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Applying a Group Decision-Making Model within a Quality Program to Improve Medication Safety

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What is already known on this topic?

- *Unsafe medication practices, particularly in preparing and administering medications through short-term enteral access devices, are a significant contributor to preventable adverse events in healthcare.*
- *Medication errors often arise from systemic and human factors, such as limited material resources, lack of training, and inadequate decision-making processes.*
- *The Plan-Do-Study-Act (PDSA) cycle is a widely recognized tool for quality improvement, but its effectiveness may be limited when applied without participatory decision-making.*

What does this study add on this topic?

- *Combining the PDSA cycle with a Group Decision-Making Model (GDMM) significantly improves compliance with medication preparation and administration guidelines, especially in critical tasks such as crushing pills into a fine and homogeneous powder.*
- *This study highlights the importance of participatory approaches in fostering team commitment, reducing resistance, and ensuring successful implementation of quality improvement measures.*
- *The findings emphasize that structured decision-making processes can lead to more effective and sustainable changes in complex healthcare environments, improving medication safety practices.*

Abstract

AIM: To assess whether adherence to decisions made by professionals involved in the preparation and administration of orally administered medications via short-term enteral access could be enhanced through the implementation of a Group Decision-Making Model within a quality improvement program, comparing the third Plan-Do-Study-Act cycle with the fourth Plan-Do-Study-Act cycle with the Group Decision-Making Model.

METHODS: This study outlines a quantitative research approach using the Standards for Quality Improvement Reporting Excellence (SQUIRE) model. The study was conducted between June 2018 and April 2019. A total of 16 nurses and 40 nursing assistants/technicians were working in the clinical medical ward at the moment of data collection. Group Decision-Making Model in conjunction with the PDSA cycle, as part of the Plan-Do-Study-Act cycle within a hospital in the State of São Paulo, Brazil, for supporting the hospital's nursing team in the preparation and administration of oral medicines via enteral access device for short-term use, including the washing of the equipment.

RESULTS: The findings, when compared to a prior Plan-Do-Study-Act cycle conducted without any involvement in decision-making, indicated that utilizing the Plan-Do-Study-Act cycle in conjunction with the Group Decision-Making Model method significantly improved the likelihood of successful implementation of quality improvement practices. This was especially noticeable in the case of the pill-crushing technique, where compliance increased from 5.3% in the Plan-Do-Study-Act cycle without the Group Decision-Making Model to 100% in the Plan-Do-Study-Act cycle with the Group Decision-Making Model.

CONCLUSION: The Plan-Do-Study-Act cycle serves as a supportive tool for the management team. Nevertheless, its effectiveness may be constrained when final decisions follow a top-down approach. The incorporation of a participatory phase using the Group Decision-Making Model has demonstrated substantial potential to enhance the prospects of successfully implementing quality improvement practices regarding the preparation and administration of oral medications through enteral access device for short-term use.

Keywords: Error in medication, improvement, patient safety

Introduction

In March 2017, the World Health Organization (WHO) launched the third global challenge for patient safety, aiming to reduce by 50% the severe and preventable harms associated with medication use (World Health Organization, 2016). Medications are implicated in at least one death per day, and it is estimated that 5–6% of hospitalizations are caused by their use. Unsafe practices related to medication use and medication errors are major causes of preventable adverse events in healthcare systems. It is estimated that 0.4% of hospitalizations are caused by inappropriate use of medications in Brazil (Santos & Boing, 2018).

The rates and nature of medication errors vary between countries, and globally, the cost associated with these events has been estimated at $42 billion per year, which corresponds to

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approximately 1% of the total global health expenditure (World Health Organization, 2016).

Although medication errors can occur at any stage of the medication use process, approximately 49% are related to prescribing and 26% to administration, with the latter being the focus of the present study (Rattanatanyapat et al., 2022). Administration failures can arise due to deficiencies in the system and/or human factors, such as fatigue, unfavorable environmental conditions, staff shortages, and limited material resources. These issues can lead to errors that result in serious harm to the patient, disability, and even death (Sameera et al., 2021).

The correct administration of enteral medications for patients with a short-term enteral access device (defined as a nasally placed feeding tube with the distal tip positioned in the stomach or duodenum) presents a further challenge, as unwanted drug-nutrient and drug–drug interactions may occur and result in adverse drug events. In a recent survey conducted in Brazilian hospitals, it was identified that the tube was not washed in 94.6% of cases, and the consequence of this practice was obstruction of the tube in 33.3% of observations (Costa et al., 2022; Pereira et al., 2023). In a survey conducted in an Indonesian hospital, with the purpose of identifying errors related to the medication process via feeding tube, in addition to factors associated with obstruction, it was identified that in 71.43% of the observed doses, liquid medications were not diluted and pills were not crushed into a fine, homogeneous powder. Additionally, not washing the tube between administrations was verified in more than 90% of cases, and there was a significant relationship between obstruction and errors in both techniques ($p < .05$) (Abu Hdaib et al., 2021).

