND DISCUSSION

Table 2A: Raw data of Pre-test assessment

Question	1	2	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
YES	10	8	6	8	2	5	9	5	9	10	1	5	2	3	8	7	7	1	6
NO		2	4	2	8	5	1	5	1		9	5	8	7	2	3	3	7	
AVERAGE	10	5	5	5	5	5	5	5	5	10	5	5	5	5	5	5	5	4	6

The table 2A shows the raw data of the responses of visually impaired patients in the pre-test assessment.

Table 2B: Raw data of Post-test assessment

Question	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
YES	10	8	6	3	5	8	7	7	3	3	10	10	10	10	10	10	2	3	9	10
NO		2	2	7	5	2	3	3	7	7							8	7	1	
AVERAGE	10	5	4	5	5	5	5	5	5	5	10	10	10	10	10	10	5	5	5	10

The table 2B shows the raw data of the responses of visually impaired patients in the post-test assessment.

Table 3: Level of Indicators on the Capacity of Medication Adherence Pill (MAP) Organizer to Enhance the level of Knowledge among Visually Impaired Patients

BEFORE	YES	NO	AFTER	YES	NO
Do you ever feel as though vision issues prevent you from doing the things you want to do?	55.0	45.0	Is it easy for you to use the MAP organizer?	90	10
Can you read the newspaper headlines in large print?	70.0	30.0	Is using the MAP organizer easier or more difficult compared to another organizer?	100	0.0

Can you read the standard print in books, magazines, or newspapers?	30.0	70.0	Do you feel comfortable using the MAP organizer?	100	0.0
Can you read the names and numbers in a phone book?	55.0	45.0	Can you use the MAP organizer without the help of your guardian?	95	5.0
Can you see the street name signs and the walk sign when you are walking on the sidewalk?	90.0	10.0	Do you find MAP organizers helpful to you in your medication adherence?	100	0.0
Do cars seem to suddenly appear close to you as you cross the street?	100.0	0.0	Are you still experiencing medication errors after using the MAP organizer?	25	75.0
Are the labels on the medicine bottles visible?	15.0	85.0	Is taking your medication still a challenge for you after using the MAP organizer?	40	60.0
When you shop, can you see the prices?	40.0	60.0	can you now manage your medication intake properly?	90	10.0

Results in table 3 revealed that there was a substantial increase in the level of knowledge among visually impaired patients who have been exposed to MAP organizer having a mean value of 82.2% after intervention.

Are you able to read your own mail?	20.0	80.0	Would you recommend the MAP organizer to visually impaired patients?	100	0.0
Can you read the handwriting you write?	30.0	70.0			
Can you recognize your family or friends' faces across a room of average size?	80.0	20.0			
Do you know your level of visual impairment?	70.0	30.0			
Have you ever discussed a vision issue with your doctor?	65.0	35.0			
Has a medical professional ever told you that there is no hope for improving your vision?	5.0	80.0			
Have you ever tried to seek out another kind of service, such as a low vision clinic, to obtain a specialized optical aid to improve your vision?	0	80.0			
Total Mean	48.3	49.3		82.2	17.8

Meanwhile, most of the respondents have found that MAP organizer was easy to use (90%), MAP organizer is easier to use compared to another organizer (100%), and they feel comfortable in using the tool (100%). The result also shown that even if the participants were visually impaired, they can still use the pill organizer without the help of their guardians (95%). Meanwhile, the participants found that the MAP was helpful in terms of identifying medication errors and managing medication because 75% of the participants were not experiencing medication errors; 60% of the participants revealed that taking medication was not already a challenge; and 90% of the participants revealed that they can already manage their intake properly after using the MAP organizer, Hence, they recommended the MAP organizer to other visually impaired individuals.

In relation to the study of Jimmy, B. & Jose, J. (2011), medication adherence is a critical aspect of healthcare management, and the use of Medication Adherence Pill (MAP) organizers has been found to have a substantial impact on helping patients adhere to their medication requirements. Non-adherence to medication in

patients has significant consequences, including the deterioration of diseases, increased mortality rates, and elevated healthcare expenses. Numerous factors can influence a patient's adherence to medication, and these barriers can be approached by considering aspects related to the patient, healthcare provider, and the overall health system, with possible interactions among them. The primary goal of MAP organizers is to provide a structured and organized approach to medication management, ultimately ensuring that patients take their medications as prescribed by their physicians, and do so on time.

