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RESEARCH ARTICLE (ORIGINAL)

Nurses' Perceptions of Therapeutic Futility in Adult Patients Admitted to a General Intensive Care Unit

Perceção dos Enfermeiros acerca da Obstinação Terapêutica em Doentes Adultos em Unidade de Cuidados Intensivos Polivalente

Percepción del Personal de Enfermería sobre la Obstinación Terapéutica en Pacientes Adultos de una Unidad Polivalente de Cuidados Intensivos

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Abstract

Background: Situations of therapeutic futility (TF) in intensive care units (ICUs) present challenges for nurses

Objective: To explore nurses' perceptions of TF in adult patients in a general ICU.

Methodology: A descriptive, exploratory study with a qualitative approach was conducted with a purposive sample of 19 nurses. Data were collected using a questionnaire with both closed- and open-ended questions and analyzed according to Bardin's content analysis method. All ethical and formal requirements were met.

Results: Nurses associated TF with diagnostic testing, invasive procedures, and intensive pharmacological interventions, which elicited feelings of anger and frustration. They identified the need to enhance communication, involve nurses in decision-making, develop protocols, and increase training in ICUs. **Conclusion:** Negative emotions triggered by TF affect nurses' experience of care management. To better manage these situations, this study presents strategies for improving ICU patients' quality of life.

Keywords: perception; nurse; medical futility; patient; critical care

Resumo

Enquadramento: As situações de obstinação terapêutica (OT) que ocorrem nas Unidades de Cuidados Intensivos (UCI) constituem-se desafiantes para os enfermeiros.

Objetivo: Conhecer a perceção dos enfermeiros face à obstinação terapêutica no Doente Adulto em UCI Polivalente.

Metodologia: Estudo descritivo, exploratório, de abordagem qualitativa através de questionário com questões fechadas e abertas, a uma amostra intencional de 19 enfermeiros, recorrendo à análise de conteúdo segundo Bardin. Cumpridos requisitos éticos e formais.

Resultados: Os enfermeiros percecionam a OT como estando associada à realização de exames de diagnóstico, a procedimentos invasivos e à administração de medidas farmacológicas intensivas, levando a sentimentos como revolta e frustração. Consideram a necessidade de melhoria da comunicação, envolvimento do enfermeiro na tomada de decisão, criação de protocolos e reforço da formação na UCI. Conclusão: A OT provoca emoções e sentimentos negativos nos enfermeiros, interferindo na forma como vivenciam a gestão dos cuidados. A fim de gerir melhor estas situações são evidenciadas estratégias que visam garantir a melhoria da qualidade de vida do doente internado na UCI.

Palavras-chave: perceção; enfermeiro; obstinação terapêutica; doente; cuidados intensivos

Resumen

Marco contextual: Las situaciones de obstinación terapéutica (OT) que se producen en las Unidades de Cuidados Intensivos (UCI) suponen un reto para el personal de enfermería.

Objetivo: Conocer la percepción de los enfermeros ante la obstinación terapéutica en el paciente adulto en una UCI polivalente.

Metodología: Estudio descriptivo, exploratorio, de enfoque cualitativo mediante cuestionario con preguntas cerradas y abiertas, a una muestra intencional de 19 enfermeros, mediante el análisis de contenido según Bardin. Se cumplieron los requisitos éticos y formales.

Resultados: El personal de enfermería percibe la OT como algo asociado a la realización de pruebas diagnósticas, procedimientos invasivos y la administración de medidas farmacológicas intensivas, lo que provoca sentimientos de rebeldía y frustración. Consideran que es necesario mejorar la comunicación, involucrar al personal de enfermería en la toma de decisiones, crear protocolos y reforzar la formación en la UCI.

Conclusión: La OT provoca emociones y sentimientos negativos en los enfermeros, lo que interfiere en la forma en que viven la gestión de los cuidados. Con el fin de gestionar mejor estas situaciones, se ponen de manifiesto estrategias dirigidas a garantizar la mejora de la calidad de vida del paciente ingresado en la UCI.

