ORIGINAL ARTICLE

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# *CONSTRUCTION OF A FLOWCHART FOCUSED ON THE PROBABILITY OF GASTROSTOMY TUBE OBSTRUCTION IN PEDIATRICS*

# *CONSTRUCCIÓN DE UN DIAGRAMA DE FLUJO A LA MEDIDA DE LA PROBABILIDAD DE OBSTRUCCIÓN DE LA SONDA DE GASTROSTOMÍA EN PEDIÁTRICA*

# CONSTRUÇÃO DE FLUXOGRAMA VOLTADO À PROBABILIDADE DE OBSTRUÇÃO DO TUBO DE GASTROSTOMIA EM PEDIATRIA

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**ABSTRACT**
Objective: to build a protocol aimed at the probability of gastrostomy tube obstruction in children. Method: This is a methodological study in two stages: narrative review and construction of the protocol. Results: In the first stage, a data collection was carried out in May and June 2022, through searches in the databases: Nursing Database (BDENF), Latin American and Caribbean Literature in Health Sciences (LILACS) and Online Medical Literature Search and Analysis System (MEDLINE), Spanish Bibliographic Index in Health Sciences (IBECS) with access through the Virtual Health Library. A search was also carried out in the magazine Estima and two books related to the topic were consulted. In the second stage, a protocol was created based on the review. The protocol was represented in the form of a flowchart with an algorithm, in order to facilitate understanding by professionals. Conclusion: The challenges faced in the daily use of gastrostomy tubes in children are evident. Thus, through a narrative review of the literature, it was identified that gastrostomy care is complex and that there are gaps and a lack of studies on the standardization of techniques in relation to unblocking the gastrostomy tube in pediatrics.
**Keywords:** Gastrostomy; Nursing Care; Pediatrics; Enterostomal Therapy.

**RESUMEN**
Objetivo: construir un protocolo dirigido a la probabilidad de obstrucción de la sonda de gastrostomía en niños. Método: Se trata de un estudio metodológico en dos etapas: revisión narrativa y construcción del protocolo. Resultados: En la primera etapa se realizó una recolección de datos en mayo y junio de 2022, a través de búsquedas en las bases de datos: Base de Datos de Enfermería (BDENF), Literatura Latinoamericana y del Caribe en Ciencias de la Salud (LILACS) y Sistema de Análisis y Búsqueda de Literatura Médica en Línea. (MEDLINE), Índice Bibliográfico Español en Ciencias de la Salud (IBECS) con acceso a través de la Biblioteca Virtual en Salud, también se realizó una búsqueda en la revista Estima y se consultaron dos libros relacionados con el tema. En la segunda etapa se creó un protocolo basado en la revisión. El protocolo se representó en forma de diagrama de flujo con un algoritmo, con el fin de facilitar la comprensión por parte de los profesionales. Conclusión: Los desafíos que se enfrentan en el uso diario de las sondas de gastrostomía en niños son evidentes. Así, a través de una revisión narrativa de la literatura, se identificó que el cuidado de la gastrostomía es complejo y que existen vacíos y falta de estudios sobre la estandarización de técnicas en relación al desbloqueo de la sonda de gastrostomía en pediatría.
**Palabras clave:** Gastrostomía; Atención de Enfermería; Pediatría; Estomaterapia.

**RESUMO**
Objetivo: construir um protocolo voltado a probabilidade de obstrução do tubo de gastrostomia em crianças. Método: Trata-se de um estudo metodológico em duas etapas: revisão narrativa e a construção do protocolo. Resultados: Na primeira etapa, foi realizado um levantamento de dados em maio e junho de 2022, por meio de buscas nas bases de dados: Base de Dados de Enfermagem (BDENF), Literatura Latino-americana e do Caribe em Ciências da Saúde (LILACS) e Sistema Online de Busca e Análise de Literatura Médica (MEDLINE), Índice Bibliográfico Español en Ciencias de la Salud (IBECS) com acesso por meio da Biblioteca Virtual em Saúde. Também foi realizada busca na revista Estima e consultados dois livros relacionados a temática. Na segunda etapa foi construído um protocolo com base na revisão. O protocolo foi representado em forma de fluxograma com algoritmo, a fim de facilitar a compreensão por parte dos profissionais. Conclusão: É evidente os desafios enfrentados no cotidiano do uso de tubo gastrostomia em crianças. Assim, por meio da revisão narrativa da literatura identificou-se que o cuidado com gastrostomia é complexo e que existe lacunas e escassez de estudos acerca da padronização de técnicas em relação a desobstrução do tubo de gastrostomia em pediatria.
**Palavras-chave:** Gastrostomia; Cuidados de Enfermagem; Pediatria. Estomaterapia.