The result was in congruent to the study of Schwartz, J (2016) because it was said that the effectiveness of pill organizers in enhancing medication adherence has been supported by research studies. Studies have consistently demonstrated that the use of pill organizers leads to improved adherence rates among patients. By utilizing MAP organizers, patients are better able to organize their medications, follow their prescribed schedules, and avoid missing or skipping doses. On the other hand, according to Dowden's study (2020), although pill organizers may seem like an ideal way to ensure medication adherence among older patients, there is limited evidence supporting their effectiveness and they may even have adverse effects. The Royal Pharmaceutical Society report found insufficient evidence that pill organizers help patients take their medicines or improve patient outcomes.

It opposed the results in table 2 because it was stated that there was just limited evidence on its effectiveness and that it is not really helpful in the medication adherence of the patients. The Care Quality Commission states that pill organizers do not always simplify medication management and should not be the first choice for people in care homes. NICE guidance suggested that a monitored dosage system should only be considered after a health professional's assessment and taking into account the patient's or family's opinion. However, a review of community pharmacies in England revealed that the decision to provide a pill organizer was primarily based on the practitioner's judgement, with patient or carer opinions playing a lesser role. Furthermore, a significant portion of pharmacies did not conduct a needs assessment or reassessment before supplying a pill organizer. This suggested that a large number of pill organizers may be inappropriately provided. Pressure from prescribers and the desire to maintain a positive relationship with local GPs were cited as reasons for supplying pill organizers even when pharmacists disagreed with the assessment. (Dowden, 2020; Yeung, 2019; Stewart, 2018)

The Medication Adherence Pill (MAP) organizer consists of pill compartments or slots labeled with different shapes, days of the week and specific times by the use of braille. This design allows patients to know which medications they need to take at each designated time even if they are visually impaired. The shapes, braille and organization of medications reduce the risk of confusion and facilitate the accurate administration of prescribed drugs.

According to the journal of Ashraf Mehdinia, et al., (2020) One of the key benefits of pill organizers is that they serve as effective reminders for patients to take their medications. The visual cues provided by the organizers help individuals stay on track with their medication regimen. This is particularly important for patients who may have complex medication schedules or who take multiple medications throughout the day. Medication Adherence Pill (MAP) organizers simplify the process of remembering and managing medication doses, making it easier for patients to adhere to their prescribed treatment plans. Furthermore, the use of Medication Adherence Pill (MAP) organizers addresses common barriers to medication adherence. Patients often struggle with forgetfulness, especially when they have to take medications at different times or have multiple medications to manage. (Oman, 2011) MAP organizers mitigate this issue by providing a clear visual representation of the medication schedule, reducing the chances of missed doses. Additionally, the organization and convenience offered by MAP organizers make it easier for patients to incorporate medication-taking into their daily routines.

In conclusion, the use of Medication Adherence Pill (MAP) organizers had been found to be an effective intervention for enhancing medication adherence among patients. By providing a structured and organized approach to medication management, MAP organizers help patients take their prescribed medications on time. The visual reminders, simplification of medication schedules, and reduction of barriers to adherence all contribute to the effectiveness of MAP organizers. Healthcare providers can consider recommending and incorporating MAP organizers as part of a comprehensive strategy to improve medication adherence and promote better health outcomes for their patients. The results for medication adherence as indicators for MAP organizer as a potent tool to enhance medication compliance is shown in table 4.

**Table 4:** Level of Indicators on the Capacity of Medication Adherence Pill (MAP) Organizer to Enhance the Medication Adherence among Visually Impaired Patients

BEFORE	YES	NO	AFTER	YES	NO
Do you take medications?	100	0.0	Do you take your medications as prescribed by your physician?	100.0	0.0
Do you have maintenance medications?	100	0.0	Do you sometimes forget to take your medications?	80.0	20.0
			People sometimes miss taking their medication for	65.0	35.0

			reasons other than forgetting. Over the past 4 weeks, were there any days when you did not take your medications?		
			Have you ever cut back or stopped taking your medications without telling your doctor?	35.0	65.0
			When you travel or leave home, do you sometimes forget to bring your medication?	55.0	45.0
			Do you think you are adherent to your medication?	65.0	35.0
			Do you think you can take your medication without the help of your family or guardian?	60.0	40.0
			Do you have a storage box for your medicines?	25.0	75.0
			Do you know how to properly store your medications?	20.0	80.0
			Are you storing your medicines in the right place?	20.0	80.0
			Do you use the MAP organizer daily?	100.0	0.0
<b>Total Mean</b>	100.0	0.0		56.8	43.2

