How to define a quadruple aim framework to assess value in critical pathway of the patients with *Clostridioides difficile* infection

A.G. DE BELVIS[1,2], A. FRATINI[2], C. ANGIOLETTI[2], A. MORSELLA[1,2], R. RUGGERI[2], G. PEPE[2], G. IANIRO[3,4], C. SETTANNI[3], A. GASBARRINI[3,4], G. CAMMAROTA[3,4]

[1]Department of Life Sciences and Public Health, Section of Hygiene, Università Cattolica del Sacro Cuore, Rome, Italy
[2]Critical Pathways and Outcomes Evaluation Unit, Fondazione Policlinico Universitario Agostino Gemelli IRCCS, Rome, Italy
[3]Digestive Diseases Centre, Fondazione Policlinico Universitario Agostino Gemelli IRCCS, Università Cattolica del Sacro Cuore, Rome, Italy
[4]Dipartimento Universitario di Medicina e Chirurgia Traslazionale, Università Cattolica del Sacro Cuore, Rome, Italy

Abstract. – OBJECTIVE: The study aims to define the set of Key Performance Indicators (KPIs) required to assess the Value delivered by managing patients with Clostridioides difficile infection through a Critical Pathway. We used the quadruple aim Value-Based approach, and we validated the set of KPIs with the Delphi method.

MATERIALS AND METHODS: The study focuses on patients on board a Critical Pathway on Clostridioides difficile Infection and targeted towards a Fecal Microbiota Transplantation (FMT). FMT has been used to successfully treat recurrent Clostridium difficile infection. A two-round e-Delphi survey collecting data was conducted in 2019-2020 to validate the Value-Based evaluation tool. The Value-Based criteria taken into account are Clinical Outcomes, Experience of Care, Per-capita cost, Physician's burnout.

RESULTS: The two rounds led to the validation of 50 items, and four primary clinical outcomes (Mortality rate, length of stay, readmission and complications related to the illness).

CONCLUSIONS: The evaluation tool included is validated in its totality and can provide a comprehensive overview of the Value created by the Critical pathway for patients with Clostridioides difficile. We can extend the approach illustrated in this study can also to evaluate other Critical pathways.

Key Words:
Clostridioides difficile, Delphi, Value-based, Fecal microbiota transplantation, PCA/PDTA implementation, Key performance indicator.

Introduction

Clostridioides difficile-associated illness is an increasingly prevalent and morbid condition. The elderly population is at a disproportionate risk of developing the symptomatic form and associated complications, including progression to severe or fulminant disease and development of recurrent *Clostridioides difficile* infection[1].

There has been a considerable increase in *Clostridioides difficile* infection's (CDI) incidence and prevalence in the last decade. Today, it has become the principal cause of diarrhea associated with antibiotics in the general population and, above all, a cause of infection within hospital settings[2].

Faecal microbiota transplantation (FMT) has revolutionised patients' management with recurrent *Clostridioides difficile* infection (rCDI)[3,4]. With resolution rates exceeding 90%, the use of FMT has increased in clinical practice and is now a recommended treatment for rCDI, as it reduces mortality and hospital costs[5], and has been regulated by several guidelines.

In light of the above, it is necessary to enhance the patient management tools needed to treat specific clinical conditions. Clinical care pathways, first introduced in the USA in the early 1980s and then exported to Europe – mainly in the UK – were adopted as clinical governance tools to define and optimise care processes, improve quality and ensure that every care episode follows the most updated scientific evidence. By the beginning of the 21st century, critical pathways had spread worldwide and nowadays are a patient-centred care management tool[6-9].

In 2014, Fondazione Policlinico Universitario A. Gemelli – IRCCS (FPG-IRCCS), a large tertiary care centre located in Rome (Italy), set up and

implemented a critical pathway *Clostridioides difficile* infection and its related monitoring system[10].

Performance monitoring is generally the primary means of verification and measurement to guarantee the continuous quality improvement of care. Its critical determinant and fulcrum are the key performance indicators (KPI), which must be adequately selected and calculated to monitor the critical pathway's overall performance[11]. Thus, the quality monitoring and improvement system must be consolidated and ambitious at the system level.

Such KPIs are to be defined in the CP's design phase, considering the nature of the hospital's informative systems and the sustainability of their calculations and will serve the triple function of providing an understanding of the care process as it progresses, monitoring performance and supporting accountability. Thus, the indicators to be included must present the following characteristics:
- Be essential and relevant;
- Populated with the best available data;
- Capable of producing an effect when communicated.

