

TAILOR COMMUNICATION STRATEGIES BY PHARMACISTS TO PEDIATRIC AND GERIATRIC CAREGIVER TO DECREASE CAREGIVER MEDICATION ERRORS AND INCREASE CAREGIVER SATISFACTION IN OUTPATIENT PHARMACY AT KFAFH

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Abstract

Background

Medication errors, prevalent in caregiver interactions, pose significant risks to patient safety. Tailored communication strategies by pharmacists are pivotal in mitigating such errors. This quality improvement project focuses on enhancing communication with pediatric and geriatric caregivers to reduce medication errors.

Method

The rapid cycle quality improvement method PDSA was used for this project, focusing on enhancing communication strategies for pharmacists interacting with pediatric and geriatric caregiver populations. We analyzed identified challenges in miscommunication and implemented several actions.

Interventions

- 1- Use language that is appropriate for the caregiver's health literacy level
- 2- Provide patient-friendly educational materials.
- 3- Pharmacists can encourage caregivers to ask questions when they are unsure of how to give medications at home by increasing awareness that caregiver difficulty with administering medications is common and that questions are expected
- 4- The teach-back method involves asking patients or caregivers to repeat back the instructions given to them to ensure that they understand the information correctly
- 5- Encourage caregivers to request a dosing tool if one is not provided. Dosing tools can help caregivers measure the correct medication dose and reduce the risk of medication errors.

Results

- Decrease medication errors among pediatric and geriatric caregivers' post- intervention by 71.63%.
- Increased average Percentage of patient-caregiver satisfaction by 83.49%, resulting in a noticeable improvement in caregiver experience and engagement.
- Increased average Pharmacist Adherence to Tailored Communication Protocols by 85.45%
- Increased % Use a "teach back" technique to check understanding by 281.25 %
- Increased Pharmacist Engagement in communication skill education programs by 106.5%

Conclusion

Pharmacists' tailored communication strategies play a pivotal role in reducing medication errors among pediatric and geriatric caregivers. By understanding and adapting to various communication preferences, pharmacists can significantly enhance patient safety and overall healthcare outcomes.

Key words: Pediatrics caregiver, Geriatric Caregiver, Medication Error, communication.

Problem Description:

in pharmacy school. The development of patient-pharmacist communication abilities by pharmacists was assessed by an analysis of 47 research.[6]

- During pharmaceutical treatment management consultations, pharmacists can employ the teach-back method to make sure patients comprehend the drug information that was discussed. This can also help to increase medication adherence [7].

- Patient-pharmacist counseling also leads to greater patient satisfaction with the pharmacist consultation.[8]

- Individual pharmacists can improve their patients' health literacy by implementing a three-step process, developed by Jacobson and colleagues: 1- assessing the pharmacy for health literacy-friendliness, 2- training the pharmacy staff in clear communication, 3- introducing interventions to facilitate medication adherence, such as pill cards and telephone reminder systems [9]

- Patient-centered instructions were more likely to be understood than standardized labels.[10]

- Pharmacists can improve patients' ability to take medications properly by learning how to communicate more effectively [11]

- Using the "teach-back" method is crucially important. In one study, patients were much more likely to take their medications correctly if they could show a health care provider which tablets they would take instead of simply repeating instructions that the provider spoke moments before.[9]

- The use of patient education tools, such as pill cards and automated prescription reminder telephone calls, can be helpful for some patients with low health literacy.

- Low health literacy has been shown to lead to both poor patient adherence [12] and poor health outcomes.[13][14]

- The pharmacy is a critical part of that system,[15][16] but pharmacists have not been communicating in a sufficiently consumer-friendly manner to address patients' problems with comprehension. Forty-eight percent of patients misinterpret medication drug labels, and many take their medications improperly.[17][18]

- Research from the USA and Canada indicates that a sizable portion of unfavorable incidents take place at home [19][20]. For instance, in 2003, 13% of the more than 3 million American patients getting at-home medical treatment experienced an unfavorable event [20].

- This is not just an issue for the elderly; US children under the age of six have an average annual rate of prescription errors of 26.4 per 10,000 population [21].

- The distribution and types of medication errors in the home context are poorly known, and in many situations, a third person is in charge of giving medication at home [22].