Bringing about changes within complex systems like healthcare necessitates a significant investment of time, resources, and unwavering dedication. These endeavors entail multiple components, including human, material, organizational, financial, and other resources. Consequently, effecting enduring changes and making decisive decisions poses a formidable challenge for managers operating within this environment (Nilsen et al., 2020).

To assist in the planning and execution of process changes, a model for improvement can be applied, as it focuses on improving quality through the continuous learning and actions of the collaborators involved. The model consists of answering three questions combined with the Plan-Do-Study-Act (PDSA) cycle, in which the basic principles for the development of changes are used (Langley, 2011).

The hypothesis was whether a participatory decision-making process would increase the commitment of the nursing team to the decisions made in a PDSA cycle, as suggested in previous studies, by improving the sense of fairness and satisfaction regarding the group decision's final outcome (Ziotti & Leoneti, 2020). To decide which techniques would be adopted by the entire nursing team of the hospital unit, the Group Decision-Making Model (GDMM) method was used in the fourth PDSA cycle. The application of the method was carried out as proposed by Leoneti and de Sessa (2017) (Leoneti, 2016; Ziotti & Leoneti, 2020).

The aim of the study was to assess whether adherence to decisions made by professionals involved in the preparation and administration of orally administered medications via short-term enteral access could be enhanced through the implementation of a GDMM within a quality improvement program. Comparing the third PDSA cycle with the fourth PDSA cycle with the GDMM.

Research Question

1. Could a Group Decision-Making Model combined with the PDSA cycle reduce errors in the preparation and administration of oral medicines via short-term enteral access devices?

The Situation Before Implementing the Group Decision-Making Model Method

Identification of Errors Related to the Preparation and Administration of Medications

We previously conducted a cross-sectional study in three Brazilian secondary-level hospitals in 2014 to analyze the nursing team's practices related to drug administration through short-term enteral access devices. We examined two hospitals in São Paulo state, one in Ribeirão Preto city (with 122 doses) and another in Campinas (with 115 doses), as well as one hospital in Minas Gerais state (with 137 doses). A significant level of inadequate administration was observed. A hospital participating in the research (City of Ribeirão Preto) was chosen for the program implementation. The choice was justified by the existing partnership between the research team and the Risk Management Commission, as well as by the hospital managers' interest in the project (Gimenes, 2017).

Selection and Implementation of a Hospital for the Quality Improvement Program

In 2015, we carried out two PDSA cycles in order to improve medication administration at the Ribeirão Preto 50-bed teaching hospital, in São Paulo State. As a result of the first cycle, a guide to safe practices, based on a literature review, was presented to the hospital's health professionals through a meeting attended by physicians, nurses, nutritionists, and pharmacists. The healthcare team recognized the necessity of the guide, and through meetings with the nursing team and in conjunction with a pharmacist, adjustments were made through four meetings that took place between the months of April and August 2015. The guide was made available on the hospital's computer system and also as a printed version for the entire team (Pereira et al., 2020). The impacts of this change were not tested immediately.

In the second PDSA cycle, we provided the nursing professionals with training on the techniques for preparing and administering drugs through short-term enteral access devices. A lecture about the pharmaceutical forms available in the hospital was delivered, and information about how to reconstitute them safely was provided. For the drugs that cannot be prepared and administered via short-term enteral access devices, a table was prepared with the suggested possible substitutions. The information was made available to nurses and physicians at the study hospital (Pereira et al.,

2019; Pereira et al., 2020). The impacts of the change were not tested immediately.

Early in 2017, we conducted a third PDSA cycle with the aim of assessing the nurses' compliance with the practice guidance to support safe medication through short-term enteral access devices. This cycle was aimed at testing the changes made in the previous cycles. In this cycle, 122 doses were observed and the measures were compared with the baseline. The procedures of crushing pills into a fine and homogeneous powder, flushing the tube prior to, between, and after medication administration were studied and compared with the baseline. According to researchers, a worsening in the variable of crushing the pills into a fine and homogeneous powder was identified, from approximately 93% compliance at baseline to 5.3% compliance. It is worth noting that the study hospital did not have the equipment to crush pills. Therefore, the nurses used scissors or medication bottles and later reconstituted the powder with plain water in a disposable cup or directly in the 20 milliliters (mL) syringe (Pereira et al., 2020).