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## INTRODUCTION

Gastrostomy is a surgical procedure that establishes access to the stomach through the abdominal wall. The main indications for tube use are swallowing disorders of muscular or neurological origin and gastric decompression[1]. Care for children with gastrostomy tubes must be carefully planned by nursing professionals, from the moment of admission to the health unit until discharge, to ensure proper functioning[2]. Among the necessary care, the correct administration of the diet stands out to maintain its permeability and the integrity of the peristomal skin, aiming to minimize the risk of complications, such as tube obstruction[3].

Gastrostomy tubes can become obstructed for a variety of reasons, including the formation of a precipitated formula from contact with an acidic fluid, stagnant formula, tube properties, contaminated formula, and administration of inappropriate medications. Addressing each of these potential causes will help ensure tube patency and continued administration of nutritional formula[4].

To this end, nurses need to approach the family and get to know them in order to identify their needs and the most appropriate guidance to offer, based on dialogue, which promotes bonding and trust to carry out care practices. Knowing the frailties and potentialities of the person with the gastrostomy tube promotes humanization and care planning[5].

In this context, technologies are tools that can be used by nurses to care for and educate themselves and others. In addition, they fill gaps in care, assist with the demands and needs of patients that arise from countless contexts, and also assist caregivers and professionals with specific care[6].

Therefore, the application and development of a care plan is a form of technology inserted in the context of nursing practice and can be classified as soft-hard, since it involves rules and routines for accomplishing something. It is also necessary to recognize the purpose of nursing care in order to classify the technology and be able to use it appropriately[7].

The ability to minimize tube obstruction will save time and money in the public service, as well as trauma experienced by patients during reinsertions. Reducing the incidence of obstruction will also allow the provision of nutrients and fluids necessary to achieve better health care outcomes[6]. Thus, scientific and technological advances have required health professionals to have specific knowledge and constantly improve their skills in order to provide excellence in the quality of care services[8].

A nurse specializing in stoma therapy or a stoma therapist (ST) is someone who has the knowledge, specific training, and skills to care for clients with acute and chronic wounds, ostomy patients, and patients with fistulas, anal and/or urinary incontinence[9]. Thus, they are involved in the care of patients with gastrostomy, contributing to the satisfactory maintenance of the tubes.

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## OBJECTIVE

To build a flowchart focused on the probability of gastrostomy tube obstruction in pediatrics.

## METHOD

This is a methodological study, which aims to investigate, organize, and analyze data to build, evaluate, and validate research instruments and techniques intended for the development of specific data collection tools with a view to improving the reliability and validity of these instruments[10].

Thus, this study constructed a protocol focused on gastrostomy tube clearance, with the aim of encouraging and improving the practice of specialist nurses and trained nurses in the care of children with gastrostomy.

It was developed in two stages: narrative review, to analyze available publications on the care of children with gastrostomy. The narrative review consists of mapping, classifying, and analyzing the literature, allowing for the updating of knowledge on a topic and the discussion of a specific subject from a theoretical or contextual point of view, as well as the identification of approaches, gaps, and perspectives for future studies. It should be noted that the narrative review does not require strict and explicit search and selection protocols, nor does it require the exhaustion of sources[11].

The review was conducted in May and June 2022, using the following databases: Nursing Database (BDENF), Latin American and Caribbean Health Sciences Literature (LILACS), Online System for Searching and Analyzing Medical Literature (MEDLINE), and Spanish Bibliographic Index in Health Sciences (IBECS), accessed through the Virtual Health Library. A search was also conducted in the journal Estima, and two books related to the topic were consulted.

The following inclusion criteria were considered for the articles consulted:

scientific documents in English, Portuguese, and Spanish, without time restrictions, that addressed the topic of interest. Duplicate studies were excluded.

Controlled descriptors were selected to set up search strategies for the articles, which were extracted from the Health Sciences Descriptors (DeCS) and Medical Subject Headings (MeSH). Thus, the following strategy was used, with the help of the Boolean operator AND*:* “Nursing care” AND “Gastrostomy” AND “Pediatrics.”