Palabras clave: percepción; enfermero; obstinación terapéutica; paciente; cuidados intensivos







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Introduction

The emergence of new techniques, treatments, and diagnostic methods has enabled more effective clinical responses and increased longevity (Oliveira et al., 2021). This reality has also contributed to an increase in therapeutic futility (TF), which is defined as the continued use of treatments deemed futile with little prospect of achieving positive clinical outcomes or prolonging life in a meaningful way for the patient (Voultsos et al., 2021). In intensive care units (ICUs), where technicist care predominates, the occurrence of futile care is frequent, creating potential ethical and professional dilemmas for healthcare teams, particularly nurses (Nazari et al., 2022). When nurses are unable to act in accordance with their values due to the obligation to sustain futile treatments, they experience moral distress, which can evolve into burnout syndrome (Fumis et al., 2017).

In light of this issue and its implications for nursing practice, it is crucial to explore nurses' perceptions of TF situations in adult patients admitted to general ICUs.

Background

In recent years, increased life expectancy and the growing number of people with chronic diseases who require prolonged medical care have led to unrealistic expectations and a dependence on advanced technologies (Virdun et al., 2015). ICUs are an expression of this reality: highly specialized, organized, and technologically sophisticated environments where multidisciplinary teams provide care to critically ill patients (Vieira et al., 2022). However, despite the availability of advanced resources in these settings, situations of profound vulnerability and irreversibility persist, leading to care practices marked by TF or even medical futility (Vieira et al., 2022).

Medical futility refers to the implementation of therapy or care without reasonable expectation of cure or significant benefit to the patient (Nazari et al., 2022). Both medical futility and TF represent interventions that may cause greater harm than the disease itself. These approaches are ineffective in delivering patient-centered care, especially in situations where there is no possibility of cure (Virdun et al., 2015).

Nurses play a pivotal role in resource allocation to safeguard patients' rights, preserve their dignity, and ensure respect for the ethical principles that guide their practice. These principles, particularly beneficence and nonmaleficence, are compromised in situations of TF because this type of care ultimately causes suffering without benefiting the patient. Nurses who face this reality experience personal, professional, and ethical challenges that can lead to burnout and affect the quality of care (Nazari et al., 2022). TF can also reduce job satisfaction and contribute to emotional exhaustion in both physicians and nurses, resulting in adverse consequences for patients and their families (Bacoanu et al., 2024).

Research question

What are nurses' perceptions of TF in adult patients admitted to general ICUs?

Methodology

A descriptive, exploratory study with a qualitative approach was conducted to explore nurses' perceptions of TF in adult patients admitted to a general ICU of a public hospital in the Lisbon region. A purposive sample was selected based on the following inclusion criteria: working as a nurse in the ICU in a management or care role and agreeing to participate in the study. For data collection, a questionnaire was developed based on a literature review, containing both open- and closed-ended questions to encourage greater openness and sincerity among participants. This approach was chosen to minimize the influence of the researcher, who, although external to the ICU, was receiving training there. It reduced the risk of bias caused by subjective interpretations or influences because the issues were sensitive and delicate. To comply with all ethical requirements, the study was authorized by the hospital's Board of Directors and approved by the Ethics Committee (Opinion no. 173/2024).

First, the questionnaire was pre-tested with 10 nurses from the same unit who did not participate in the study to assess its relevance, clarity, comprehensibility, and average completion time. Minor adjustments were made to the open-ended questions.

After this phase, the ICU nurse manager received 50 questionnaires in a sealed envelope and distributed them to the other members of the nursing team. Confidentiality and anonymity were ensured, as the data were exclusively used for this study. Informed consent was obtained when the envelope was delivered.

Of the 50 questionnaires, 19 (38%) were completed and returned. No reasons for non-participation were reported to the researchers. Given that the questionnaire was anonymous, it was not possible to identify which nurses did not participate or the reasons for their non-participation. The questionnaire starts with a brief introduction to the study, including its relevance, objectives, and purpose. It consists of two demographic characterization questions, four questions addressing professional experience and years of service, and six open-ended questions about the occurrence of TF situations, perceived reasons for TF, experienced feelings and emotions, knowledge of end-of-life protocols in the ICU, most common TF practices, and relevant measures/strategies to manage these practices in the ICU.