Employing a Group Decision-Making Model in Conjunction with the Plan-Do-Study-Act Cycle

Considering the results identified by the researchers, a fourth PDSA cycle was immediately carried out by the establishment of a quality improvement team including nurses, nursing technicians, nursing assistants, and pharmacists of the Ribeirão Preto hospital. These experts actively participated in the decision-making procedure, with their insights and contributions playing a significant role in choosing among techniques for preparing and administering enteral medications through a short-term enteral access device to make the processes safer and more efficient. The hypothesis posited that the inclusion of a participatory decision-making process would enhance the nursing team's dedication to the choices made within the PDSA cycle. This is consistent with earlier research that indicated this approach could boost perceptions of fairness and satisfaction regarding the group decision's ultimate outcome (Pereira et al., 2020).

In determining the techniques to be embraced by the hospital's nursing team, a GDMM method grounded in game theory was employed (Leoneti, 2016) in the fourth PDSA cycle, following the methodology for its application as proposed by researchers. The method selected applies a mathematical solution based on equilibrium, applying a concept of solution through consensus among people involved in group decision-making (Leoneti & de Souza, 2017).

The GDMM is a process in which several people actively participate to reach a collective decision. Instead of a single person making the decision, the group discusses, shares information, and considers different perspectives before choosing the best solution. This model is commonly used in organizations, committees, or work teams.

Main approaches to group decision-making: (1) consensus decision: the group works to find a solution that everyone accepts, even if not all members consider it ideal; (2) voting decision: each group member votes on one or more options, and the one receiving the majority of votes is selected; (3) autocratic decision: one person, usually the leader, makes the final decision but takes the group's opinions into account before deciding; and (4) compromise decision: the group finds a middle-ground solution, combining ideas from different members so that no one is left dissatisfied.

This model is valued because the decision results from collaboration, considering a broader range of information and perspectives, which can lead to more informed and effective decisions (Robbins & Judge, 2017).

Methods

Study Design

This study outlines a quantitative research approach using the Standards for Quality Improvement Reporting Excellence (SQUIRE) model. In addition, Participatory Action Research (PAR) was also used, as the study participants were actively involved in the process of change and decision-making. This approach allows decision-making groups to become active subjects in the research and is widely used in educational and healthcare contexts to enhance collaborative practices (Kemmis & McTaggart, 2005).

Sample

The study was conducted between June 2018 and April 2019. A total of 16 nurses and 40 nursing assistants/technicians were working in the clinical medical ward at the moment of data collection. In Brazil, there are three categories of nursing professionals responsible for the care provided to patients: (1) nurses, who are responsible for the supervision of the nursing assistants and technicians; (2) nursing technicians, who perform medium and high complexity actions (Peres et al., 2018); and (3) nursing assistants, who perform low complexity actions (Santos et al., 2009). According to the Regional Nursing Council's opinion, nurses, nursing technicians, and nursing assistants are qualified to prepare and administer orally administered medications via short-term enteral access devices (Conselho Regional de Enfermagem, 2013).

During this fourth PDSA cycle, the nursing team engaged in the decision-making process, 122 doses of medications were observed, and the results were compared to the observations carried out in the third PDSA cycle, in the quality improvement program that occurred without participatory decision making (Pereira et al., 2020).

The sample calculation was based on a study conducted by Lisboa et al. (2013). The total number of doses prepared and administered via enteral tube per month was considered, along with the formula for sample calculation of cross-sectional studies with a finite population. A CI of 95%, α of 0.05, and critical value of 1.96 were used. Additionally, it was considered that 20% of nursing professionals make some type of error in the preparation and/or administration of medication via nasoenteral tube, as per a previous survey conducted by the nursing service (Lisboa et al., 2013). In the present study, 366 observations were made, considering potential losses. This total corresponds to doses observed at baseline ($n = 122$) and in the years 2017 and 2019 ($n = 122$ each).

Data Collection Tools

Measures

The measures "Crushing pills initiated," "Crushing pills concluded as a fine and homogeneous powder," "Flushing the tube prior to administration," "Flushing the tube between medications," and "Flushing the tube after administration" from the fourth PDSA were selected to be compared with the observations carried out in the third PDSA.

The Fourth Plan-Do-Study-Act Cycle—Problem Structuring

The procedure for applying the multicriteria decision support method was developed by researchers (Leoneti & de Souza, 2017). The method involves the use of a mathematical function modeling multicriteria problems (Leoneti, 2016).