- Some evidence indicates that both informal and formal careers may lack training or knowledge, adding to potential risk in administering medicines [23][24][25].

- Errors in pediatric medication administration in the home environment are common [21] [26] and can result in serious consequences.[27] These errors include dosing mistakes (both underdosing and overdosing), errors in frequency or duration of dosing (including missed doses), administration of incorrect medications or formulations, wrong route of administration, incorrect preparation or storage, and use of expired medications.[29][27][30][31]

- Following their child's discharge from a public hospital emergency room, over half of caregivers administered a medication dose that differed by more than 20% from the specified amount; 1 in 4 caregivers delivered a dose that deviated by more than 40%, according to research.[26] In a similar scenario, comparable rates were obtained in a second trial.³² In another study, almost half of the caregivers provided their child with OTC drug doses that were outside of the prescribed range. [33]

Measures:

The outcome measures were selective to evaluate the impact of the implementation of the active strategies

- Number of Medication Errors by care givers post-intervention.
- Percentage of Patient Caregiver Satisfaction
- Percentage of Pharmacist Adherence to Tailored Communication Protocols

Process Measures:

- %Patient satisfactions on the clarity of information shared
- % Dispensing appropriate measuring devices (oral syringes)
- % Encourage patients to carry the list of their medications to every physician appointment and update this list whenever changes are made to their medication regimen
- % Use a "teach back" technique to check understanding
- % of Utilization of Educational Material: Monitoring the distribution and subsequent use of pamphlets, digital resources.
- Rate of Caregiver Queries
- Pharmacist Engagement in communication skill education program

Data collections Tools:

- Outcome Measure: Online survey tools Google Forms for Patient Caregiver Satisfaction: Use Likert scales to capture quantitative data. Regular audits and observations would be conducted to assess staff adherence to safety protocols.
- Process Measure: Regular audits and observations "Pharmacist-Interaction" Assess the implementation of tailored communication strategies, use of a teach-back method, encouragement for questions, provision of dosing tools. Training Records: number of Pharmacist Engagement in communication skill education program
- Data was collected via an excel sheet (Number of reports of Medication Errors by caregivers).
- Baseline data were taken from the data previously reported to the CQI department.
- Data is analyzed and follow up daily and reported to the CQI department.

Analysis

Descriptive statistics were carried out; categorical variables were summarized by number and percent; Data was displayed inline graphs to examine variation occurring at the aggregate level.

All statistical analysis was performed by using software Microsoft Excel.

Ethical Considerations:

This project was initiated by Pharmacy Department and approved by CQI & PS. No consent from the patient is required for this project.

Design

Interventions:

On January 1, 2023, medication safety pharmacists and outpatient pharmacy staff within the Hospital implemented active strategies to Improve the Prescription Refill Experience in Outpatient Pharmacy at KFAFH.

We are doing:

- 1- Use language that is appropriate for the caregiver's health literacy level
- 2- Provide patient-friendly educational materials
- 3- Pharmacists can encourage caregivers to ask questions when they are unsure of how to give medications at home by increasing awareness that caregiver difficulty with administering medications is common and that questions are expected
- 4- The teach-back method involves asking patients or caregivers to repeat back the instructions given to them to ensure that they understand the information correctly
- 5- Encourage caregivers to request a dosing tool if one is not provided. Dosing tools can help caregivers measure the correct medication dose and reduce the risk of medication errors.

Engagement Approach: Regular meetings and brainstorming sessions were held to discuss each intervention. Feedback from both pharmacy staff and potential end-users was collected and considered in the design process.

Anticipated Problems:

Resistance to Change: Some staff and caregivers might resist new approaches initially.

Resource Limitations: Budget constraints or technological barriers might hinder the adoption of certain tools.

Sustainability Plan:

Training Integration: Embedding cultural competency training into the outpatient pharmacy ongoing education programs.

Continuous Evaluation: Establishing a feedback loop for continuous assessment and adaptation of communication strategies.

Resource Allocation: Securing resources for language tools and aids as part of the regular budget allocation.

Leadership Support: Gaining leadership buy-in to ensure ongoing support for sustaining these interventions.

The interventions were developed with the understanding that tailored communication strategies, when integrated into daily practice, could significantly reduce medication errors and enhance caregiver satisfaction. The engagement of diverse team members ensured the interventions were comprehensive and reflective of various perspectives, aiming for a sustainable impact on improved patient care.

