Original Article

Development of the BRASPEN instrument for evaluating interdisciplinary nutritional therapy teams based on the Capability Maturity Model (CMM)

Desenvolvimento da Ferramenta SBNPE para avaliação de equipes interdisciplinares de terapia nutricional segundo o Modelo de Maturidade de Competências (Capability Maturity Model – CMM)

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ABSTRACT

Introduction: A Capability Maturity Model (CMM) was developed and adapted for Multidisciplinary Nutritional Therapy Teams (MNT) in the Brazilian hospital context, aiming to provide a structured tool for organizational assessment and development. **Methods:** The model was developed by a group of 7 experts using the competency-based maturity model in seven stages: 1) review of guidelines and related documents, 2) identification of relevant processes related to nutritional therapy, 3) categorization by thematic domains, 4) determination of maturity levels, 5) critical review and implementation of improvements, 6) finalization of the model and 7) elaboration of a checklist model-based verification. The development took place between the months of July and December 2024. **Results:** The model was developed with six maturity levels (non-existent, incipient, managed, defined, quantitatively managed and optimized), covering 60 key processes distributed between stages 0 to 5, distributed over 6 domains (administrative, standards and guidelines, resources, education and training, research and development, information management). For each domain, from 1 to 4 requirements were established for maturity level progression, making a total of 39 requirements. An evaluation matrix was developed covering six fundamental domains (Administrative, Care, Resources, Education and Training, Research and Development, and Information Management) and six progressive levels of maturity (0 - non-existent to 5 - optimized). For each domain-level intersection, objective evaluation criteria were established. A structured check sheet was created for practical application, with a specific scoring system. **Conclusion:** A new model for the evaluation of the MNT was proposed based on the competency maturity model. The tool can be used as a complementary tool to other methods for assessing the competence maturity level of MNTs.

RESUMO

Introdução: Foi desenvolvido um modelo de maturidade de competências (MMC ou Capability Maturity Model) adaptado para Equipes Multidisciplinares de Terapia Nutricional (EMTN) no contexto hospitalar brasileiro, visando fornecer uma ferramenta estruturada para avaliação e desenvolvimento organizacional. **Método:** O modelo foi desenvolvido por grupo de sete especialistas utilizando o modelo de maturidade por competências em sete etapas: 1) revisão de diretrizes e documentos correlatos, 2) identificação dos processos relevantes relacionados à terapia nutricional, 3) categorização por domínios temáticos, 4) determinação dos níveis de maturidade, 5) revisão crítica e implementação de melhorias, 6) finalização do modelo e 7) elaboração de checklist de verificação baseado no modelo. O desenvolvimento ocorreu entre os meses de julho e dezembro de 2024. **Resultados:** O modelo foi desenvolvido com seis níveis de maturidade (inexistente, nascente, gerenciado, definido, quantitativamente gerenciado e otimizado), abrangendo 60 processos chave distribuídos entre os estágios de 0 a 5, distribuídos ao longo de 6 domínios (administrativo, assistencial, recursos e insumos, educação e treinamento, pesquisa e desenvolvimento, gestão da informação). Para cada domínio, de 1 a 4 requisitos foram estabelecidos para progressão de nível de maturidade, somando um total 39 requisitos. Uma matriz de avaliação foi desenvolvida, contemplando seis domínios fundamentais (Administrativo, Assistencial, Recursos e Insumos, Educação e Treinamento, Pesquisa e Desenvolvimento e Gestão da Informação) e seis níveis progressivos de maturidade (0 - inexistente a 5 - otimizado). Para cada intersecção domínio-nível, foram estabelecidos critérios objetivos de avaliação. Um checklist estruturada foi criada para aplicação prática, com sistema de pontuação específico. **Conclusão:** Um novo modelo de avaliação das EMTN foi proposto com base no modelo de maturidade de competências. A ferramenta pode ser utilizada como instrumento complementar a outros métodos para avaliação do nível de maturidade de competências das EMTNs.

Keywords:
Nutrition therapy, multiprofissional team, health management, healthcare quality indicators.

Unitermos:
Terapia nutricional, equipe multiprofissional, gestão em saúde, maturidade organizacional, indicadores de qualidade em assistência à saúde.

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INTRODUCTION

In Brazil, the multidisciplinary nutrition teams (MNT) play a central role in hospital dynamics, acting in an interprofessional manner as a key element in the safe and effective care of patients against nutritional risk and malnutrition. The presence of MNT and the correct use of hospital resources contribute to the reduction of complications and length of hospital stay[1-3].

In a continental country full of regional heterogeneities such as Brazil, the stimulus for the formation and maintenance of MNT can be diversified and variable over time, in addition to depending on the organizational structure in which the activities are developed[4,5]. As a reflection of these same heterogeneities, there is the coexistence of teams in an advanced stage of maturity and others still in an incipient stage.

Given the regional differences and the need to support the improvement of the MNT in our country, it is necessary not only to carry out the situational diagnosis, but also to point out the direction in which the teams can progress in their maturation journey. Methods that allow this double objective to be achieved are desirable.

The Capability Maturity Model (CMM) is a tool applied in organizations in order to evaluate the institution or a department, according to the degree of maturity of processes. It has been used in several areas of human activity, including Healthcare[6-10].