The study found that all visually impaired patients reported taking their medications as prescribed by their physicians, indicating a high level of adherence. The table 3 revealed that there is a mean value of 56.8% before intervention. However, 80% of patients sometimes forget to take their medications, which is a common



challenge for this population. Additionally, 65% of patients experienced days when they did not take their medications, suggesting factors beyond forgetfulness affecting adherence. A concerning finding is that 35% of patients admitted to cutting back or stopping their medications without informing their doctor, highlighting the need for interventions and better communication with healthcare providers. When traveling or leaving home, 55% of patients forget to bring their medications, indicating a need for tailored strategies or reminders. While 65% of patients believe they are adherent, objective measures are necessary for a comprehensive assessment. Regarding independence, 60% believe they can manage their medications without assistance, demonstrating moderate self-confidence. Storage challenges are evident, with only 25% having a storage box and 20% knowing how to properly store medications. However, 100% of patients reported daily use of MAP organizers, indicating their potential to support adherence. Overall, the findings from the research on table 3 indicate that while visually impaired patients show a high level of adherence to medication prescriptions and engage with MAP organizers, challenges such as forgetting medications, missed doses, non-disclosure of medication changes, lack of knowledge about proper storage, and limited organization persist. These results emphasize the importance of developing tailored interventions, providing education, and offering support to enhance medication adherence among visually impaired individuals. Furthermore, the utilization of MAP organizers is an effective tool to address these challenges and improve overall medication adherence outcomes in this population.

The result is in congruent with the study of Jimmy, B. & Jose, J. (2011) because it is stated there that there are several factors that are likely to influence medication adherence. It is also stated that one of the primary causes of non-adherence among patients is forgetfulness, according to the findings of a study. The study revealed that approximately 49.6% of participants identified forgetfulness as a significant unintentional factor contributing to non-adherence. In addition, according to the American Medical Association (AMA) the majority of nonadherence stems from intentional decisions made by patients, where they consciously choose not to take their medication based on their own knowledge, experiences, and beliefs. In their study there are eight reasons for their nonadherence such as fear, cost, misunderstanding, too many medications, lack of symptoms, mistrust, worry and depression. According to the study of Frank Roger, the failure to follow a medication regimen can result in serious medical outcomes for the patients and significantly increase health costs. Visual acuity, contrast sensitivity and stereopsis should be considered potential risk factors for impaired ability to implement a medication regimen in older adults. There are a handful of versatile solutions to improve the medication adherence. The pillbox being one of the most widely used methods. There are a vast quantity of different pillboxes, As such, pillbox characteristics such as a lack of contrast between letters and the background (container color), inadequate opening/closing mechanism, small compartments in relation to the

size and number of tablets to be used, shape of the device, and lack of a separation between medication to be taken before and after breakfast are all important.

The Medication Adherence pill Organizer (MAP), a customized Pillbox for Visually Impaired Patients with a weekly format with 3 sub-compartments corresponding to different periods of the day (Morning, Noon, Evening,) with a braille, were developed to decrease adherence errors. Easy to use and allow the visually impaired to maintain an independent lifestyle. On the other hand, the result is incongruous with the study of The Pharmacist’s Resource for Clinical Experience because it is stated that patients are adherent to their medications. According to the World Health Organization (WHO), both patients and the ambulatory healthcare team share the responsibility of medication adherence. The WHO emphasizes that medication adherence can have a more significant impact on patient outcomes than the specific treatment itself. Adherence to medication can influence various aspects, including the quality and length of life, health outcomes, and overall healthcare costs. To foster a trusting and effective pharmacist-patient relationship, it is crucial to maintain a blame-free environment and provide patients with praise when they achieve their goals. Effective interventions to improve adherence include face-to-face counseling, the use of mobile text messaging, simplifying medication regimens, employing adherence packaging, minimizing adverse effects, assisting with access to medication, and involving team members. Enhancing adherence can lead to substantial clinical and financial benefits.