Strategy

Specific Aims

Primary Aims

o Decrease caregiver medication errors by 20% by the end of 2023 among pediatric and geriatric caregivers.

o Increase average caregiver satisfaction scores by 75% by the end of 2023.

Secondary Aims

o Increase average Pharmacist Adherence to Tailored Communication Protocols by 75 % by the end of 2023

o Increase the percentage of Pharmacist Engagement in communication skill education program

Methods (context)

The project was carried out in King Fahd Armed Forces Hospital, Jeddah. The Plan Do Study Act rapid cycles Quality improvement method was used for this project. The PDSA activities focus on tailoring communication Strategies by pharmacists to pediatric and geriatric caregiver to decrease caregiver medication errors and increase caregiver satisfaction in outpatient pharmacy At KFAFH. We have analyzed identified challenges in communication by pharmacists to pediatric and geriatric caregiver populations, leading to medication errors, and several actions were put into place. The project was conducted from Jan 01, 2023, with ongoing monthly monitoring measures followed by interventions and action plans accordingly. (Figure 1)

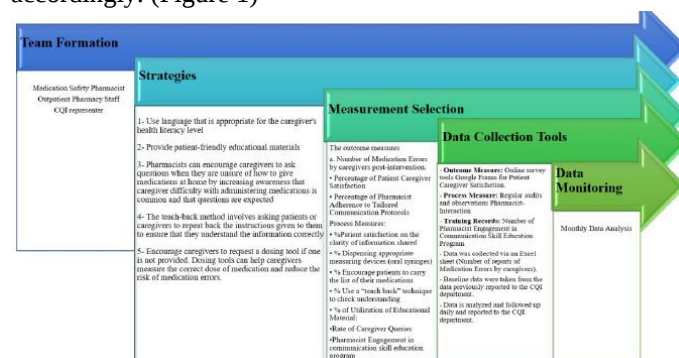


Figure 1

PDSA Cycle 1:

Aim: Enhance communication strategies for caregivers of pediatric and geriatric patients.

Change Hypothesis and Strategy: Introduce education material and simplified language in medication instructions.

Implementation: Developed education material illustrating administration techniques.

Simplified language in written instructions.

Data Collected: Feedback surveys from caregivers assessing the usefulness and clarity of information, along with error rates after the intervention.

Key Learning: education material was highly effective in improving caregiver understanding, resulting in a notable reduction in medication errors. However, some caregivers required additional support despite simplified instructions.

Outcome vs. Prediction: education material was more impactful than anticipated, significantly reducing errors. However, simplifying language did not uniformly address all comprehension challenges.

PDSA Cycle 2:

Aim: Enhance direct communication strategies between pharmacists and caregivers.

Change Hypothesis and Strategy: Implement role-playing exercises for pharmacists to practice communication with caregivers of pediatric and geriatric patients.

Implementation: Conducted role-playing sessions simulating interactions between pharmacists and caregivers, focusing on effective communication techniques.

Data Collected: Feedback from pharmacists about the effectiveness of role-playing, caregiver surveys assessing communication satisfaction, and error rates after interactions.

Key Learning: Role-playing exercises significantly improved pharmacist confidence and skills in engaging with caregivers. Caregiver satisfaction also increased, leading to a reduction in errors during these interactions.

Outcome vs. Prediction: Role-playing exercises proved highly effective in enhancing pharmacist-patient caregivers' interactions, leading to increased caregiver satisfaction and reduced errors.

Each PDSA cycle involved clear objectives, strategic interventions, and data-driven evaluations. The iterative nature allowed for swift adaptations based on learnings.

Education material exceeded expectations in reducing errors, while role-playing exercises significantly enhanced pharmacist-caregiver communication. The key learning was that multifaceted approaches, combining education material with direct communication skill enhancement, proved most effective in mitigating medication errors. The need for ongoing support for comprehension-challenged caregivers became evident, indicating the necessity for diverse strategies to cater to varying caregiver needs.

Study of the Intervention(s)

Assessment of the intervention and their outcome was monitored as follow:

- Data collection and analysis on monthly basis.
- Once-Weekly meeting for the team to study the data.
- The selected intervention was implemented systematically to monitor its impact individually.