The second stage involved the construction of a protocol focused on the probability of clearing the gastrostomy tube in pediatrics, to be performed by stoma therapists and trained nurses. The construction was based on the review.

For a better visualization of the selection and screening process of scientific articles for the narrative review, the 2020 PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analyses) tool was used, as shown in Figure 1.

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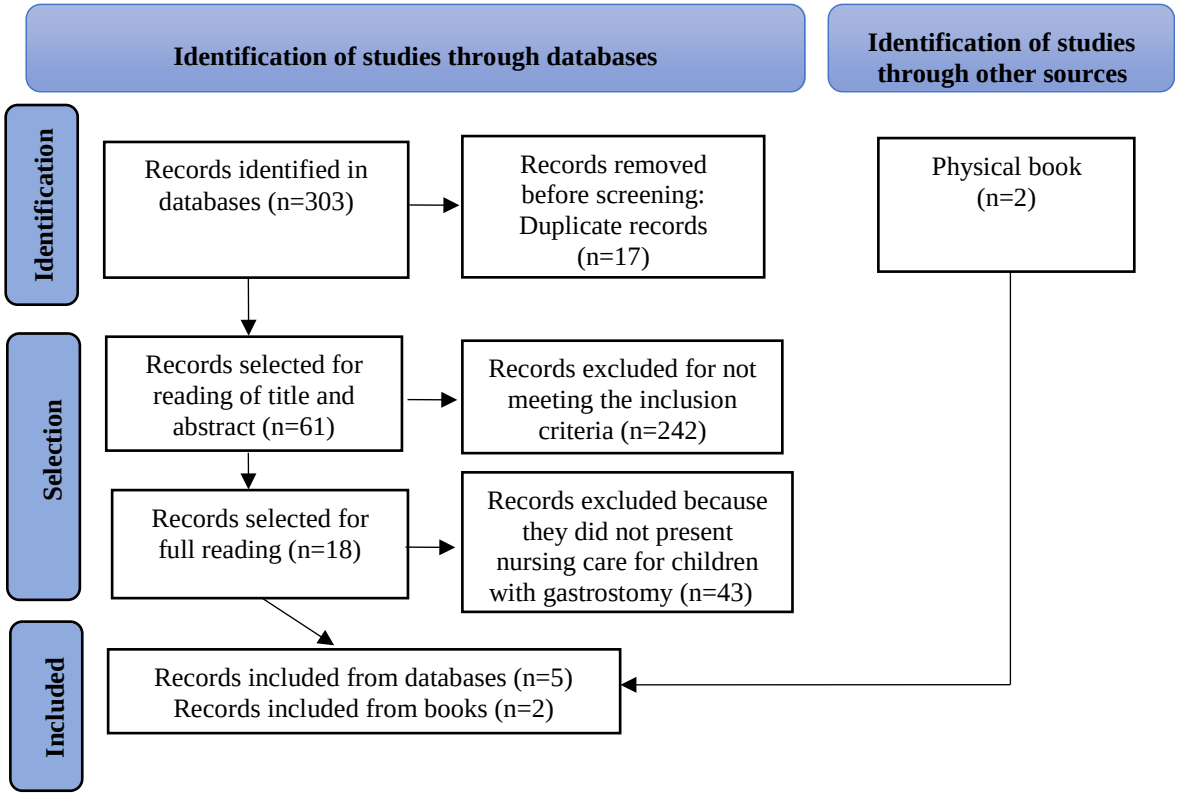
**Figure 1 -** Flowchart illustrating the study screening and selection process, constructed based on the PRISMA recommendation. Fortaleza, Ceará, Brazil, 2022




Source: PRISMA (*Preferred Reporting Items for Systematic Review and Meta-Analyses*).

It should be noted that, as these are public domain data, all scientific works used were duly cited in accordance with Law No. 9,610/98, which defines the relevant aspects regarding the scope of copyright[12].

## RESULTS

Table 1 shows the seven studies that were included in the final sample of the narrative review, five of which were published in Brazil, including field studies (n=3), dissertations (n=1), methodological studies (n=1), and books (n=2).

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**Table 1 –** Characterization of the publications included in the narrative review.