The generic nature of these models makes them deployable for use by a variety of groups or disciplines interested in specific organizational improvements. The development of models in the areas of interest follows the method of identifying the essential functions of the organization or activity, categorization by thematic areas or domains, and distribution along the scale of maturation, from initial to optimized. Each maturation level is characterized by key competencies needed to advance to subsequent stages, thus creating an "evolutionary improvement path" on which organizations can systematically progress[11-14].

The present study aims to develop a specific Maturity Model for Brazilian MNTs, aiming to provide a practical tool for the evaluation and development of these teams in the Brazilian hospital context.

METHODS

The objective of this work is to propose an evaluation model of MNT based on the CMM's degree of maturity of competencies.

Five specialists with a degree in nutritional therapy from the Brazilian Society of Parenteral and Enteral Nutrition (BRASPEN) and members of the 2024-2025 management board participated in the elaboration of the theoretical model. The professionals were nutritionists, doctors and nurses with more than ten years of care experience in the area and with experience in MNT management, as well as hospital certification processes, in addition to experience in the public and private spheres.

The dynamics were developed through remote meetings to analyze the bibliographic survey, carry out the brainstorming technique, build the model, and critically review, which incorporated suggestions and improvements. Finally, there was the development of a checklist for field application (Supplementary Information 1). Simple majority voting was the mechanism to resolve divergences in the structure of the model.

The development of the model was based on the survey of normative documents, technical guidelines and complementary literature, followed by the extraction of relevant practices, behaviors and activities in the field of nutritional therapy (Figure 1). The complementary literature was used as a guide for the construction of the model by stages of bibliographic survey, empirical complementation, identification of practices, identification of domains and stages of maturity.

Regulatory documents:

- Portaria No. 272 of April 8th 1998[15]
- Portaria No. 337 of April 14th 1999[16]
- Collegiate Board Resolution No. 63, of July 6th, 2000[17]
- Collegiate Board Resolution No. 503, of May 27th, 2021[18]

Technical guidelines:

- Brazilian Society of Parenteral and Enteral Nutrition Guideline SBNPE/BRASPEN on Nutritional Therapy in Critically Ill Patients[19]
- Brazilian Society of Parenteral and Enteral Nutrition Guideline SBNPE/BRASPEN for Nursing in Nutritional Therapy[20]
- Turkish Society of Clinical Nutrition Guidelines[21]
- ESPEN Guideline on Hospital Nutrition[22]
- ESPEN Practical Guideline: Home Enteral Nutrition[23]
- ASPEN Guidelines for the Provision and Assessment of Nutrition Support Therapy in the Adult Critically Ill Patient[24]

Complementary literature:

- Publications on CMM applied in health and other areas[8,25-28]
- Studies on quality indicators in nutritional therapy[29-31]
- Documents from health accreditation organizations[32,33]

The document analysis method followed a systematic process of identifying the mandatory legal and technical requirements, surveying the recommended good practices,

mapping quality indicators and classifying the elements identified in operational domains.

After the survey of the technical, legal and operational requirements, a brainstorming session was held among the members of the drafting committee to review the items and vote.

Definition of domains and allocation of practices

Grouping according to thematic areas or domains was carried out after identifying the essential processes and competencies related to nutritional therapy. Based on the authors' previous experience in patient care in nutritional therapy, teaching and process management, the following areas were proposed: Administrative, Care, Resources and Inputs, Education and Training, Research and Development, and Information Management.

Specification of maturity levels

The establishment of maturity levels for the field of nutritional therapy was guided by the guiding question: "What are the processes like in a fully developed MNT?". By analogy with examples extracted from the bibliographic database and taking into account the experience with MNT management in different contexts, six maturity levels were established in consensus, from 0 to 5, reflecting the natural evolution of the teams from initial training to the state of operational excellence.

The stages of model construction are represented in figure 1.

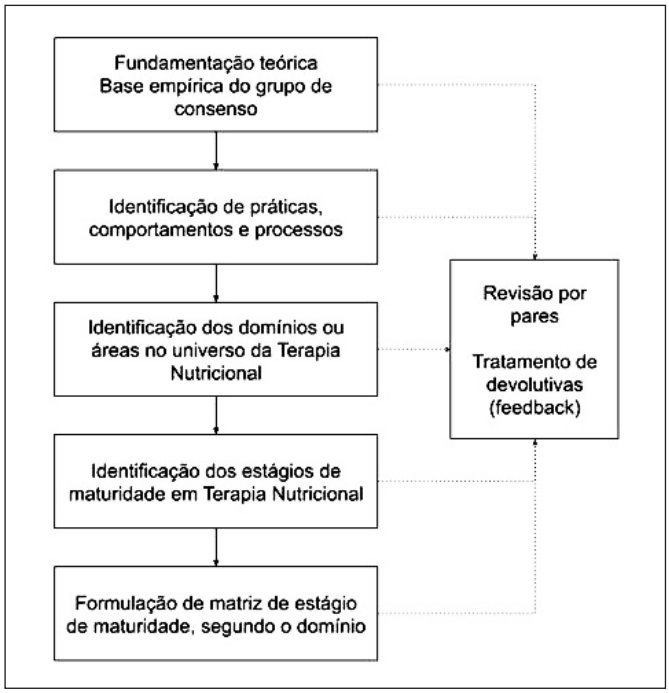

Figura 1. *An overview of the development of a Capability Maturity Model (CMM) for Multidisciplinary Nutrition Teams (MNT).*

Before the final vote, a final round of critical evaluation was carried out, taking into account the following guiding questions:

1. Is the model applicable in different contexts in the national landscape?
2. Does the model have the potential to be applied in other countries?
3. Is there clarity and objectivity in the established criteria?
4. Is there feasibility of practical implementation?
5. What are the potential enablers and barriers?
6. What are the suggestions for adjustments and improvements?
7. What are the dissemination strategies?