After 3 months, we noticed an improvement of decrease caregiver medication errors among pediatric and geriatric caregivers and Increase caregiver satisfaction scores. (Figure 2 ,3,4).

Percentage reduce caregiver medication errors among pediatric and geriatric caregivers post-intervention

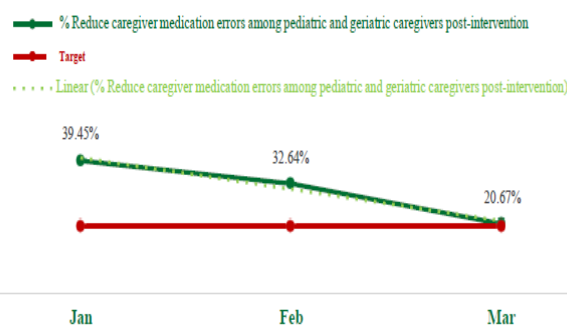


Figure 2

Percentage of patient-caregiver satisfaction

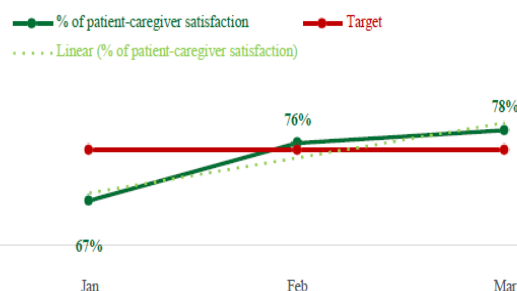


Figure 3

Percentage Pharmacist Adherence to Tailored Communication Protocols

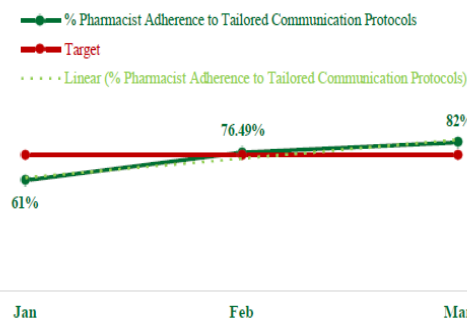


Figure 4

Because of the initial findings, we decide to continue using Tailored communication strategies by pharmacists in Outpatient Pharmacy

Results:

- The pharmacist prevented 5250 prescribing errors from occurring. About 3 MEs per prescription were prevented.
- Most patients involved in preventing MEs were in the age group of 1 month -65 years.
- The number of interventions was provided as prescribing stage: 1008 interventions for pediatric patients were recorded, 2034 interventions for geriatric patients were recorded, and 2208 interventions for adult patients were recorded.
- The solutions suggested during this improvement project succeeded in decreasing the number of medication errors by 71.63%
- Increased percentage use a "teach back" technique to check understanding by 281.25%.
- The average percentage of satisfaction of Caregivers on the clarity of information shared is 83.49 %.
- The average percentage of Pharmacist Adherence to Tailored Communication Protocols is 85.45%
- The average percentage of Patient satisfactions on the clarity of information shared is 83.9 %
- Increased percentage of Dispensing appropriate measuring devices (oral syringes) by 566.6%
- Increased percentage encourage patients to carry the list of their medications to every physician appointment and update this list whenever changes are made to their medication regimen by 91.42%
- Increased percentage of Pharmacist Engagement in communication skill education program by 106.5%

- Percentage Reduce caregiver medication errors among pediatric and geriatric caregivers post-intervention