The nursing team completed the questionnaire in the unit and handed it directly to the nurse manager. Each questionnaire took an average of 10 minutes to complete. Data was transcribed for qualitative analysis, which followed Bardin's three main stages: pre-analysis, exploration of the material, and treatment of the results. In the first

stage, the researcher reviewed the content several times to become familiar with the data. In the second stage, the transcripts were organized and divided into segments relevant to the study's objective. The elements addressing the research question were identified to explain the phenomenon under study in a spirit of discovery and promote a deeper understanding of the data. In the third stage, data were coded, organized, and processed using the NVivo software. NVivo facilitated transcription storage, data coding, and categorization. Two researchers specializing in qualitative research interpreted the data. In cases of disagreement, a third researcher was consulted. Validating the information with the participants would have been useful. The quantitative data were processed using IBM SPSS Statistics software, version 26.0, for Windows. This study adhered to the COnsolidated criteria for REporting Qualitative research (COREQ) guidelines.

Results

Most participants were women (84%), with 37% under the age of 29. Concerning professional experience, 52% of nurses reported more than 15 years of professional practice, while 47% had worked in the unit for less than five years. With regard to academic qualifications, 21% of participants had completed a postgraduate program, and 31% held a specialist certification. Of those, 26% had a master's degree.

When asked whether TF situations had occurred in the unit, 73% of participants answered "yes", 16% answered "no", and 11% did not answer.

The richness of the answers to the open-ended questions led to the identification of categories and subcategories (Bardin, 2016). Participants' reports were identified by the letter "P" followed by the corresponding questionnaire number. The analysis was organized by theme, category, and subcategory.

Theme A) Situations of therapeutic futility in intensive care units

Two categories were identified based on the participants' reports: (a) practices that prioritize cure and (b) practices that prolong suffering. The first category comprised two subcategories: (a.1) organ support therapies and (a.2) invasive procedures/surgeries.

Within the first subcategory (a.1) of the category "Practices that prioritize cure", participants identified TF situations such as "prolonging mechanical ventilation and maintaining vasopressor support despite the patient's irreversible clinical condition" (P2), "implementing dialysis in a patient with clinical signs of shock and an irreversible condition" (P6, P15), and the "situation of a patient nearing the end of life" (P15). Other situations included the "administration of blood products to end-of-life patients" (P15) and "initiating new therapeutic measures despite the prognosis" (P8).

In the second subcategory (a.2), participants mentioned "futile and unnecessary surgeries without considering the patient's terminal condition or survival" (P1, P14), a

"patient with a surgical diagnosis, multiple complications, and comorbidities undergoing several invasive interventions" (P13), "futile invasive techniques" (P15), and the "implementation of invasive mechanisms to prevent death despite the patient's poor prognosis" (P10).

The following practices were identified in category (b), "Practices that prolong suffering": "insisting on maintaining care despite irreversibility" (P7); "therapeutic futility in situations of poor prognosis" (P8); "treatments provided to end-of-life patients that are more harmful than the disease itself and offer no immediate utility/benefit to the palliative patient" (P16); "conducting unnecessary complementary diagnostic tests" (P15); "prolonging the suffering of both patients and their families when the nurse perceives that the outcome will not be favorable" (P17); "insisting on futile medical measures in cases of clinical irreversibility for several days until all members of the health team reach agreement" (P18); "the late admission of the patient to the unit to receive futile treatments" (P19); and "the professionals use life-sustaining measures to avoid confrontation with death in cases of terminal illness" (P10).

Theme B) Perceived reasons for situations of therapeutic futility

The identified reasons were grouped into two categories: a) Context and b) Multidisciplinary team. For the first category, three subcategories were identified: (a.1) technicist care model; (a.2) admission criteria; and (a.3) research needs. Four participants in the first subcategory (a.1) identified the "curative intent of the ICU" as a reason for futile care practices" (P2, P3, P6, P10). One participant mentioned "the biomedical model as the implemented model" (P3), while another referred to the need for "medical objectivity" (P14). Another participant highlighted the "need to introduce new techniques and innovative medication" (P19), and two participants pointed out reasons related to the ICU being a "highly technological environment" (P2, P10). In the second subcategory (a.2), the participants mentioned that "patients were admitted with little curative potential" (P3) and "advanced age at ICU admission" (P5). In the third subcategory (a.3), the answers focused on "the need to study pathological situations" (P7, P8, P13) and "the need to seek scientific evidence for curricular purposes" (P8). In the second category (b), Multidisciplinary team, the reasons were grouped into two subcategories: (b.1) decision-making aspects and (b.2) psychological and emotional aspects. In the first subcategory (b.1), the participants mentioned "the need for multidisciplinary consensus before implementing end-of-life protocols" (P6); "the lack of communication within the multidisciplinary team" (P15, P17); "the lack of communication with the family" (P15); "insufficient assessment of the patient's condition" (P15, P16); "disagreement within the team regarding the withdrawal of life-sustaining measures" (P5, P17); and "fragmentation of care among the various specialties caring for the same patient" (P2).