**Table 5.** Testing the Significant Relationship among Visually Impaired Patients Before and After Using the Medication Adherence pill (MAP) organizer

Test Variables	X <sup>2</sup>	P value	Remarks*
Knowledge	8.62	0.013	Significant
Medication Adherence	4.80	0.091	Not significant

\*Calculation was performed at 0.05 level of significance

The statistical analysis conducted on the data revealed two key findings. First, there was a significant difference ( $p < 0.05$ ) between the pre-assessment and post-intervention levels of knowledge among visually impaired patients. This indicated that the intervention with MAP organizers had a substantial impact on increasing the patients' knowledge about medication management. The statistical significance suggests that the

observed increase in knowledge is unlikely due to random chance. This finding indicated that the usage of MAP organizers significantly helped the respondents in enhancing their level of knowledge. The organizers may have provided them with valuable information, reminders, or educational resources that effectively improved their understanding of medication-related topics. The statistically significant difference in knowledge before and after the intervention suggested that the organizers were effective in increasing the patients' knowledge levels.

On the other hand, the statistical analysis revealed no significant difference ( $p>0.05$ ) in medication adherence before and after the intervention among visually impaired patients. This means that the use of MAP organizers did not have a substantial impact on improving the patients' overall medication adherence. The result was in congruent to the Schwartz, J. (2011) because it was stated in their study findings that a majority of participants utilized pillboxes as a means to effectively manage their medications, and those who used pillboxes demonstrated higher levels of medication adherence compared to nonusers. Furthermore, the users of pillboxes expressed overall satisfaction, as reflected by an average quest score of 4.33 and it helped in their level of knowledge.

It is important to note that statistical non-significance does not necessarily imply that there was no effect at all. It means that the observed difference in medication adherence between the pre-assessment and post-intervention stages could be due to random variation rather than a true effect of the intervention. There could be several reasons for the lack of significant difference in medication adherence. It is possible that the intervention with MAP organizers did not effectively address the specific barriers to adherence faced by visually impaired patients. Adherence is a complex behavior influenced by various factors such as forgetfulness, personal beliefs, or external circumstances, and the organizers may not have adequately addressed these factors. Additionally, there could have been limitations in the study design or implementation that affected the ability to detect a significant change in medication adherence. Factors such as the duration of the intervention, sample size, or measurement methods could have influenced the statistical power of the analysis.

In summary, the statistical analysis revealed a significant increase in knowledge among visually impaired patients after the intervention with MAP organizers. However, there was no statistically significant difference in medication adherence before and after the intervention. Further research may be needed to explore additional interventions or strategies that specifically target the barriers to adherence in this population and enhance overall medication adherence outcomes.

**Table 6.** Testing the Significant Difference among Visually Impaired Patients Before and After Using the Medication Adherence pill (MAP) organizer

Test Variables	T value	P value	Remarks*
Knowledge	1.971	0.0084	Not significant
Medication Adherence	1.00	0.500	Not significant

\*Calculation was performed at 0.05 level of significance

Statistical analysis revealed that there was no significant difference ( $p > 0.05$ ) before (pre-assessment) and after (post intervention) on the level of knowledge and medication adherence among visually impaired patients. However, based on mean values, it was shown that the level of knowledge and medication adherence among patients had substantially increased after undergoing intervention with MAPs organizer. This means that MAPs organizers significantly helped the respondents in terms of enhancing their level of knowledge.

The Medication Adherence Pill (MAP) organizer consists of pill compartments or slots labeled with different shapes, days of the week and specific times by the use of braille. This design allowed patients to know which medications they need to take at each designated time even if they are visually impaired. The shapes, braille and organization of medications reduce the risk of confusion and facilitate the accurate administration of prescribed drugs. In relation to the other studies, according to Ashraf Mehdinia et al.,(2020) one of the key benefits of pill organizers is that they serve as effective reminders for patients to take their medications. The visual cues provided by the organizers help individuals stay on track with their medication regimen. This is particularly important for patients who may have complex medication schedules or who take multiple medications throughout the day. Medication Adherence Pill (MAP) organizers simplify the process of remembering and managing medication doses, making it easier for patients to adhere to their prescribed treatment plans. Furthermore, the use of Medication Adherence Pill (MAP) organizers addresses common barriers to medication adherence. Patients often struggle with forgetfulness, especially when they have to take medications at different times or have multiple medications to manage. (Oman, 2011)

## CONCLUSION

The results of the study indicate that visually impaired patients who used the MAP organizer intervention experienced a significant increase in their level of knowledge. The majority of respondents had positive experiences with the MAP organizer, finding it easy to use and beneficial in identifying medication

errors and managing their medication. They expressed their willingness to recommend the MAP organizer to others. However, challenges such as forgetting medications, missed doses, and lack of knowledge about proper storage were identified. While the use of MAP organizers showed potential in supporting adherence, there was no significant improvement in overall medication adherence. The study underscores the importance of interventions, education, and support to enhance medication adherence among visually impaired individuals. It also suggests the need for further research to identify effective strategies in this population.