Fortaleza, Ceará, Brazil, 2022

| Review | Characterization | | |
|---|---|---|---|
| **Author/year** | **Type and area of publication** | **Method** | **Main Elements** |
| Rodrigues et al., 2020[8] | Journal article Nursing | Methodological study: building and validation for a booklet | The article presents an educational booklet focused on the care of children with gastrostomy, divided into ten areas: Gastrostomy; Feeding care; Medications; Skin care; Bathing; Dressings; Granuloma; Accidental dislodgement; Infection; and Catheter replacement |
| Rodrigues et al., 2018[13] | Journal Article Nursing | Field study | The study describes the main complications and care related to the use of gastrostomy tubes in pediatrics |
| Carvalho, M. O. G, 2015[14] | Dissertation | Sensitive Creative Method (SCM) | The study found that caregivers were able to identify tube obstruction and used various strategies to clear it, including straining food to remove solid residues, administering food by gravity, and blowing on the button connection |
| Fleischer, I Bryant, D, 2010[15] | Article in Nursing Journal | Case study | The study presents recommended nursing interventions to maintain tube patency and prevent obstruction, such as washing the tube and administering liquid medication. It points to the following methods for clearing obstructions: carbonated drinks, meat tenderizer, and pancreatic enzymes diluted with sodium bicarbonate and water |
| Silva et al., 2019[1] | Article in Medical Journal | Cross-sectional, documentary, and retrospective study | This article provides information on the epidemiological aspects of gastrostomy in pediatrics, discusses the profile of children undergoing gastrostomy, the most commonly used techniques, tube replacement time, the main complications of peristomal skin, and the most commonly used tube type |
| Santos; Cesaretti/ 2015[16] | Book | Not applicable | The book has a specific chapter on gastrostomy, which addresses its indications, techniques, and care. This knowledge is fundamental to understanding how gastrostomies are performed, what precautions should be taken, and specific information to guide nursing care |
| Mello; Mansur/ 2018[17] | Book | Not applicable | The book deals exclusively with the care of people with gastrostomy from a multidisciplinary perspective. It includes a chapter on nursing care and the main recommendations regarding gastrostomy tube obstruction |

Source: Prepared by the authors

The flowchart was represented in the form of an algorithm in order to facilitate understanding by professionals. It is a representation that describes step by step the nature and flow, with the aim of demonstrating in a clear and didactic way, information and elements in operational sequence that characterizes the work being performed[18].

Table 2 shows the representative diagram of the symbols that make up a flowchart.

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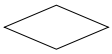
**Table 2** – Schematic representation of the symbols that make up a flowchart

| | | | |
|---|---|---|---|
|  | Indicates the beginning or end of the process |  | Indicates the documents used in the process |
|  | Indicates each activity that needs to be performed |  | Indicates a wait |
|  | Indicates a decision point |  | Indicates that the flowchart continues from this point in another circle, with the same letter or number, which appears inside it |
|  | Indicates the direction of flow | | |

Source: Peinado e Graeml[19]

The flowchart was then built with information considered relevant, set out in the document entitled **"PEDIATRIC PATIENT WITH PROBABLE GASTROSTOMY TUBE OBSTRUCTION (GTM)".** The flowchart of the constructed protocol is shown below (Figure 2).