In subcategory b.2, the following aspects were identified: "clinical curiosity" (P7, P13); "difficulty accepting patient

death" (P10); "lack of sensitivity" (P12); "lack of empathy" (P12; P13); "lack of compassion for the patient" (P12); "professional immaturity" (P13); and "insecurity of the clinical staff" (P15).

Theme C) Feelings/emotions experienced in situations of therapeutic futility

In this theme, only one category with significant expression was identified, related to negative feelings and emotions: "helplessness" (P2, P3, P5, P7, P12, P13, P15) and "acknowledging it" (P8, P14); "sadness" (P2, P6); "futility regarding the care provided" (P3, P14, P17, P19); "outrage" (P6, P14, P17, P19); "inhumanity" (P7, P12, P13, P19); "frustration" (P7, P8, P15, P18); "disrespect" (P8); "anger" (P10); "insecurity" (P12, P13); "devaluation" (P15); and "distress" (P16).

Theme D) Most common therapeutic futility practices in the intensive care unit

Participants mentioned practices that were grouped into two categories: a) Invasive Procedures and b) Prescribed therapy. The first category included four subcategories: (a.1) invasive mechanical ventilation; (a.2) complementary diagnostic and treatment methods; (a.3) dialysis technique; (a.4) surgical interventions. Regarding the first subcategory (a.1), participants mentioned "invasive mechanical ventilation as a means of prolonging life" (P2) and "orotracheal intubation because it is useless and does not benefit the patient" (P3). Regarding the second subcategory (a.2), they referred to "excessive complementary diagnostic tests" (P19), "constant requests for diagnostic means and invasive treatments to prolong life" (P2, P12, P13), and "analytical and culture studies for diagnosis, often excessive and useless in the patient's current situation" (P3). In the third subcategory, only one participant (P4) mentioned "dialysis technique" as a frequent invasive FT procedure. Regarding the fourth subcategory, participants referred to "the surgery as an invasive procedure to resolve immediate problems" (P5; P14). Their reports revealed the existence of "excessive invasive techniques" (P19).

Regarding the second category, "Prescribed therapy," three subcategories emerged: (b.1) devices; (b.2) vasopressor therapy; and (b.3) other pharmacological measures. Regarding the first subcategory (b.1), the participants

mentioned "TF practices are related to device placement" (P7, P8, P12, P13) and "device maintenance" (P10). The second subcategory (b.2) encompassed the "use of vasopressors in high doses when the condition is irreversible" (P2), the "maintenance of vasoactive drugs" (P5, P6), the "increase in amines" (P15, P18), and the "increase in norepinephrine above 400 mcg in a patient at the end of life" (P16). The last subcategory (b.3) included "antibiotic therapy" (P6, P15), "intensification of therapy" (P7, P8, P15), "excessive medication" (P13), and "administration of blood products" (P15). In this theme, one participant identified "all measures (excluding comfort measures) performed on these patients" as TF practices (P18).

In this theme, two categories emerged: (a) Context and (b) Multidisciplinary team. The first category included strategies such as (a.1) Creation of protocols; (a.2)

Theme E) Strategies for managing therapeutic futility

Training; and (a.3) Patient assessment. With regard to the first subcategory (a.1), the participants mentioned the "development of an end-of-life protocol" (P2, P5, P15, P19) and the "definition of standards of practice in the end-of-life care process" (P12). In subcategory a.2, they emphasized the "need for informal sharing of experiences" (P8), the "need for structured and continuous training on the subject" (P8, P10, P12, P13), the "need to reorganize the training plan" (P18), the "presentation of cases to improve future interventions" (P7), "holding monthly meetings to discuss cases" (P18), and "moments of sharing/debriefing of previous situations" (P17). As for the third subcategory (a.3), the participants considered it important to "define admission criteria" (P3), "a careful evaluation of the patient before admission" (P3), and "conduct a multidisciplinary patient assessment" (P4). Regarding the second category, "Multidisciplinary team," participants considered b.1) "Communication" and b.2) "Decision-making" to be important. In the first subcategory (b.1), they recognized the importance of "moments of multidisciplinary discussion" (P7, P8, P9, P11, P12, P13, P14, P15, P16), "more effective interdisciplinary communication" (P2, P18), and "communicating with the family" (P15).