Development of checklist

A checklist was created by consensus among the evaluators, after the elaboration of the model.

The maturity assessment system was developed using a systematic and considered approach, based on the following criteria.

Evaluation scale by criterion: A triple scale was adopted for each criterion evaluated:

- 0 points: requirement not met
- 1 point: requirement partially met
- 2 points: requirement fully met

Weights by domain: the domains were weighted differently according to their relevance in the context of nutritional therapy:

- Care: 25% (main focus on core activity)
- Administrative: 20% (basic organizational structure)
- Resources and Inputs: 15% (resources needed)
- Education and Training: 15% (skills development)
- Information Management: 15% (documentation and analysis)
- Research and Development: 10% (innovation and improvement)

Criteria distribution: each domain contains specific criteria distributed among the six maturity levels (0-5), totalling:

- Administrative: 11 criteria (22 points maximum)
- Care: 12 criteria (24 points maximum)
- Resources and Inputs: 8 criteria (16 points maximum)
- Education and Training: 9 criteria (18 points maximum)
- Research and Development: 9 criteria (18 points maximum)
- Information Management: 11 criteria (22 points maximum)

The calculation of the maturity level was established through the following process:

- Calculation by domain: for each domain, the percentage obtained is calculated as: Domain Percentage Score = (Points Earned ÷ Maximum Domain Points) × 100
- Weighted Score: the percentage score is then multiplied by the weight of the domain: Weighted points = Percentage score × Weight of the domain
- Global score: the weighted points of all domains are added, resulting in a maximum value of 100 points: Global score = • (Weighted points of each domain)

Determination of maturity level: The global score is classified into one of six maturity levels:

- Level 0 (Non-existent): 0-20%
- Level 1 (East): 21-40%
- Level 2 (Emergent): 41-60%
- Level 3 (Established): 61-80%
- Level 4 (Institutionalized): 81-90%
- Level 5 (Optimized): 91-100%

RESULTS

The initial version of the tool was developed over six months (from July to December 2024). A meeting was held to present the project, in which the doubts were resolved and the documentation was submitted to the analysis of the working group. Improvements in the way the text is written have been incorporated. There was no divergence among the members of the working group.

The list of processes, practices, and behaviours extracted from the references and added to the contributions of the experts is shown in Table 1.

The elements of the list have been grouped according to the relevant areas or areas:

1. *Administrative Domain:* covers the organizational and managerial aspects of nutritional therapy in the hospital environment. It includes everything from the training and regulation of the MNT to the management of human resources, defining roles, responsibilities and organizational structure necessary for the effective functioning of the service.

Table 1 – Practices, behaviours and activities and corresponding domains.

Domain	Activities	Practices and behaviours
Administrative	- Presence/absence of a dedicated doctor or nutritionist	- Holding regular meetings
	- Allocation of professionals in their functions	- Documentation of meetings through minutes
	- Existence of a bylaw	- Certification of professionals
	- Planning of activities	- MNT approval
	- Positioning in the company's organizational chart	- Participation in regional or national events
	- MNT composition (complete/incomplete)	- Engagement in the society of experts
	- Presence of a technical and administrative person	- Recognition by the board
Care	- Nature of the action (reactive vs. proactive)	- Participation in intersectoral protocols (bronchoaspiration, pressure injury, hyperglycemia)
	- Patient screening process	- Application of quality management techniques
	- Identification of patients at risk	- Indicator collection and analysis
	- Structuring of patient follow-up	- Ambulatory operation
	- Description of processes and procedures	- Post-discharge follow-up
	- Response to opinions	- Post-hospital stay navigation
	- Patient mapping	- Teleconsultation
	- Medical record	- Obtaining specific certifications (ISO, JCI, Qmentum, ONA)
	- Performing situational diagnosis	- Managerial and strategic analysis of indicators
	- Implementation of improvement actions	
	- Development of SOPs	
	- Meeting hospital demands	
	- Use of process indicators	

Continuation Table 1 – Practices, behaviours and activities and corresponding domains.