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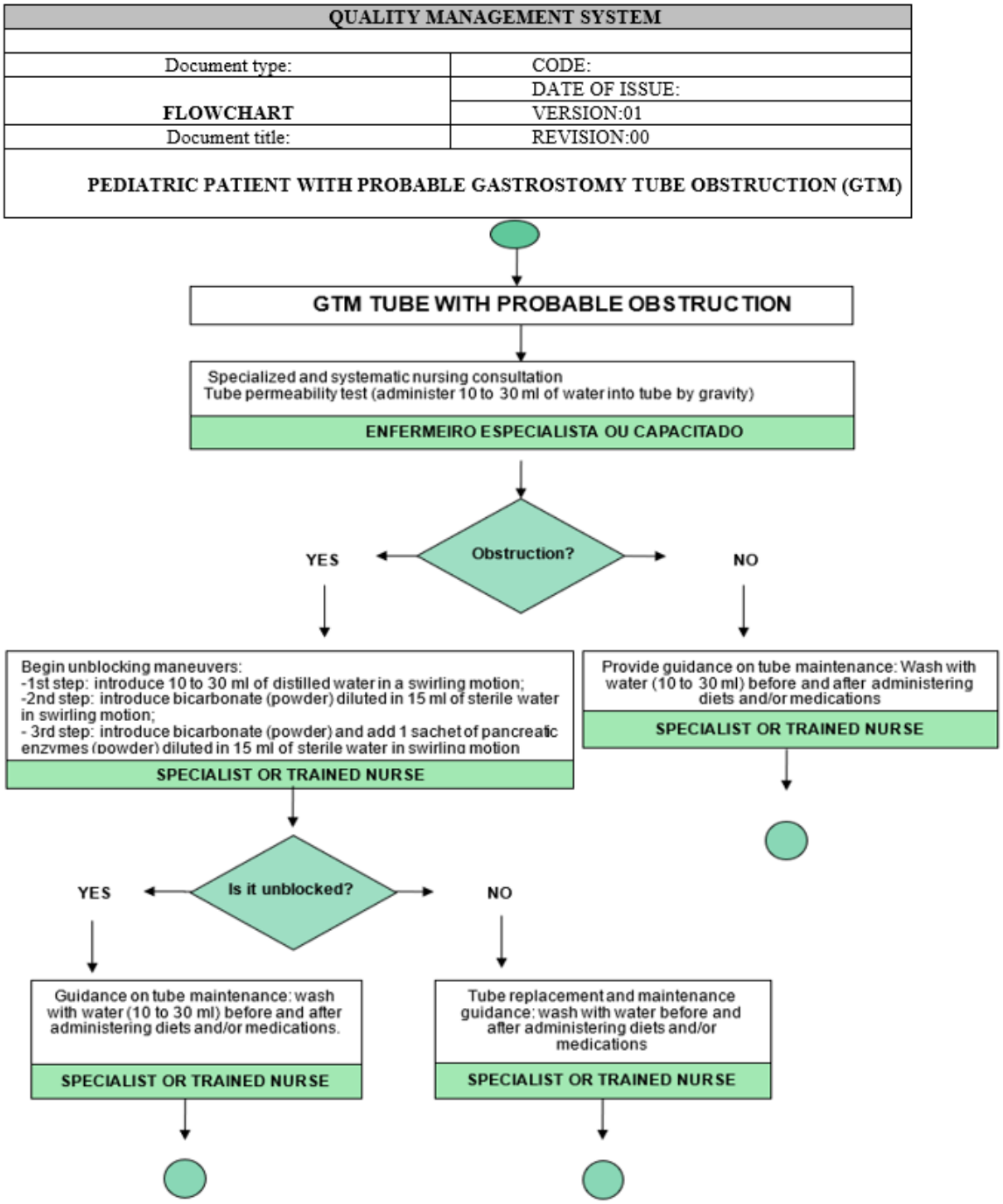
**Figure 2** – Flowchart for pediatric patients with probable gastrostomy tube obstruction




Source: Prepared by the authors

## DISCUSSION

Of the studies analyzed, the authors mainly addressed the care of children with gastrostomy[1,8,13,14]. In addition, there has been an increase in publications related to the topic in the last five years, especially studies developed with the use of soft technologies, with regard to educational tools such as protocols, flowcharts, videos, booklets, and illustrated brochures focused on the care of children with gastrostomy[8,20,21,22].

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Gastrostomy tube obstruction is caused by several reasons, among which residues were cited as one of the causes pointed out by the authors. Studies have recommended flushing the tube with 10 to 30 ml of water to minimize the mixing of the nutritional formula with gastric juice and thus maintain an alkaline pH, with an average of 7.6[4,16,15].

The protocol is a tool that nurses should adopt to improve the quality of care provided, through the standardization of techniques and interventions in a clear, sequential manner, promoting improvements in patient care and safety[23]. Thus, a protocol for clearing gastrostomy tubes in pediatric patients can improve nursing care for children with gastrostomy and can be a tool for proper planning and intervention to maintain tube patency.

However, research conducted by other authors has shown that even with a pH of 5 and 6, they recommend immediate tube flushing with 20 to 30 ml of water before and after the introduction of acidified formula. As for the introduction of liquid medications with a pH of up to 5 through the tube, the authors advise that these should be diluted with water and the tube should be flushed with 30 ml of water before and after administration[4,14].

The use of tablets should be carefully evaluated and recommended only when there is no other possibility, as tube obstruction can be caused by improperly crushed pills, congestion, precipitate formation from formula medications, or drug interactions. Therefore, it is recommended that tablets be diluted in water before administration and that the tube be flushed before and after administration[8,4].