The following table systematizes the themes, categories, and subcategories that emerged from the analysis (Table 1)

 Table 1

 Systematization of results by themes, categories, and subcategories

Theme	Categories	Subcategories
A – Situations of therapeutic futility in intensive care units	a) Practices that prioritize cure b) Practices that prolong suffering	a.1) Organ support therapiesa.2) Invasive procedures/surgeries
B - Perceived reasons for situations of therapeutic futility	a) Context b) Multidisciplinary team	a.1) Technicist care modela.2) Admission criteriaa.3) Research needsb.1) Decision-making aspectsb.2) Psychological and emotional aspects
C – Feelings/ emotions experienced in situations of therapeutic futility	Negative feelings and emotions	
D - Most common therapeutic futility practices in intensive care units	a) Invasive procedures b) Prescribed therapy	 a.1) Invasive mechanical ventilation; a.2) Complementary diagnostic and treatment methods; a.3) Dialysis technique; a.4) Surgical intervention b.1) Devices; b.2) Vasopressor therapy; b.3) Other pharmacological measures.
E - Strategies for managing therapeutic futility	a) Context b) Multidisciplinary team	a.1) Creation of protocols;a.2) Training;a.3) Patient assessment.b.1) Communicationb.2) Decision-making

Discussion

In the daily routine of ICU nurses, TF occurs primarily in practices that prioritize cure, such as organ support therapies and invasive procedures/surgeries. The following interventions were identified in situations of clinical irreversibility: invasive mechanical ventilation, vasopressor therapy, renal replacement techniques, and other measures considered futile, which is in line with previous studies (Hynes et al., 2022; Mani & Ibrahim, 2017; Vieira et al., 2024). The codes of ethics of the Portuguese medical and nursing regulatory authorities state that TF should be avoided to protect the individual's dignity and honor their previously expressed wishes - freely made and with full knowledge and understanding - through advance directives, living wills, or informed consent. The National Council of Ethics for the Life Sciences (CNECV) also condemns TF, advocating for proportionate and clinically beneficial interventions.

In ICUs, practices of TF have been identified that prolong suffering related to futile care and unnecessary diagnostic tests. These practices are related to the excessive use of pharmacological and technological interventions to the detriment of care that humanizes death, as Silva et al. (2018) highlight. Similarly, Beckstrand et al. (2023) report that nurses identify physicians' persistence in futile treatments as an obstacle. Other studies (Hynes et al., 2022; Lee et al., 2022; Mani & Ibrahim, 2017) suggest that professionals choose unnecessary measures out of fear of ethical and legal repercussions, even when they are not beneficial to individuals at the end of life.

This study highlights Context as one of the perceived

reasons for TF, including the technical care philosophy and model, admission criteria, and research needs. This context focuses on intensive treatment and symptom management, which, as Hynes et al. (2022) point out, encourages interventions, even in end-of-life situations. Additionally, research needs include conducting tests, applying experimental protocols, and case studies, all of which reinforce the technical approach, particularly in units functioning as learning contexts for professionals undergoing training (Vieira et al., 2024).

Moreover, the multidisciplinary team plays a central role in TF situations, in terms of both decision-making and the psychological and emotional factors involved. In this study, communication is crucial in preventing such situations. As in other studies (Hynes et al., 2022; Spoljar et al., 2022), ineffective communication between professionals, the lack of clear guidelines on the objectives of the care provided, and the lack of justification for interventions are identified as causes of TF. El Jawiche et al. (2020) emphasize the importance of shared decision-making in multidisciplinary teams. Beckstrand et al. (2023) report that nurses often give families false hope, while Silva et al. (2018) advocate for more consistent communication about care objectives in ICUs. Mani and Ibrahim (2017) argue that communication with families and managing their expectations of cure are obstacles to be avoided to prevent TF. Furthermore, a lack of consensus among healthcare professionals regarding clinical indications and care plans can hinder the implementation of appropriate end-of-life measures (Hynes et al., 2022; Mani & Ibrahim, 2017). From a psychological and emotional perspective, clinical curiosity associated with research and professional

immaturity can lead to TF practices (Voultsos et al., 2021). Other factors include difficulty accepting death, fear of ethical and legal repercussions, and family pressure regarding the suspension of treatment (El Jawiche et al., 2020; Voultsos et al., 2021).