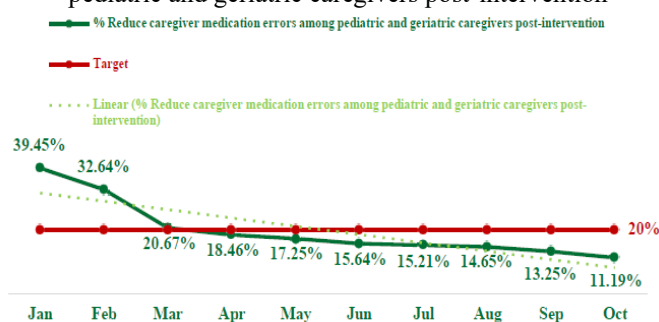


Figure 5

Percentage of patient-caregiver satisfaction

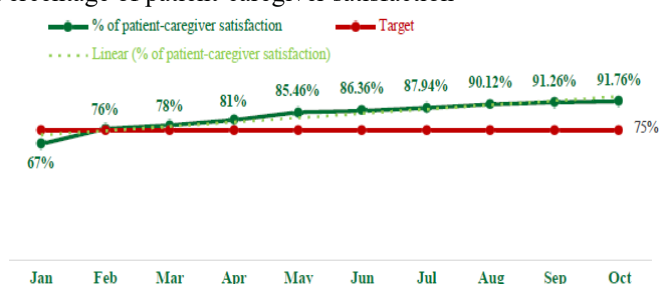


Figure 6

Percentage Pharmacist Adherence to Tailored Communication Protocols

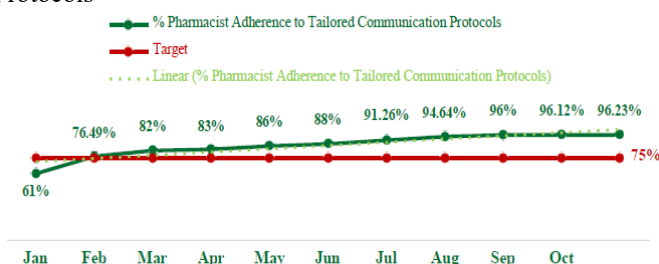


Figure 7

Percentage Use a “teach back” technique to check understanding.

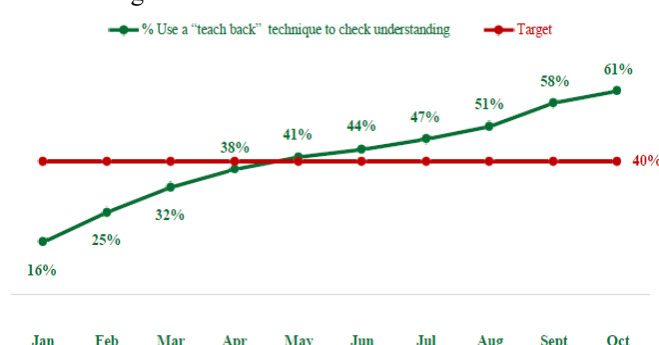


Figure 8

Percentage Patient satisfactions on the clarity of information shared

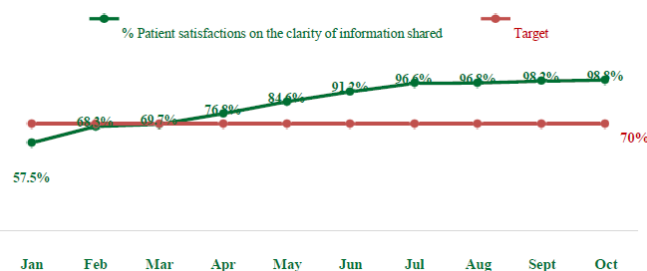


Figure 9

Percentage Patient satisfactions on the clarity of information shared

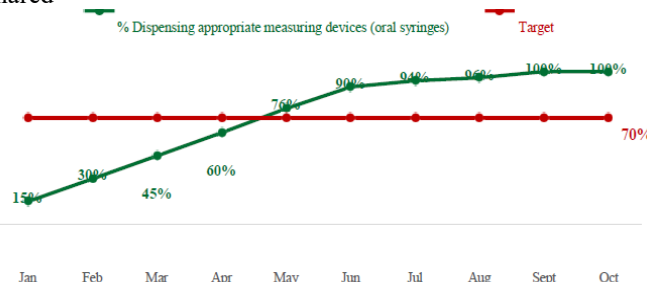


Figure 10

% Encourage patients to carry the list of their medications to every physician appointment and update this list whenever changes are made to their medication regimen