A form was created containing instructions for the application of the method, along with the decision matrix. In this study, the matrix was developed with alternatives related to techniques for preparing and administering medication via enteral access device for short-term use (Leoneti & de Souza, 2017).

The alternatives were developed and then validated through interviews with professionals working at the study hospital who are responsible for performing the techniques for preparing and administering medication via enteral access device for short-term use.

In total, 16 professionals were interviewed to develop the alternatives, and 14 were interviewed to validate them, with eight participating in both interviews conducted from June to September 2017. Based on the literature review and the expertise of the study researchers, the techniques were examined and certified for their safety and effectiveness for patients using via enteral access device for short-term use (Gimenes et al., 2017).

Drawing upon both the literature review and the researchers' expertise, the techniques proposed during the interview phase were scrutinized to ascertain their safety and efficacy for patients employing short-term enteral access devices. Among the alternatives put forth by interviewees, those pertaining to enteral medication administration deemed effective were thoroughly examined: (1) crushing the pill and flushing the tube with a 20 mL syringe; (2) crushing the pill and washing the tube using the enteral nutrition equipment; (3) reconstituting the powder and flushing the tube with a 20 mL syringe; and (4) reconstituting the powder and flushing the tube using the enteral nutrition equipment.

To assess these alternatives, the interviewees were also asked: "What factor hinders the safe administration of medication to patients using via enteral access device for short-term use?" The following factors were selected: (1) time: time to perform the techniques for preparing and administering medication via enteral access device for short-term use; (2) materials: availability of necessary materials to perform the techniques for preparing and administering medication via enteral access device for short-term use; (3) training: proficiency of the team regarding the technique to be performed; and (4) understanding: degree of difficulty in performing the techniques for preparing and administering medication via enteral access device for short-term use.

To define the performance of the alternatives regarding these factors, the professionals working at the study hospital responsible for preparing and administering medication via enteral access device for short-term use were interviewed again. The interviews were conducted during morning, afternoon, and night shifts, over three days of the week. In this case, nine professionals were interviewed between October and November 2017, including four nurses, one assistant, three nursing technicians, and one pharmacist.

The medical team members of the study hospital were invited to participate, but there were no interested parties. The professionals who agreed to participate in the interview evaluated, on a Likert scale with nine levels, the factors established in the form as follows: (1) for the factor "time to perform the techniques for preparing and administering medication via enteral access device for short-term use" (from 1 to 9), where 1 indicates more time and 9 indicates less time; (2) for the factor "materials necessary to perform the techniques for preparing and administering medication via nasoenteral tube" (from 1 to 9), where 1 indicates scarcely available and 9 indicates abundantly available; (3) for the factor "training of the team (referring to the qualification of nursing professionals) to perform the techniques for preparing and administering medication via enteral access device for short-term use" (from 1 to 9), where 1 indicates poorly qualified and 9 indicates highly qualified; and finally, (4) for the factor "understanding of the team to perform the techniques for preparing and administering medication via enteral access device for short-term use (referring to the cognitive demand to perform both techniques)" (from 1 to 9), where 1 indicates high demand and 9 indicates low demand. Based on the median of the values indicated by the interviewees as the performance of the alternatives in the factors, the decision matrix was formulated regarding the preparation and administration of medication via enteral access device for short-term use (Table 1).

Group Decision-Making Model Method Application

Using the form created, the GDMM Application method at the Ribeirão Preto hospital with the nursing team involved in medication administration through short-term enteral access devices on 13 November 2017. The application lasted 1 hour and 30 minutes and aimed to decide on the alternative to be used for crushing pills and flushing the tubes. Five healthcare providers participated in the decision: two nursing assistants, one nursing technician, one nurse, and one pharmacist.

The application of the GDMM method was divided into three stages. Firstly, the instructions were presented using a form that had been previously created and validated. Then the participants analyzed the problem decision matrix (Table 1) and were requested to order the criteria and alternatives according to their preferences, in an ascending manner. A method of eliciting preferences was used to convert the orders into preference vectors, in this case the Rank-Ordered Centroid method. Participants were given 15 minutes to evaluate the matrix and complete the table according to their preference.

Table 1.
Decision Matrix Regarding the Decision-Making Related to Oral Medication Administration Through Short-Term Enteral Access Devices

	Criteria			
	1	2	3	4
Alternatives	**Time**	**Materials**	**Training**	**Understanding**
(A) Crush the pill and wash the tube with 20 mL syringe	7.5	5	4.5	4.5
(B) Crush the pill and wash the tube using the enteral nutrition equipment	4	7	6.5	3
(C) Reconstitute the powder and wash the tube with 20 mL syringe	3.5	6.5	4	6
(D) Reconstitute the powder and wash the tube using the enteral nutrition equipment	1.5	9	5	3.5

Note: Time: from 1 to 9 (9 being the shortest). Materials: from 1 to 9 (9 being abundantly available). Training: from 1 to 9 (9 being poorly qualified). Understanding: from 1 to 9 (9 being easiest).