The Core Dimensions (CDAs) are to be identified within the CP's strategic goals. The aim is to converge data acquisition towards the most valuable quality and health elements, leaving aside other secondary measurements. Their relative KPIs provide the information necessary to orient efforts across the organisation towards a common.

In light of the above, to activate Performance monitoring's capacity to impact the dimensions of sustainability, innovation, and access to care, the set of KPIs developed must effectively capture the Value that each CDA brings to such dimensions. As indicated by the principles of the Quadruple Aim framework (7) of Value-Based Care, a set of population health, quality of care and cost indicators must be developed, which will help organisations visualise their progress in such an ample context.

To implement the Quadruple Aim framework of health care, a clearly articulated set of concepts that comprise each aim must be formulated[12,13]. For this reason, it is necessary to focus on the concept of patients' Value, explained by the Value-Based Healthcare framework[13], accompanying the measurement of the results with the measurement of costs and search for those stages and variations of the process that do not improve health results.

VBH represents an evolution of Evidence-Based Medicine where the ulterior dimension of Value is added and articulated, systematically bringing together the fundamental elements of healthcare: quality, safety and efficacy are integrated with the Value perceived by patients and sustainability of care.

Through this applied model, healthcare service delivery shifts from a single-specialty approach to one constructed around the patient and his multiple health needs by assigning the entire cycle of care for the patient's condition – with relative complications and circumstances – to interdisciplinary teams. From here, the urge to measure the Value (intended as outcomes and sustainability) of the entire care cycle, focusing on clinically and scientifically relevant outcomes to obtain the information necessary for continuous improvement, also integrated with evaluations from the patient's perspective, obtained by analysing the so-called patient-reported outcomes (PRO).

The last step of the transition is to move the financing model towards systems that simultaneously incentivise health outcomes while maintaining the system's sustainability by reimbursing care-cycle costs instead of single services or episodes of care measured outcomes.

In the light of the above, it appears fundamental to redesign care processes to optimise internal resources and reduce waste within a service cycle – in terms of both time and cost – by implementing measurement strategies and methods to guarantee Value for the patient[14]. In this paper, we aim to define and weigh a set of main dimensions and relative KPIs to assess the Value brought to patients with *Clostridioides difficile* infection by FPG-IRCCS's Critical pathway, following a Quadruple Aim Value-Based approach.

Materials and Methods

Starting from a detailed literature review, the authors conducted a two-round Delphi survey[15] to assess the four main dimensions of Value creation[16]: Clinical Outcomes, Experience of Care, Per-capita cost and Physicians' burnout. Each aspect included 6 to 21 items that had to be scored for the following four criteria:
- General relevance
- Support from scientific evidence
- Measurability
- Actionability

The mean of the four scores provided then constituted the "Overall" score, used to exclude items from the final set of indicators. In both rounds, the indicators that scored lowest were excluded. The

Second Round was also used to validate the final set of items.

Thirteen experts among managers, economists, physicians and nurses were recruited among Academic experts on Health Economics, Critical Pathways and Internal medicine; Healthcare Professionals and patients' organisations. They received a fillable Excel file by e-mail containing the items and the instruction to fill the form anonymously. They were also allowed to comment on the results and provide advice that could improve the evaluation tool.

Preliminary Activity

Before the launch of the first Round, authors identified a list of potential indicators and the treatment's primary clinical outcomes. For this purpose, a literature review was conducted to search for a validated method to explore each of the four aspects. We found primary validated sources such as Maslach Burnout Inventory and Istat Multiscopo. Also, the Long-Term Durability and Safety of FMT Questionnaire has been used in the past to identify clinical outcomes. Primary sources were then adapted and modified to fit our study purpose.

- ˆLong Term Durability and Safety of FMT Questionnaire[17] for Clinical Outcomes
- Istat Multiscopo Questionnaire[18] for Experience of Care
- Istat Multiscopo Questionnaire[18] for Per-capita cost
- Maslach Burnout Inventory[19] for Clinical Outcomes (**Annex 1: Questionnaire structure**)

At the end of the study and after the two Delphi Rounds the instrument in its integrity (including all the questionnaires) was validated.

First Round

For the first Round, experts were asked to express their degree of agreement on a Likert scale from 1 to 3 (with 1 corresponding to the lowest - "Not relevant" and 3 to the highest - "Relevant"), with the set of the statements formulated for each indicator, with regards to the 4 criteria described above.

The first Round of consultation started on the 20th of December 2019 and ended on the 6th of January 2020.

The authors considered the following levels of agreement:
- "Strong agreement": "Overall" score of the item is equal to or more than 2.5 out of 3.0.
- "Partial agreement": "Overall" score for each item is equal to or more than 2.0 out of 3.0.