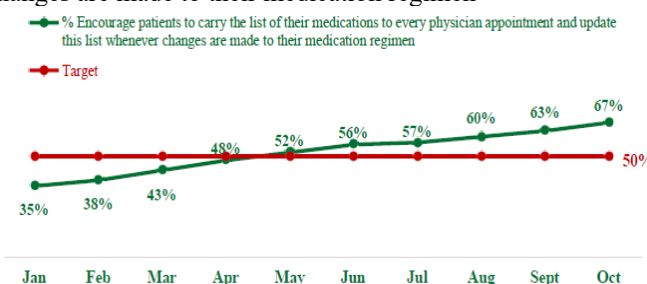


Figure 11

Percentage of Pharmacist Engagement in communication skill education program

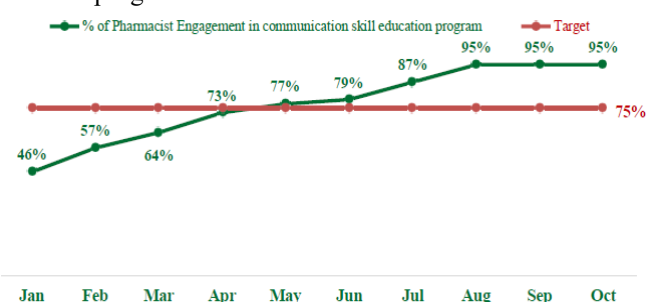


Figure 12

Summary and Interpretation:

The project on tailoring communication strategies for decrease caregiver medication errors and increase caregiver satisfaction in outpatient pharmacy provided valuable insights and learnings, alongside acknowledging certain limitations.

Lessons Learned: (Impact of the project)

- Tailored Approaches Yield Results: Customizing communication strategies based on caregiver preferences significantly improved understanding and reduced errors.

- **Feedback Is Essential:** Continuous feedback loops were crucial for refining interventions and enhancing effectiveness over time.

- **Interdisciplinary Collaboration Is Key:** Involving nurses, administrators, and caregivers in the process ensured comprehensive perspectives and better-tailored interventions.

Strengths of the Project:

- **Comprehensive Approach:** The project addressed multiple facets, from training pharmacists to implementing tools and feedback mechanisms, creating a holistic intervention.

- **Iterative Improvement:** Embracing the PDSA cycle allowed for iterative improvements based on real-time data and feedback, making interventions more effective.

Challenges Faced and Navigated:

Resistance to Change: Initially, some staff were hesitant to adopt new communication methods. Addressing this involved additional training and emphasizing the benefits.

Resource Constraints: Limited resources impacted the full-scale implementation of certain tools, necessitating creative solutions within budgetary confines.

Changes for Future Projects:

- **Faster Iterations:** Implement smaller, quicker cycles to adapt interventions more rapidly based on real-time feedback.

- **Resource Allocation:** Anticipate and secure more resources in advance to avoid delays in implementing certain tools or strategies.

Project Limitations:

- **Turnaround of caregivers:** Rapid turnover of caregivers affected the depth of engagement and follow-up for caregivers' education efforts.

- **Generalisability:** The project's specific environment might limit generalisability to different pharmacy settings.

- **Resource Constraints:** Limited resources impacted the full-scale implementation of certain tools, necessitating creative solutions within budgetary confines.

Confounding Factors:

Confounding Factors: External factors such as changes in caregiver demographics or staff turnover might have influenced outcomes beyond the project's control.

Imprecision and Data Needs:

Additional Data Points: Collecting data over a more extended period could provide a clearer understanding of long-term effects and sustainability.

Reflecting on these lessons, strengths, limitations, and challenges, future projects would benefit from a more nuanced understanding of resource allocation, quicker adaptation to feedback, and a focus on longer-term sustainability to overcome potential limitations and biases encountered in this endeavor.

Conclusion:

Background Research and Contribution:

The project built upon existing knowledge highlighting the significance of tailored communication in Decrease caregiver medication errors and Increase caregiver satisfaction in outpatient pharmacy. It added a practical dimension by implementing specific interventions tailored to diverse caregiver populations. While existing research emphasized the importance of communication, our project provided actionable strategies and insights for implementation.

Achievement of Aims and Adjustments:

The project largely achieved its aims by successfully implementing tailored communication strategies, training pharmacists, and introducing tools to enhance interactions. Adjustments were made throughout the process based on iterative improvements from PDSA cycles, aligning interventions more closely with desired outcomes.

Usefulness and Measures:

The project proved useful by significantly reducing medication errors and improving caregiver satisfaction, as measured through established metrics. While the measures were appropriate, incorporating additional balancing measures to evaluate potential unintended consequences would enhance future assessments.

Cost Analysis and Sustainability:

The interventions required initial investment, primarily in training and tool implementation.