Domain	Activities	Practices and behaviours
Resources and Inputs	- Standardization of nutritional therapy products	- Non-standard formula acquisition process
	- Management of formula supply	- Incorporation of new technologies
	- Regularity in provision	- Conducting clinical usability studies
	- Product portfolio definition	
	- Influence of MNT on procurement decisions	
Education and Training	- Conducting internal training	- Participation in the continuing education grid
	- Frequency of training	- Conducting external training
	- Source of demand for training (MNT vs. others)	- Course offerings
Research and Development	- Production of papers for congresses	- Research development
	- Presentation at congresses	- Regularity of research activities
Information Management	- Data collection on patient movement	- Adherence to the General Data Protection Law (LGPD)
	- Recording of diagnoses and prevalence	- Use of IT tools for data capture and analysis
	- Use of systems of record (paper vs. electronic)	- Direct extraction of data from the electronic medical record
	- Patient map maintenance	- Implementation of predictive tools
	- Use of spreadsheets	

2. *Care Domain*: focuses on the technical and operational aspects of nutritional therapy, establishing standardized methods for all stages of nutritional care. It ranges from the identification of patients at risk to the guidance of hospital discharge. Includes metrics for evaluating the quality of service.
3. *Resources and Inputs Domain:* relates to the management of the material resources necessary for the activity, including the portfolio of nutritional formulas, equipment and infrastructure. It guarantees the availability and quality of essential materials for the service.
4. *Education and Training Domain*: focuses on the continuous development of professional competencies and the dissemination of knowledge. It ranges from team training to the education of patients and families, ensuring constant updating and the quality of nutritional care.
5. *Research and Development Domain:* dedicated to the scientific and technological advancement of nutritional therapy, promoting the production of knowledge through research, participation in scientific studies and incorporation of innovations. It seeks the continuous improvement of practices through scientific evidence.
6. *Information Management Domain:* focuses on the efficient management of data and information related to nutritional therapy, using technology to optimize records, monitoring, and analysis of results. It allows evidence-based decision-making and systematic monitoring of processes.

The transposition and adaptation of the stages of maturity of the MMS to the perspective of nutritional therapy generated the following system (Table 2):

- Level 0: There is no structured care for patients at nutritional risk in the form of MNTs. It is characterized by the absence of consistent nutritional therapy practices in an interdisciplinary scope and the absence of dedicated trained professionals. The transition to the next level requires the designation of a trained medical professional or nutritionist, ensuring the continuous provision of resources and establishing an exclusive schedule for these professionals to work, in favour of patient care and establishment of standard operational processes.

Table 2 – Established maturity levels.

Level	Characteristics	Requirements for progression
Level 0: Non-existent	• Absence of consistent nutritional therapy practices at an interdisciplinary level	• Designation of a trained medical professional or nutritionist
	• Lack of trained professionals dedicated to nutritional therapy	• Continuous provision of resources
	• Absence of structured processes	• Establishment of protected hours for work
Level 1: Incipient	• Teams in initial training	• Recognition of the need for improvement
	• Ad hoc and poorly structured processes	• Commitment to organizational change
	• Significant variability in practices	• Team building and/or establishment of regular communication between members
	• Lack of standardization or systematic planning	• Understanding of the current state of processes
	• Dependence on the individual competence of professionals	• Establishment of clear roles
	• Possible but inconsistent functional results	• Implementation of basic training
	• Frequent violation of processes in crisis situations	
Level 2: Managed	• Operation with a defined person	• Establishing regular team meetings
	• Beginning of documentation of practices	• Clear definition of roles and responsibilities
	• Structured communication between members	• Beginning of systematic process documentation
	• Standardized responses to common situations	• Standardization of specific procedures
	• Initial structuring of processes and projects	• Implementation of knowledge assessments
	• A team with more homogeneous professional qualifications	• Integration of technological tools
	• Specific training in nutritional therapy	• Establishment of basic quality indicators
	• Shared interest and dedication by the team	• Development of initial care protocols
	• Delivery of services in line with the expectations of patients and clinical staff	• Creation of formal communication flows between sectors
Level 3: Defined	• Documented and standardized processes	• Centralization of protocol and process documentation
	• SOPs implemented	• Implementation of comprehensive training programs
	• Quality and safety aspects more explicitly included	• Introduction of performance metrics
	• Regular retraining and training programs	• Integration of feedback system
	• Effective integration with other sectors of the hospital	• Technological improvement
	• Systematic resolution of operational bottlenecks	
	• Possibility of different maturity levels between sectors	
	• Structured system of registration and documentation	
	• Initial monitoring of indicators	

Continuation Table 2 – Established maturity levels.

Level	Characteristics	Requirements for progression
Level 3: Defined	• Interface protocols with other teams	
	• Development of internal audit system	
	• Setting goals based on indicators	
	• Creation of a continuous team development plan	
	• Implementation of knowledge management processes	
Level 4: Quantitatively managed	• Quantitatively measured and controlled processes	• Development and implementation of comprehensive Indicators
	• Systematic use of indicators and benchmarks	• Implementation of robust data collection and analysis mechanisms
	• Objective evaluation of efficiency and effectiveness	• Establishment of improvement cycles (e.g., PDCA) in the delivery of care
	• Implementation of advanced methods and technologies	• Development of operational adaptability and flexibility
	• Large-scale data management	• Integrated quality management system
	• Real-time monitoring	
	• Early treatment of anomalies	
	• Proactive corrective and preventive actions	
Level 5: Optimized	• Engagement in a constant cycle of continuous improvement	Points for support:
	• Active search for innovations and refinement	• Alignment with institutional strategic planning
	• Integration of research and development into regular activities	• Development of institutional policies
	• Focus on excellence and competitiveness	• Brand and reputation management
	• Strategic and anticipated action	• Optimization of operating costs
	• Advanced multi-sector integration	• Maximization of results
	• Development of collaboration and research networks	• Anticipation of industry trends
	• Structured knowledge management program	
	• Mentoring and leadership development system	Characteristics of excellence:
	• Active participation in scientific forums and societies	• Superior execution of the concept of quality
	• Production and dissemination of knowledge	• Maintenance of organizational competence
		• Effective cross-sectoral coordination
		• Strategic performance in the external environment
		• Proactive change management
		• Innovation leadership