Regarding the infusion rate of formulas, studies have shown that when administered at slow or paused rates, it can be a cause of obstruction. This is because nutritional formulas are suspensions, and larger particles (sodium, calcium caseinate, and soy protein) are prone to settling on the walls of the tube if the flow rates are too slow or intermittent. When higher-calorie and/or fiber-containing formulas are administered, they tend to become more viscous and further increase the risk of obstruction[16].

To minimize obstruction, the authors recommend routine flushing of feeding tubes with approximately 30 ml of water at least every four hours during continuous feedings and at least 30 ml of water after each intermittent or bolus feeding. In cases where slow infusions are necessary, enteral infusion pumps should be used. In such cases, attention should be paid to changes as soon as the diet has ended, and when the infusion pump alarms, immediate intervention should be performed to verify the cause and resolve it[15].

Regarding the material of the tubes used, the authors identified a lower frequency of obstruction in polyurethane feeding tubes compared to silicone tubes, possibly because silicone tubes tend to have thicker walls, reducing their internal diameters[4].

In a study conducted using 20 French tubes over a period of two to three months, two of which were inserted using the percutaneous

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technique and one jejunostomy tube, the authors observed the formation of bacterial colonies in the three silicone tubes, leading to occlusion in two of them. Histological dissection of these tubes showed that the yeast penetrated the silicone material and became very adhesive, as well as worn. Another study showed that tube obstruction can also be caused by significant contamination (bacterial count of $10^7$cfu/ml), which causes the formula to coagulate[4].

As for the tube diameter, studies indicate that it is not a significant factor in tube obstruction. However, there is no consensus in the literature on when tubes should be replaced. Therefore, it is recommended that gastrostomy tubes be replaced according to the manufacturer's recommendations and in cases of material wear, such as broken connections, food residue adhering to the tube, or obstruction that cannot be successfully cleared[16,8].

Several solutions have been recommended for washing gastrostomy tubes. These include water, carbonated beverages, and cranberry juice. Cranberry juice is used because of its low pH value, ranging from 2.5 to 2.7. The most commonly used carbonated beverage was Coca-Cola, which has a pH of 2.5. These two substances were compared to water, however, no significant difference in unclogging rates was shown when compared to the use of water [4,16,8].

Other studies have pointed to the introduction of carbonated beverages, pancreatic enzymes mixed with sodium bicarbonate, and water as methods for dissolving the occlusion[15,16]. However, the literature has shown that the introduction of swirling water should be the first choice, since no major advantages were found when compared to carbonated drinks and juices, which are commonly used in homes[14]. Therefore, water is the most recommended solution for maintaining tube patency.

Regular assessment of tube patency is essential, as tube occlusion will prevent the infusion of formula or medications. In addition, resistance may be observed when water is introduced to flush the tube or administer medication. Some recommended nursing interventions to maintain patency include using the appropriate amount of fluid when flushing the tube, administering liquid medication when possible or, if a liquid formulation is not available, using tablets diluted in water, as well as carefully monitoring food infusions[8].

Studies have also shown that proper handwashing and cleaning techniques when preparing and administering formula are essential to minimize diet contamination. Therefore, the manufacturer's recommendations regarding the preparation and administration time of the diet should be followed, respecting the dilution of the formula, to avoid contamination[14].

Nurses should encourage caregivers to participate in the care and handling of the tube, instructing lay caregivers on changes in the routine of children with gastrostomy[14]. Thus, observing the possible causes of gastrostomy tube obstruction and caring for it is a complex activity that requires knowledge to avoid

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complications with the tube and maintain its patency and durability.

## CONCLUSION

The development of the protocol entitled "Probability of gastrostomy tube unblocking" is another tool to assist in the care of patients with gastrostomy.

Therefore, the appropriate use of the flowchart can improve the relationship with both patients and healthcare professionals, with the aim of improving the quality of care. Thus, the flowchart developed strengthens care by implementing and controlling targeted and structured actions. However, it is necessary to clarify that the protocol is a guide that can guide care and assist the clinical competence of the professional.

It should be noted that a difficulty in the study design process was the scarcity of studies in the literature that could support the development of the protocol on the subject.

Finally, the protocol must be kept up to date based on the literature. However, the support of a team specialized in stoma therapy was essential to keep the protocol in line with the real needs of the sector. It should be noted that the protocol developed will be submitted to a validation process by a committee of experts on the subject in a subsequent study.

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**Authors' contribution**

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