However, the reduction in medication errors and potential downstream savings in healthcare costs, particularly related to preventable adverse events, can contribute to longterm financial benefits. The project's sustainability hinges on continuous evaluation, feedback mechanisms, and integrating tailored communication as standard practice within the organization.

Replicability and Next Steps:

The project holds promise for replication in similar healthcare settings by emphasizing the significance of tailored communication strategies. Spreading this project would involve sharing best practices, tools, and insights gained from feedback mechanisms. Future steps involve long-term data collection to assess sustained impact, explore scalability, and potentially expand interventions to other healthcare settings.

Further Study and Conclusion:

Continued study in this field could involve longitudinal assessments to gauge the prolonged effects of tailored communication on medication errors and caregiver satisfaction.

Furthermore, exploring the scalability of these interventions to larger healthcare systems or different care settings could be beneficial.

Overall, the project demonstrated the effectiveness of tailored communication strategies in reducing medication errors among diverse caregiver populations. With a focus on continuous evaluation, feedback integration, and efforts towards wider dissemination, this work presents a significant step toward improving patient safety and care quality within healthcare systems.

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References

- [1] DiMatteo MR. The role of effective communication with children and their families in fostering adherence to pediatric regimens. *Pat Educ Counsel*. 2004;55(3):339–344.
- [2] Baillie, L. , Gallini, A. , Corser, R. , Elworthy, G. , Scotcher, A. , & Barrand, A. (2014). Care transitions for frail, older people from acute hospital wards within an integrated healthcare system in England: A qualitative case study. *International Journal of Integrated Care*, 14(1). 1–11. 10.5334/ijic.1175
- [3] Rustad, E. C., Furnes, B., Cronfalk, B. S., & Dysvik, E. (2016). Older patients' experiences during care transition. *Patient Prefer Adherence*, 10, 769–779. 10.2147/PPA.S97570
- [4] Gail Davison, Richard Conn, Martina Ann Kelly et al. Fifteen-minute consultation: Guideto communicating with children and young people. Davison G, et al. *Arch Dis Child Educ Pract Ed* 2023;108:91–95. doi:10.1136/archdischild-2021-323302.
- [5] Guncag Ozavci, Master of Business Administration et al. Towards patient-centred communication in the management of older patients' medications across transitions of care: A focused ethnographic study. *J Clin Nurs*. 2022 Nov; 31(21-22): 3235–3249.
- [6] Kerr A, Kelleher C, Pawlikowska T, et al. How can pharmacists develop patient-pharmacist communication skills? a realist synthesis. *Patient Educ Couns*. 2021;104(10):2467-2479. doi:10.1016/j.pec.2021.03.010.
- [7] Health literacy universal precautions toolkit, 2nd edition. Agency for Healthcare Research and Quality. Updated September 2020. Accessed December 5, 2022.
- [8] Schommer JC, Wiederholt JB. Pharmacists' views of patient counseling. *Am Pharm*. 1994;NS34(7):46–53.
- [9] Jacobson K. Strategies to Improve Communication Between Pharmacy Staff and Patients: A Training Program for Pharmacy Staff. Rockville, Md: Agency for Healthcare Research and Quality; 2008. Available at: www.ahrq.gov/qual/pharmlit/pharmtrain.htm. Accessed July 29, 2011
- [10] Wolf MS, Davis TC, Curtis LM, et al. Effect of standardized, patient-centered label instructions to improve comprehension of prescription drug use. *Med Care*. 2011;49(1):96–100
- [11] Wolf MS, Williams MV, Parker RM, et al. Patients' shame and attitudes toward discussing the results of literacy screening. *J Health Commun*. 2007;12(8):721–732.
- [12] Ley P. New York: Croom Helm; 1988. *Communicating With Patients: Improving Communication, Satisfaction, and Compliance*.