- Level 1: At this level, there are teams in initial formation, whose processes tend to be ad hoc, characterized by significant variability and lack of standardization or planning. The results depend more on the individual competence of the professionals than on organized processes. Common challenges include lack of resources, lack of specialized professionals, and prevalence of non-formal practices. Transitioning to the next level requires recognizing the need for improvement, building staff, establishing regular communication, understanding the current state, clearly defining roles, and introducing basic training, as well as creating SOPs.
- Level 2: The operation starts to have a defined person or manager, and begins to structure itself in terms of processes and projects. Professionals are often more qualified, with specific training and dedication to the topic of nutritional therapy. The delivery of services meets the expectations of key stakeholders, including patients and clinical staff. To advance to the next level, it is necessary to establish regular meetings, clearly define roles and responsibilities, initiate systematic documentation, standardize specific procedures, implement knowledge assessments, and integrate technological tools.
- Level 3: At this stage, processes are documented and there are regular retraining and training programs. SOPs are implemented following the institutional standard. Integration with other sectors of the hospital allows solving difficulties and joining efforts for organizational efficiency. It is common to observe sectors operating at different levels of maturity within the same organization. Transitioning to the next level requires centralizing documentation, implementing comprehensive training programs, introducing performance metrics, and improving technology.
- Level 4: Processes are measured and controlled quantitatively by means of indicators. Teams use specific metrics and benchmarks to measure performance, providing objective assessment of efficiency and effectiveness. Advanced methods and technologies make it easy to handle large volumes of data, including statistical quality control, automatic data capture, and predictive analytics. The increasing integration with information technology allows real-time monitoring, enabling early treatment of anomalies and preventive corrective actions. To reach the maximum level, it is necessary to develop comprehensive indicators, implement robust data analysis mechanisms, establish continuous improvement cycles, and ensure operational adaptabiliLevel 5: Represents the peak of maturity, with teams engaged in a constant cycle of continuous improvement and active search for innovations. Research, development and innovation are a regular part of the performance. Challenges include sustaining growth, developing the market, incorporating new technologies, and maintaining a reputation as a centre of excellence. The focus transcends doing well and better, aiming to outperform competitors. Continuous improvement is achieved by innovation and technological advancements aligned with the institutional strategy. The objectives are continuously reviewed to respond to external challenges, and may require changes in processes, paradigms and organizational structure. The coordination integrates several sectors to maximize results, minimize costs and strengthen the brand, with early and strategic action considering the external environment. This level represents the sphere of strategic planning and institutional policies.

The product was a matrix that associates fundamental domains with six maturity levels (0 - non-existent to 5 - optimized). For each domain-level intersection, objective criteria and expected practices were established, allowing systematic evaluation and guiding the progressive development of skills in nutritional therapy (Table 3). The six maturity levels (non-existent, incipient, managed, defined, quantitatively managed and optimized) covered 60 key processes distributed between stages 0 to 5, distributed over the six domains. For each domain, from one to four requirements were established for maturity level progression, making a total of 39 requirements for level progression.

Regarding the checklist, a qualitative evaluation model was created that enables an objective and reproducible evaluation, allowing comparisons between different institutions and monitoring the evolution of the same team over time. The triple scale in values of 0, 1 or 2 was chosen to simplify the evaluation process, reducing subjectivity, while the relative weights of the domains reflect their relative importance for the effective functioning of an MNT.

DISCUSSION

Brazil is a country of continental dimensions and intense regional variability. These differences extend to the health area and its respective subdivisions, such as nutritional therapy, a specialty that is part of the hospital dynamics and is carried out in the form of MNTs.

The operational success of these teams depends on the collaboration of their members, but it does not dispense the engagement of other agents within the hospital environment, such as coordinators and professionals from other services, hospital managers, patients, family members and auditors[34-37]. External agents can also influence the dynamics, such as societies of experts, through consensus and guidelines, government entities, through prioritization of local strategies and policies, or even external funders and paying sources, with regard to discussions about financial resources[38-40].

Table 3 – Maturity assessment matrix between the established domains and levels.