Concerning feelings and emotions, nurses reported feeling helplessness, outrage, frustration, dehumanization, moral conflict, insecurity, distress, sadness, and anger. These feelings are similar to those identified by Voultsos et al. (2021). Hynes et al. (2022) warn that these feelings can lead to burnout, underscoring the need to understand the reasons and avoid TF situations.

In professional practice, the most common TF practices identified in this study include invasive procedures, such as mechanical ventilation; complementary diagnostic and treatment methods; dialysis techniques; and surgery. However, Vieira et al. (2022) found that nurses considered that interdependent, routine, or protocolized interventions (e.g., positioning, monitoring, and device replacement) are futile nursing interventions.

Recognizing that complex care requires teamwork, one of the most important measures is the prescribed therapy, including device maintenance, vasopressor therapy, and other pharmacological measures, such as antibiotic therapy and blood product administration. According to Vieira et al. (2022), TF consists of administering high doses of vasopressors that provide no benefit.

Within a culture of care grounded in individual and collective accountability, Context and Multidisciplinary team emerged as strategies for managing TF. Regarding context, the creation of protocols, specific training, and rigorous patient assessments were identified as strategies to prevent TF. Standardizing practices, particularly through the creation end-of-life protocols in ICUs, enables a more consistent and standardized approach among professionals (Beckstrand et al., 2023; Hynes et al., 2022). Training is now recognized as essential and should include TF, with a special focus on palliative care, to promote the development of appropriate end-of-life care management skills (Shustari et al., 2022). Participants also emphasized the importance of discussing clinical cases and clearly defining ICU admission criteria, which should be evaluated by the multidisciplinary team. The multidisciplinary team plays a key role in TF management, with communication and decision-making being crucial aspects. Nurses advocated for multidisciplinary meetings to improve communication between professionals, which is consistent with studies by Voultsos et al. (2021) and Silva et al. (2018). Communication with the family is crucial to properly managing TF situations. Studies highlight the importance of providing clear, objective, and realistic information to avoid creating false expectations (Hynes et al., 2022; Mani & Ibrahim, 2017; El Jawiche et al., 2020; Beckstrand et al., 2023). In the decision-making process, it is essential to include nurses' opinions in medical handovers, particularly in situations of irreversibility or end-of-life care, as nurses are often the professionals who know the patient best (Voultsos et al., 2021; El Jawiche et al., 2020; Mani & Ibrahim, 2017). The results of this study are relevant to areas that were not previously recognized, which necessarily requires adopting attitudes and implementing interventions guided by professional ethics and deontology. This domain encompasses processes of change that involve contextual adjustments and multidisciplinary teams.

Conclusion

Situations of TF are extreme experiences marked by high complexity that generate moral, ethical, and personal conflicts, challenging healthcare professionals. According to nurses, the occurrence of TF situations among adult patients in general ICUs depends on several factors. These factors include prioritizing cure, prolonging suffering through invasive procedures, disproportionate therapeutic measures in view of the patient's prognosis, the context of the ICUs, and the dynamics of multidisciplinary teams. Nurses associate these situations with negative feelings that affect them both personally and professionally. They believe it is necessary to create protocols that promote standardized, consensual practices; provide specific TF training; improve communication between multidisciplinary team members; and ensure nurses' involvement in decision-making processes.

This study contributes to raising nurses' awareness of TF and proposes strategies to prevent it. One limitation is the lack of an assessment of how factors such as interpersonal difficulties, gaps in clinical communication training, and structural flaws in decision-making processes influence nurses' perceptions of TF. Due to the nature of the study, the results are not generalizable, although they may be applicable to similar contexts. Future studies should focus on identifying and validating strategies to address TF and evaluating their effectiveness.

Author contributions

Conceptualization: Branco, C., Marques, R. Data curation: Branco, C., Monteiro, E. L.

Formal analysis: Branco, C.

Investigation: Branco, C., Marques, R.

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Validation: Monteiro, E. L., Sousa, P. P., Marques, R. Visualization: Monteiro, E. L., Sousa, P. P., Marques, R. Writing – original draft: Branco, C., Monteiro, E. L. Writing – review & editing: Branco, C., Monteiro, E.

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