- [13] DeWalt DA, Berkman ND, Sheridan SL, et al. Literacy and health outcomes: A systematic review of the literature. *J Gen Intern Med*. 2004;19:1228–1239.
- [14] Schillinger D, Barton LR, Karter AJ, et al. Does literacy mediate the relationship between education and health outcomes? A study of a low-income population with diabetes. *Public Health Rep*. 2006;121(3):245–254.
- [15] Ellitt GR, Brien JE, Aslani P, Chen TF. Quality patient care and pharmacists' role in its continuity: A systematic review. *Ann Pharmacother*. 2009;43:677–691
- [16] Murray M. Continuity of health care and the pharmacist: Let's keep it simple. *Ann Pharmacother*. 2009;43(4):745–747.
- [17] What Did the Doctor Say? Improving Health Literacy to Protect Patient Safety. Oakbrook Terrace, Ill.: Joint Commission; 2007. *Health Care at the Crossroads Reports series*. Available at: www.jointcommission.org. Accessed July 28, 2011.
- [18] Wolf MS, Davis TC, Shrank W, et al. To err is human: Patient misinterpretations of prescription drug label instructions. *Patient Educ Counsel*. 2007;67(3):293–300
- [19] Forster AJ, Murff HJ, Peterson JF, Gandhi TK, Bates DW. The incidence and severity of adverse events affecting patients after discharge from the hospital. *Ann Intern Med*. 2003;138(3):161–7. pmid:12558354
- [20] Madigan EA. A description of adverse events in home healthcare. *Home Healthc Nurse*. 2007;25(3):191–7. pmid:17353712
- [21] Smith MD, Spiller HA, Casavant MJ, Chounthirath T, Brophy TJ, Xiang H. Out-of-Hospital Medication Errors Among Young Children in the United States, 2002–2012. *Pediatrics*. 2014;134(5):867–76. pmid:25332497
- [22] Sanders J, Esmail A. The frequency and nature of medical error in primary care: understanding the diversity across studies. *Family practice*. 2003;20(3):231–6. pmid:12738689
- [23] Donelan K, Hill CA, Hoffman C, Scoles K, Feldman PH, Levine C, et al. From the field. Challenged to care: informal caregivers in a changing health system: social policy must respond to what caregivers are telling us about their experiences. *Health Aff*. 2002;21(4):222–31.
- [24] Choo J, Hutchinson A, Bucknall T. Nurses' role in medication safety. *J Nurs Manag*. 2010;18(7):853–61. pmid:20946221
- [25] Axelsson J, Elmstahl S. [Unqualified home care aides put the patient at risk. Better knowledge concerning drug administration must be required]. *Lakartidningen*. 2002;99(11):1178–83. Swedish. pmid:11985013
- [26] Yin HS, Dreyer BP, van Schaick L, Foltin GL, Dinglas C, Mendelsohn AL. Randomized controlled trial of a pictogram-based intervention to reduce liquid medication dosing errors and improve adherence among caregivers of young children. *Arch Pediatr Adolesc Med*. 2008;162(9):814–822
- [27] Tzimenatos L, Bond GR; Pediatric Therapeutic Error Study Group. Severe injury or death in young children from therapeutic errors: a summary of 238 cases from the American Association of Poison Control Centers. *Clin Toxicol (Phila)*. 2009;47(4):348–354
- [28] AANA News Bulletin. ISMP Calls for Elimination of "Teaspoonful" and Other Non-Metric Measurements to Prevent Errors. *AANA J Suppl*. 2009;63(7):6–7. Available at: <https://www.proquest.com/openview/8fbde830f1b8602a645efcfc7e741301/1?pqorigsite=gscholar&cbl=41335>. Accessed October 20, 2021
- [29] Gummin DD, Mowry JB, Spyker DA, Brooks DE, Osterthaler KM, Banner W. 2017 Annual Report of the American Association of Poison Control Centers' National Poison Data System (NPDS): 35th annual report. *Clin Toxicol (Phila)*. 2018;56(12):1213–1415

- [30] Schillie SF, Shehab N, Thomas KE, Budnitz DS. Medication overdoses leading to emergency department visits among children. *Am J Prev Med.* 2009;37(3): 181–187
- [31] Walsh KE, Mazor KM, Stille CJ, et al. Medication errors in the homes of children with chronic conditions. *Arch Dis Child.* 2011;96(6):581–586
- [32] Yin HS, Dreyer BP, Ugboaja DC, et al. Unit of measurement used and parent medication dosing errors. *Pediatrics.* 2014;134(2). Available at: www.pediatrics.org/cgi/content/full/134/2/e354
- [33] Li SF, Lacher B, Crain EF. Acetaminophen and ibuprofen dosing by parents. *Pediatr Emerg Care.* 2000;16(6):394–397