Domain	Level 0 - Non-Existent	Level 1 - Incipient	Level 2 - Emerging	Level 3 - Established	Level 4 - Institutionalized	Level 5 - Optimized
Administrative	• Non-existent actions	• Non-dedicated doctor/nutritiontst, professionals frequently displaced from function	• Incomplete MNT	• Full MNT, including technical and administrative manager	• MNT professional with participation in a regional or national event at least 1 time a year	• MNT professional engaged in the society of experts
		• Absence of regulations and planning	• Presence of written regulations	• Regular meetings and with minutes/ records		
		• Not included in the company's organizational chart	• Recognition by the board	• Certified professionals		
			• Professionals looking for certification	• MNT homologation		
Care		• Reactive action ("chase after patients")	• Some processes and procedures described	• Processes described in the form of SOPs	• Participation in intersectoral protocols (bronchial aspiration, pressure injury, hyperglycaemia)	• Outpatient, post-discharge follow-up
		• No screening process or identification of patients at risk	• Response to opinions	• Regular attendance to hospital demands	• Quality management techniques.	• Post-hospital admission navigation (teleconsultation)
		• Unstructured follow-up of patients	• Patients mapped and regular follow-up recorded in medical records	• Use of process indicators	• Regular collection and analysis of indicators	• MNT-specific certification (ISO, JCI, Qmentum, ONA)
			• Situational diagnosis and isolated improvement actions		• Indicator system	• Indicators studied for managerial and strategic purposes
Resources and Inputs		• Absence of standardization of resources	• Regular provision of formulas and resources, without MNT endorsement	• Defined portfolio, appropriate to the needs of the hospital (MNT influences the decision)	• Ease of acquisition of non-standard formulas	• Path of incorporation of new technologies in the hospital
		• Shortage of formulas				• Clinical usability studies of new products
		• Irregularity in the provision				
Education and Training		• Sporadic, on-demand or irregular training	• Internal, regular training, demanded by MNT	• Training, demand of continuing education	• Training and external courses	• Institutionalized continuing education • Participation in international training and external courses
Research and Development		• Irregular	• Irregular	• Papers for congresses	• Presentation at congresses	• Research development
Information Management		• Lack of demographic and clinical metrics	• Patient Map	• Patient map with features	• IT tools for data capture and analysis (direct extraction of the electronic medical record)	• IT Tools for Forecasting
		• Paper records	• Usage of spreadsheets	• Adherence to the General Data Protection Law		
			• Electronic medical record records			

Supplementary Information 1 – Checklist for the nutritional therapy maturity assessment system.

NUTRITIONAL THERAPY MATURITY ASSESSMENT SYSTEM

INSTRUCTIONS FOR USE

For each item, assign:

- 0 points: Requirement not met
- 1 point: Requirement partially met
- 2 points: Requirement fully met

Calculate the score per domain by adding the points.

Calculate the global score by adding up all the domains.

Use the classification tables to determine the maturity level.

AREAS OF ASSESSMENT

1. ADMINISTRATIVE DOMAIN (Weight: 20%)

Guiding question: How is the administrative organization of MNT structured?

Level 0 - Non-Existent

- [ ] Are there basic administrative actions? (Check if there are any administrative initiatives related to nutritional therapy)

Level 1 - Incipient

- [ ] Are professionals dedicated to their specific functions? (Check for deviation of function)
- [ ] Is there any regiment, even if informal? (Check documentation or evidence of standards)
- [ ] Is the MNT included in the institution's organizational chart? (Check institutional documents)

Level 2 - Emerging

- [ ] Is there a formal written regulation? (Request document)
- [ ] Is there formal recognition by the Board? (Check ordinances, notices or minutes)
- [ ] Are the professionals in the process of certification? (Check registrations or vouchers)

Level 3 - Established

- [ ] Is the MNT complete with a designated Technical Head? (Check team composition and ordinances)
- [ ] Are regular meetings held with documentation? (Check attendance and minutes)
- [ ] Do professionals have TN certification? (Check certificates)

Level 4 - Institutionalized

- [ ] Is the MNT officially homologated? (Check institutional documentation)
- [ ] Is there regular participation in scientific events? (Check certificates and reports)

Level 5 - Optimized

- [ ] Are members engaged in specialized societies? (Check memberships and participations)

Administrative Domain Subtotal: ____ / 22 points

2. CARE DOMAIN (Weight: 25%)

Guiding question: How are patient care processes in nutritional therapy executed?

Level 0 - Non-Existent

- [ ] Are there minimally structured care actions? (Check for any evidence of compliance)

Level 1 - Incipient

- [ ] Are there any basic processes described? (Check documentation, even if rudimentary)
- [ ] Is there systematized compliance with opinions? (Check service records)
- [ ] Is any basic patient mapping performed? (Checklists or records)

Level 2 - Emerging

- [ ] Is the follow-up recorded regularly? (Check evolution in medical records)
- [ ] Is situational diagnosis performed? (Check reports or analyses)
- [ ] Are improvement actions implemented, even if isolated? (Check intervention logs)

Continuation Supplementary Information 1 – Checklist for the nutritional therapy maturity assessment system.

Level 3 - Established

- [ ] Are there SOPs implemented and followed? (Check documentation and membership)
- [ ] Is the hospital's demands regularly met? (Check response time)
- [ ] Are process indicators used? (Check which indicators and records)

Level 4 - Institutionalized

- [ ] Does the MNT actively participate in intersectoral protocols? (Check Joint Protocols)
- [ ] Is there a structured system of indicators? (Check dashboard or reports)

Level 5 - Optimized

- [ ] Does the MNT have specific certification? (Check ISO, JCI certificates, etc.)
- [ ] Are indicators used for managerial and strategic purposes? (Check executive reports)

Subtotal Care Domain: ____ / 24 points

3. MASTERY OF RESOURCES (Weight: 15%))

Guiding question: How is the management of material resources and products for nutritional therapy carried out?