In the second stage, each participant presented their order of preference of alternatives to the group, and a negotiation phase was initiated. The main researcher followed the discussion and the interactions between the study participants. Meanwhile, the participants' data collected from the forms were transferred into three Microsoft Excel® spreadsheets to generate the GDMM method outcome, as follows: (1) the first spreadsheet contained the Rank-Ordered Centroid method, which aims to generate the weight vectors of each participant from the respective order of criteria; (2) the second spreadsheet contained the calculations required by the utility function, where the algebraic operation between the decision matrix and each of the weight vectors was performed to calculate the values of satisfaction with each of the 256 possible arrangements that could be generated in the negotiation. In addition to finding Nash equilibrium solutions between the arrangements; (3) the third spreadsheet was where, in the case of more than one Nash equilibrium found, the alternative with the highest utility average was recommended as a solution for the participants, as suggested by researchers (Leoneti, 2016; Leoneti & de Souza, 2017). This phase also had a maximum time limit of 15 minutes for the negotiation and decision on the best alternative for the group (to apply this concept, refer to Figure 1).

In a last and final stage, using a ballot, each participant presented their final decision. It was possible to determine whether there was a consensus among the participants (if all selected the same alternative that was chosen by the group) or whether any of the participants chose a different alternative from the others, indicating a possible "breach" of contract and potential difficulties for the implementation of the decision, as suggested by researchers (Ziotti & Leoneti, 2020). Therefore, after presenting the group's decision and the one recommended by the GDMM method, the participants secretly voted on which would be the preferable alternative for enteral medication preparation and administration through short-term enteral access devices. In this phase, the participants could sustain their agreements or deviate from them.

The interventions carried out from baseline to the fourth cycle can be seen in Figure 2.

Statistical Analysis
The data were introduced in Epi Data version 3.1 and later transferred to Microsoft Excel® to perform a descriptive analysis of the data. Descriptive data analysis was performed using the trend graph for the purpose of monitoring the process and identifying any observed issues. Descriptive analyses were performed, and the absolute and relative frequencies of the study measures were evaluated. The graph was created using the U trend and statistical control chart. The graphs were generated using Minitab 19 software. The analyses were conducted considering a confidence level of 5% ($\alpha = 0.05$).

Ethical Considerations
The project received approval from the Institution's Committee for Ethics in Research from the School of Nursing at the University of São Paulo, Brazil involving human subjects (Approval no: CAAE: 64957217.7.0000.5393, Date: March 4, 2018).

Results

After the negotiation phase, the group chose the alternative "(A) Crushing the pill and flushing the tube with a 20 mL syringe." The same alternative was recommended by the GDMM method, which was disclosed to the participants after the negotiation process. It should be highlighted that in the individual ordering stage of the alternatives, for three participants, alternative A was the most preferred, while two participants preferred alternative C. For one of them, alternative A was the worst ranked in the ordering of both participants, indicating a strong group conflict between the choice of crushing the pills and reconstituting the powder. However, there was convergence in the method of flushing the tube with a 20 mL syringe. Therefore, there was no consensus regarding alternative A, since this alternative did not receive the vote of one participant. However, it is important to note that one of the participants changed their initial choice of C to alternative A. This participant mentioned that "both are possible; however, it is not the most viable for me," which was related to what had been discussed during the negotiation. Previously, a plastic pestle had been made available for crushing the pills, with the participant reporting that it was very difficult to crush the tablets using this equipment. It was also mentioned that in 2017, porcelain pestles were purchased and made available in each ward (Pereira et al., 2020).

The participants reported that there was a lack of equipment due to the number of hospitalized patients with short-term enteral access devices and the number of pills prescribed for patients