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## REFERENCES

- [1] *Behavioral Personality Theories - IResearchNet*. (2016, February 10). Psychology. Retrieved October 14, 2022, from <http://psychology.iresearchnet.com/counseling-psychology/personality-theories/behavioral-theories-of-personality/>
- [2] Beutel ME, Klein EM, Brähler E, Reiner I, Jünger C, Michal M, et al. Loneliness in the general population: prevalence, determinants and relations to mental health. *BMC Psychiatry*. 2017;17(1):97.
- [3] Brown, M. T., & Bussell, J. K. (2011). Medication adherence: WHO cares?. *Mayo Clinic proceedings*, 86(4), 304–314. <https://doi.org/10.4065/mcp.2010.0575>
- [4] Brunes, A., B. Hansen, M. & Heir, T. Loneliness among adults with visual impairment: prevalence, associated factors, and relationship to life satisfaction. *Health Qual Life Outcomes* 17, 24 (2019). <https://doi.org/10.1186/s12955-019-1096-y>
- [5] Brunes A, Hansen MB, Heir T. Post-traumatic stress reactions among individuals with visual impairments: a systematic review. *Disabil Rehabil*. 2018;12:1–8.
- [6] Brunes A, Nielsen MB, Heir T. Bullying among people with visual impairment: prevalence, associated factors and relationship to self-efficacy and life satisfaction. *World J Psychiatry*. 2018;8(1):43.
- [7] Cohen-Mansfield J, Hazan H, Lerman Y, Shalom V. Correlates and predictors of loneliness in older-adults: a review of quantitative results informed by qualitative insights. *Int Psychogeriatr*. 2016;28(4):557–76.
- [8] Colenbrander A. Assessment of functional vision and its rehabilitation. *Acta Ophthalmol*. 2010;88(2):163–73.
- [9] Cumberland PM, Rahi JS. Visual function, social position, and health and life chances: the UK biobank study. *JAMA Ophthalmol*. 2016;134(9):959–66.
- [10] Crews JE, Chou C-F, Zack MM, Zhang X, Bullard KM, Morse AR, et al. (n.d.) The association of health-related quality of life with severity of visual impairment among people aged 40–64 years: findings from the 2006–2010 behavioral risk factor surveillance system. *Ophthalmic Epidemiol*. 2016;23(3):145–53.