Level 0 - Non-Existent

- [ ] Is there any basic management of resources? (Check for minimum controls))

Level 1 - Incipient

- [ ] Are the resources used according to specific demand? (Check requisition processes)
- [ ] Is there a basic provision of nutritional formulas? (Check availability)

Level 2 - Emerging

- [ ] Is there a defined basic portfolio? (Checklist of standardized products)
- [ ] Is the provision of resources regular and predictable? (Check the frequency of shortages)

Level 3 - Established

- [ ] Is the portfolio complete and adequate to the needs? (Check variety and specificity)
- [ ] Is it easy to acquire non-standard formulas? (Check exception processes)

Level 4 - Institutionalized

- [ ] Is there a structured process for incorporating new technologies? (Check methodology)

Level 5 - Optimized

- [ ] Are clinical studies of product usability carried out? (Check surveys and reports)

Subtotal Resources and Inputs Domain: ____ / 16 points

4. MASTERY OF EDUCATION AND TRAINING (Weight: 15%)

Guiding question: How are the competencies of professionals involved in nutritional therapy developed?

Level 0 - Non-Existent

- [ ] Does the MNT participate in the institutional continuing education grid? (Check schedule)

Level 1 - Incipient

- [ ] Are internal trainings carried out regularly? (Check schedule and records)
- [ ] Do the trainings take place on demand from MNT? (Check origin of requests)

Level 2 - Emerging

- [ ] Does the MNT participate in the institutional Continuing Education grid? (Check schedule)

Level 3 - Established

- [ ] Is there a structured training program? (Check annual plan)
- [ ] Is the effectiveness of training evaluated? (Check evaluation methodology)

Level 4 - Institutionalized

- [ ] Are regular external trainings held? (Verify participations)
- [ ] Is there a continuing professional development program? (Check individual plans)

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Level 5 - Optimized

- [ ] Is there an advanced continuing education program? (Check for innovative methodologies)
- [ ] Do professionals regularly participate in international events? (Check certificates)

Education and Training Domain Subtotal: ____ / 18 points

5. RESEARCH AND INNOVATION DOMAIN (Weight: 10%)

Guiding question: How does MNT contribute to the generation of knowledge and innovation in nutritional therapy?

Level 0 - Non-Existent

- [ ] Are there basic research activities, even if sporadic? (Check any initiative)

Level 1 - Incipient

- [ ] Does the team participate in clinical studies, even if external? (Check for inclusion in surveys)

Level 2 - Emerging

- [ ] Are papers developed for presentation at congresses? (Check submissions)
- [ ] Are there participation in multicentre studies? (Check research partnerships)

Level 3 - Established

- [ ] Are the papers regularly presented at congresses? (Check annual attendance)
- [ ] Are there any scientific publications by the team? (Check published articles)

Level 4 - Institutionalized

- [ ] Does the MNT develop its own lines of research? (Check for ongoing projects)
- [ ] Are there formal partnerships with academic institutions? (Check agreements)

Level 5 - Optimized

- [ ] Is MNT recognized as a reference centre in research? (Check citations and invitations)
- [ ] Are innovations in protocols and techniques developed? (Check for patents or unique methods)

Subtotal Search Domain: ____ / 18 points

6. INFORMATION MANAGEMENT DOMAIN (Weight: 15%)

Guiding question: How is data and information related to nutritional therapy managed?

Level 0 - Non-Existent

- [ ] Is there any basic record of information? (Check any type of documentation)

Level 1 - Incipient

- [ ] Are paper records used in an organized way? (Check forms and filing)
- [ ] Is there a basic patient map? (Check manual logs)

Level 2 - Emerging

- [ ] Are electronic spreadsheets used for control? (Scan digital files)
- [ ] Are the records systematically made in medical records? (Check Standardization)

Level 3 - Established

- [ ] Is electronic medical records used for records? (Check System and Access)
- [ ] Does the patient map have advanced functionalities? (Check available resources)
- [ ] Is there documented adherence to the LGPD? (Check policies and processes)

Level 4 - Institutionalized

- [ ] Are IT tools used for data analysis? (Check Software and Reports)
- [ ] Is there a real-time indicator dashboard? (Check available previews)

Level 5 - Optimized

- [ ] Are predictive tools used for analysis? (Check models and algorithms)
- [ ] Is there complete integration with corporate systems? (Check interfaces and interoperability)

Subtotal Information Management Domain: ____ **/** 22 points

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SCORING AND RANKING

Maximum Global Score: 120 points

Percentage Calculation:

- Administrative Domain: ____ points ÷ 22 × 100 × 0.20 = ____ weighted points
- Care Domain: ____ points ÷ 24 × 100 × 0.25 = ____ weighted points
- Resources and Inputs Domain: ____ points ÷ 16 × 100 × 0.15 = ____ weighted points
- Education and Training Domain: ____ points ÷ 18 × 100 × 0.15 = ____ weighted points
- Research and Development Domain: ____ points ÷ 18 × 100 × 0.10 = ____ weighted points
- Management Domain: ____ points ÷ 22 × 100 × 0.15 = ____ weighted points

Weighted Global Score: ____ points (maximum 100)