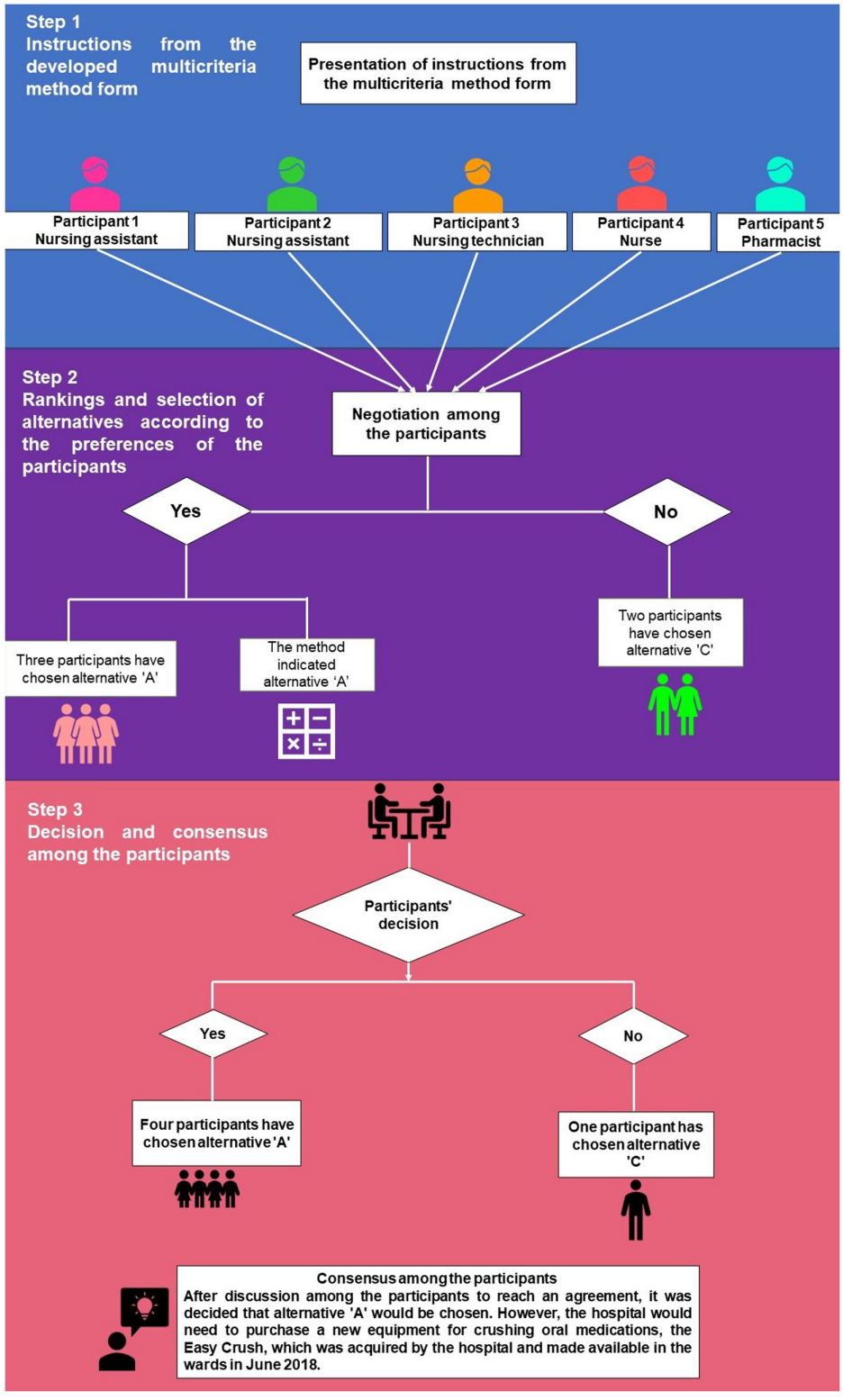

Figure 1.
Group Decision-Making Model Method Application.

scheduled for administration at the same time. In addition, the equipment was fragile, and one of the participants reported that the equipment had been broken during the execution of the technique. Therefore, considering these points, the participants finally decided to adopt the alternative "(A) Crushing the pills and flushing the tube with a 20 mL syringe." However, it was conditionally decided to purchase other equipment to grind the pills to a fine powder. The Easy Crush® equipment was chosen,

Table 2.
Approaches Utilized by the Nursing Team in the Process of Preparing and Administering Medication Via Short-Term Enteral Access Devices: Third Plan-Do-Study-Act Cycle and Fourth Plan-Do-Study-Act Cycle with GDMM

Measures	*Third PDSA Cycle % Compliance	Fourth PDSA Cycle with GDMM % Compliance
Medication Preparation		
Crushing pill initiated	66.3 (*n* = 57)	100.0 (*n* = 105)
Crushing pill concluded as a fine and homogeneous powder	5.3 (*n* = 3)	100.0 (*n* = 104)
Medication Administration		
Clearing the tube before administering	29.5 (*n* = 36)	56.5 (*n* = 69)
Clearing the tube between medications	66.3 (*n* = 59)	74.5 (*n* = 70)
Clearing tube after administering	92.6 (*n* = 113)	93.4 (*n* = 114)

Note: GDMM, Group Decision-Making Model; PDSA, Plan-Do-Study-Act.
*Pereira et al. (2020).