- [11] Dawson-Rose C, Draucker C, Corbett C, et al. Visual impairment and medication safety: a protocol for a scoping review. *Syst Rev.* 2021;10(1):107. doi:10.1186/s13643-021-01594-z. PMID: 33858308; PMCID: PMC8442271. Retrieved from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8442271/>
- [12] Dwamena, M. (n.d.). *How long do Pla 3D printed parts last?* 3D Printerly. Retrieved February 10, 2023, from [https://3dprinterly.com/how-long-do-3d-printed-partslast/?fbclid=IwAR1eZh7Qrav3vGkuPK9c9iPz4G851QDKwiTCiHkzdPh\\_vudWIn5daxaQDo](https://3dprinterly.com/how-long-do-3d-printed-partslast/?fbclid=IwAR1eZh7Qrav3vGkuPK9c9iPz4G851QDKwiTCiHkzdPh_vudWIn5daxaQDo)
- [13] Dowden, A. (2020). *Do pill organisers improve medication adherence?* *Prescriber*, 31(9), 24–27. doi:10.1002/psb.1865
- [14] *Evolution of smart pillbox: History and reasons for a need to ...* (n.d.). Retrieved October 13, 2022, from [https://www.researchgate.net/publication/355039125\\_Title\\_Evolution\\_of\\_smart\\_pillbox\\_History\\_and\\_reasons\\_for\\_a\\_need\\_to\\_design\\_a\\_smart\\_pillbox](https://www.researchgate.net/publication/355039125_Title_Evolution_of_smart_pillbox_History_and_reasons_for_a_need_to_design_a_smart_pillbox)
- [15] Fenwick E, Rees G, Pesudovs K, Dirani M, Kawasaki R, Wong TY, et al (n.d.) Social and emotional impact of diabetic retinopathy: a review. *Clin Exp Ophthalmol.* 2012;40(1):27–38.
- [16] Giles, S. J. (2021, September 15). *Visual impairment and medication safety: a protocol for a scoping review - Systematic Reviews.* BioMed Central. Retrieved October 14, 2022, from <https://systematicreviewsjournal.biomedcentral.com/articles/10.1186/s13643-021018008?fbclid=IwAR0ZwDmDxrHwqZtGxCqUh8FlgsUCw6IJP87DEhan7aMcM5t8o1AlbEXPH4>
- [17] Huang, H. Y. (2000, October 15). Impact of Pill Organizers and Blister Packs on Adherence to Pill Taking in Two Vitamin Supplementation Trials. *American Journal of Epidemiology*, 152(8),780–787. <https://doi.org/10.1093/aje/152.8.780>
- [18] J. F. Pinto, J. L. Vilaça and N. S. Dias, "A Review of Current Pill Organizers and Dispensers," 2021 IEEE 9th International Conference on Serious Games and Applications for Health (SeGAH), 2021, pp. 1-8, doi: [10.1109/SEGAH52098.2021.9551894](https://doi.org/10.1109/SEGAH52098.2021.9551894).
- [19] Jimmy, B., & Jose, J. (2011). Patient medication adherence: Measures in daily practice. *Oman Medical Journal*, 26(3), 155–159. <https://doi.org/10.5001/omj.2011.38>

- [20] Körner M, Lippenberger K, Becker S, Rösch S, Müller G, Meyer G. (n.d.) Supporting Blind and Visually Impaired Persons in Managing Their Medication. *Stud Health Technol Inform.* 2019;264:1836-1837. doi: [10.3233/SHTI190622](https://doi.org/10.3233/SHTI190622). PMID: [31483272](https://pubmed.ncbi.nlm.nih.gov/31483272/).
- [21] Lam, W. Y., & Fresco, P. (2015, October 11). *Medication adherence measures: An overview.* BioMed Research International. Retrieved October 14, 2022, from <https://www.hindawi.com/journals/bmri/2015/217047/>
- [22] Mehdinia, A., Loripoor, M., Dehghan, M., & Heidari, S. (2020, March 30). The Effect of Pillbox Use on Medication Adherence Among Elderly Patients: A Randomized Controlled Trial. *International Electronic Journal of Medicine*, 9(1), 38–43. <https://doi.org/10.34172/iejm.2020.07>
- [23] *PUBLIC TOLD: PROTECT YOUR EYES FROM BLINDNESS – DOH Press Release/06 August 2017* | Department of Health website. (n.d.). DOH. <https://doh.gov.ph/node/10735>
- [24] Smart drugs:Improving healthcare using Smart Pill Box for Medicine Reminder and Monitoring System. (2018, December). *Future Computing and Informatics Journal*, 3(2), 443–456. <https://doi.org/10.1016/j.fcij.2018.11.008>
- [25] Souza, F. R. D. e, & Santana, C. da S. (2013, December 10). *A descriptive study about the use of pillboxes by older adults.* Health. Retrieved November 28, 2022, from <https://www.scirp.org/journal/PaperInformation.aspx?PaperID=41217>
- [26] Steiner, J. F., & Earnest, M. A. (2000). The language of medication-taking. *Annals of internal medicine*, 132(11), 926–930. <https://doi.org/10.7326/0003-4819-132-11-200006060-00026>
- [27] Villanueva, E. L. D., De Guzman Tarampi, J., Cayetano, A. J. M., & Linsangan, N. B. (2020, September 3). Braille-based Pillbox for Visually Impaired with Audio Reminder. *2020 4rd International Conference on Electrical, Telecommunication and Computer Engineering (ELTICOM)*. <https://doi.org/10.1109/elticom50775.2020.9230519>
- [28] *Vision impairment and blindness.* (2022, October 13). Retrieved October 14, 2022, from <https://www.who.int/news-room/factsheets/detail/blindness-and-visual-impairment>
- [29] World Health Organization. International classification of diseases 10th revision: (2016). World Health Organization; 2016. <http://apps.who.int/classifications/icd10/browse/2016/en/>