DOMAIN CLASSIFICATION TABLE

Maturity Level	**% of Maximum Score**
Level 0 – Non-Existent	0-20%
Level 1 – Incipient	21-40%
Level 2 – Emerging	41-60%
Level 3 – Established	61-80%
Level 4 – Institutionalized	81-90%
Level 5 - Optimized	91-100%

GLOBAL CLASSIFICATION TABLE

Maturity Level	**% of Global Score**
Level 0 – Non-Existent	0-20%
Level 1 – Incipient	21-40%
Level 2 – Emerging	41-60%
Level 3 – Established	61-80%
Level 4 – Institutionalized	81-90%
Level 5 - Optimized	91-100%

DESCRIPTION OF MATURITY LEVELS

Level 0 - Non-existent: Non-existent or unstructured processes.

Level 1 - Incipient: Basic processes beginning to be established. There is a lack of standardization and documentation.

Level 2 - Emerging: Processes under development and standardization. Start of documentation.

Level 3 - Established: Well-defined and documented processes. Formal structure.

Level 4 - Institutionalized: Processes managed and measured. Use of indicators.

Level 5 - Optimized: Processes in continuous improvement and innovation. Reference in the sector.

OBSERVATIONS AND EVIDENCE

Administrative Domain:

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Care Domain:

_____

_____

Resources Domain:

_____

_____

Education and Training Domain:

_____

_____

Research and Development Domain:

_____

_____

Information Management Domain:

_____

_____

PRIORITY RECOMMENDATIONS

1. _____

2. _____

3. _____

4. _____

5. _____

Name of evaluator: _____ Date: _____/_____/_____ Institution: _____

In view of this scenario, it is necessary that the evaluation of the MNT includes not only the adherence to the technical standards of the societies of specialists, but also takes into account the stage of development in which they are, facing unique challenges in each regional reality. The technical guidelines and their good practices[15-24] provide guidance for technical performance, but they are not sufficient to guarantee the full development of interdisciplinary teams, since the operation depends on the unique circumstances of each institution. Among the published guidelines, the one from the Turkish Society of Nutritional Therapy stands out, as it covers, in addition to the technical aspects, the operational and relational aspects with other sectors and departments of the hospital[21].

To our knowledge, there were no instruments focused on the practice of nutritional therapy, which could at the same time assess the adequacy of the procedures, behaviours, and habits necessary and establish identification of the level of development of the MNT.

The CMM is a management tool used in various types of organizations to assess the level of maturity based on the characteristics of processes. These models seek to represent

the improvement of related processes or services in companies and organizations[6,7]. Because of their simplicity, these models were quickly applied to other fields of knowledge, unfolding into a true family of models used in areas as diverse as project management[41], software development[42], and people management[27]. In common, the models share the premise that the improvement of institutional processes usually follows a more or less constant pattern or behaviour.

Given its generic nature, the model can be adapted to the reality of nutritional therapy, in order to provide not only the situational diagnosis, but also the location in the MNT improvement journey, indicating the requirements for later stages.

The model can also bring secondary benefits, as it allows the visualization of how other agents in hospital dynamics relate to the teams. Achieving the integration of the agents involved (health professionals, managers, patients, etc.) can be challenging for reasons ranging from operational issues between sectors and departments to limitations of human and material resources, organizational culture, technical fragility, and even incomplete view of the system by those involved. For example, professionals from other specialties may be unaware of the resources needed to initiate and sustain an effective operation in nutritional therapy[43], while managers may be unaware of the relevance of the activity in the quality of care[44]. Furthermore, the proposed matrix provides the objective basis for establishing institutional goals and objectives, as well as enabling benchmarking between organizations[10,45].

The development method adopted considered the innovative nature and complexity of the proposed model, recognizing the need for substantial expertise in nutritional therapy for the proposition of the initial model. BRASPEN's choice as a reference entity for the elaboration of the model was based on the central role for the development and dissemination of practices in nutritional therapy in Brazil, adding credibility and practical relevance to the process.

However, the application of the model in health organizations presents some challenges and risks. The systematic mapping of processes, inherent to this method, evidences non-conformities and structural failures - an exposure that generates natural institutional resistance, especially when considering the investments necessary for progression in the levels of maturity[46].

The evaluation process demands substantial allocation of human and material resources. The unfavourable cost-benefit perception can compromise team engagement, especially in contexts of budget constraints. In addition, legal and regulatory considerations emerge as critical points, particularly regarding institutional exposure during external audit processes[47].

The sustainability of the identified improvements and the demonstration of return on investment pose significant additional challenges. This set of barriers demands a structured approach to organizational change management, based on effective communication and active support from leaders[48,49].

Within the scope of the model's developments, the empirical validation of the modelling is planned, through a pilot study among the community of working professionals, as well as the collection of criticisms for continuous improvement of the model. This future stage is essential to consolidate the tool, and make it more inclusive and robust in the face of different regional realities. The proposed model also includes the provision of periodic updates, since it should not be considered an immutable tool, especially in view of the dynamic nature of nutritional therapy.

CONCLUSION

A new model for evaluating MNTs was proposed, based on the process maturity model. This can represent a complementary tool to other methods for assessing the competences of MNTs.

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