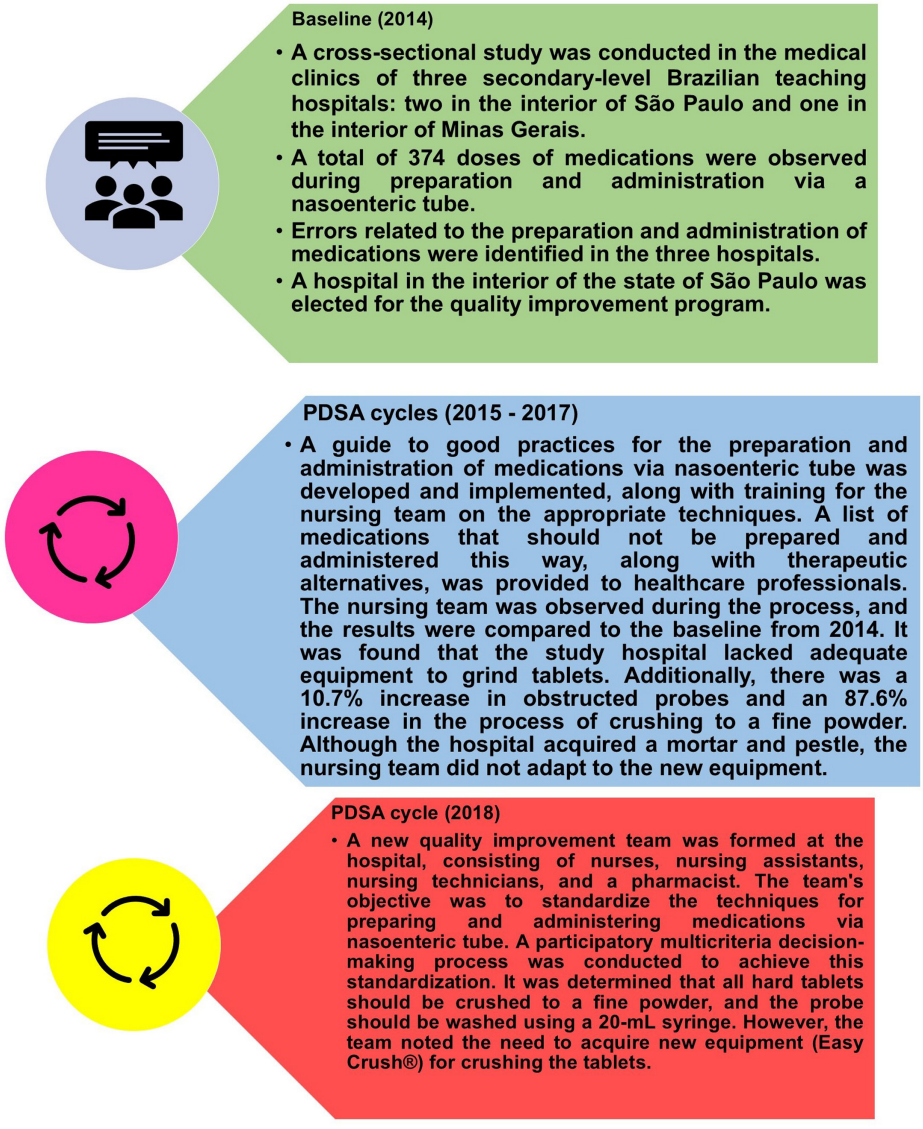

Figure 2. Overview of Interventions Implemented Across Study Cycles. Pereira et all. (2023).

which was purchased by the hospital and made available on the wards in June 2018.

After this solution was implemented in the hospital, 122 doses were observed in early 2019, about 6 months after the implementation of the solution. Compared to the preceding third PDSA cycle, which lacked any decision-making involvement, an enhancement was evident in the measure. "Crushing pills concluded as a fine and homogeneous powder" (the compliance rate increased from 5.3% in the third PDSA cycle without the GDMM method to a full 100% compliance in the fourth PDSA cycle with the GDMM method). There was also an improvement in all other variables evaluated, as can be seen in Table 2.

To make sure that the change resulted in improvement, the measure "Crushing pill concluded as a fine and homogeneous powder" was assessed over time. A trend graph was developed and reviewed by the study participants (Figure 3).

Discussion

The reality of the majority of Brazilian hospitals is that there is no shared leadership; that is, managers make top-down decisions (Flexa, 2018). The participative decision-making process presented in this study showed that professionals may have different preferences for various alternatives to perform the same procedure, which can generate conflict and implementation difficulties if they do not correspond to the perceptions of the team responsible for the care, that is, if managers do not capture the entire essence of a complex process (Gebreheat et al., 2023). It has been shown that the use of a formal GDMM method can make the process transparent, and the potential conflicts can be objectively addressed.

While the PDSA cycle is a valuable tool for assisting the management team in handling intricate changes, we discovered that when used in isolation, it may not yield substantial improvements in safe drug administration through short-term enteral access devices. Therefore, considering the question proposed by researchers Langley et al. (2011) "what change can result in an improvement?", we demonstrated that the PDSA, combined with the GDMM method, has the potential to affect quality improvement processes. Furthermore, the formalization of the decision-making process with the use of a GDMM method has the advantage of objectively stating the aims and different preferences of the decision-makers involved.

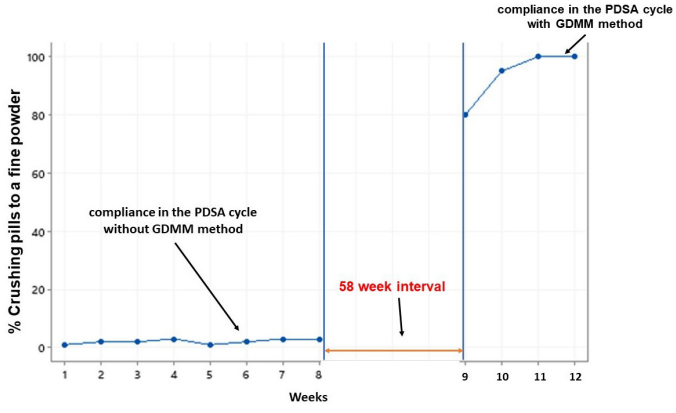

Figure 3.
Trend Graph of Measurements Tablet Crushing Pills to a Fine Power.

According to the criteria that directly influence the execution of medication preparation and administration through short-term enteral access devices, the time and materials also influenced the crushing of pills to a fine and homogeneous powder. Therefore, the purchase of equipment that crushes the pills in less time was a requirement for the adoption of the alternative chosen by the group, as the equipment would be the main factor for the rejection of the chosen technique.

Accordingly, the variable "crushing pills concluded as fine and homogeneous powder" went from 5.3% compliance in the PDSA cycle without GDMM method to 100% compliance in the PDSA cycle with GDMM method. It is important to note that there are no reports in the literature on performance for equipment similar to that observed in this study, with the commitment to the decision made by the professionals involved in drug administration through short-term enteral access use.

Another important decision was made by the group in relation to flushing the tube with the 20 mL syringe (with 30–50 mL of plain water) prior to the administration, between each medication administered, and after the administration. This is necessary due to the fact that remnants of medications can clog the tube, resulting in potential risks for incidents such as drug–drug interactions and obstruction. The results also showed strong improvements in the levels of compliance, with the best result being for the variable "flushing the tube prior to administration," improving from 31.6% of compliance in the PDSA cycle without GDMM method to 56.7% compliance in the PDSA cycle with GDMM method.

Study Limitations

This study has limitations. The GDMM was applied in only one PDSA cycle; thus, further studies will be important to demonstrate the effectiveness of a multi-criteria method in conjunction with PDSA cycles for achieving sustainable improvements. We also suggest studies using only the multi-criteria method, which is a decision tool that can help health managers. We cannot claim that the Easy Crush® equipment is efficient. Even though our results have shown improvement in the process, no study was found to demonstrate its effectiveness. We suggest further study to prove the effectiveness of the tool.

Conclusion and Recommendations

Our research suggests that involving stakeholders in the decision-making process holds significant promise for the successful implementation of quality improvement measures pertaining to medication preparation and administration techniques using short-term enteral access devices within a hospital setting. It also reduces the risk of resistance among professionals who disagree with the group's decision. We present the application and evaluation of an exclusive PDSA method, which is innovative and promising. Therefore, it is necessary that healthcare providers are supported with

evidence-based practices in order to perform safe and effective care regarding the administration of pharmacotherapy in tube-fed patients.

Availability of Data and Materials: The data that support the findings of this study are available on request from the corresponding author.

Ethics Committee Approval: Ethics committee approval was received for this study from the Ethics Committee of from the School of Nursing at the University of São Paulo, Brazil (Approval no: CAAE: 64957217.7.0000.5393, Date: March 4, 2018).

Informed Consent: Written informed consent was obtained from nurses who participated in this study.

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