- "Agreement for exclusion": "Overall" score for each item is less than 2.0 out of 3.0.

In the presence of a "strong agreement for inclusion" or "partial agreement", the indicator was included in the Second Round of the Survey. Items falling in the category "agreement for exclusion" were eliminated.

Second Round

The Second Round was structured as the First Round.

For the final list of indicators, the following levels of agreement were established:
- "Strong agreement for inclusion in the final list": "Overall" score equal to or more than 2.5 out of 3.0.
- "Partial agreement for inclusion in the final list": "Overall" score equal to or more than 2.0 out of 3.0.
- "Agreement of exclusion from final list": mean of "Overall" score for each item less than 2.0 out of 3.0.

The Second Round of consultation started on the 5th of March 2020 and ended on the 12th of March 2020.

Results

First Round of Consultation

Eleven (84%) out of the thirteen experts recruited responded to the First Round.

A summary table, representative of the mean of all the Excel files received, is shown below. The analytical results are reported below by indicator and by evaluation criterion.

Findings show that the most critical parts were the Cost Questionnaire and the Patient Satisfaction Questionnaire.

General questions characterised the first one (Table I); the experts asked to simplify and adapt them in the Second Round for the tool's specific purpose.

The Patient Satisfaction Questionnaire (Table II) received the lowest scores on some items.

Furthermore, all the Burnout Questionnaire items (Table III), taken from the Maslach Inventory, were considered suitable for identifying the issues concerning burnout level evaluation in our study.

The first version of the Cost Questionnaire (Table IV) included too many items and aspecific questions that received the lowest scores from the experts.

The Hospital perspective outcome, cost evaluation methods and KPI's (Table V) shown a slight

prevalence of preferences for the Time-driven Activity-based costing (TDABC) that was included in the Second Round.

Second Round of Consultations

Participation in the consultation was completed by ten of the First-Round participants' eleven responders (91%) and considered valid.

The second version of the Cost Questionnaire (Table VI) with fewer items and more specific questions received a positive evaluation from the experts.

The Patient Satisfaction questionnaire (Table VII) shows the greatest reduction in the number of items, as some items were not included in the Second Round. In the Second Round, all the items included were accepted by the opinion of the experts.

All the Burnout Questionnaire items (Table VIII), were considered suitable by the experts, although the measurability score got the lowest score of the Second Round. The main issue of this section was the absence of adaptability of the items. On the other hand, we were able to maintain the validity of the Maslach in its wholeness.

The Clinical Questionnaire[17] (Table IX) scored highest, with 89% of the items receiving a "strong agreement" score.

Mortality rate, readmission, complication related to the illness and the treatment, length of stay and the Charlson Comorbidity Index were all included (Table X).

Summary tables below: in green, the indicators that reached positive evaluations for inclusion with "strong agreement"; yellow represents "partial agreement" for the items with a score equal to or more than 2,0 out of 3,0. No indicator reached a score lower than 2,0 for the exclusion from the final list.

Discussion

In this study, we aimed to define and weigh a set of main dimensions and relative KPIs required to assess the Value brought to patients with *Clostridioides difficile* infection within a Tertiary Referral Italian Teaching Hospital, following the Quadruple Aim Value-Based approach.

This method, however, does not come without its limitations.

First of all, as noted in the literature[13], the implementation of the Quadruple Aim is still subject to challenges deriving from misalignments in the definition of the KPIs of population health, quality of care and costs, making the establishment of KPIs that effectively assess such elements a process that is still under develop-

ment. The outcome measures that achieved consensus represent metrics of the FMT treatment. Unlike the clinical process, KPIs may be challenging to measure[21] thus, adequate consideration should be given to defining the weight of each KPI compared to the evaluation of the Value of the entire treatment. Also, with regards to the measurement of burnout level, our findings ought to be interpreted considering that burnout levels may not have varied in the six months of the study, thus not giving helpful information to the researcher. This part also has the issue that we cannot remove any of the 22 items or add new items to maintain the Maslach Burnout Inventory[19].

The evaluation of the KPIs contains some limitations as some of the data is not registered systematically, and authors do not have access to diagnostic data registered outside of FPG-IRCCS.

For instance, as the evaluation on healthcare costs, the Activity-based costing (ABC) approach helps calculate baselines for activities, develop the model, and retesting the model once implemented. Time-Driven ABC, developed by Kaplan and Anderson, requires less time and resources than the traditional ABC[22] as it can be performed with estimates of resources' practical capacity and relative costs and unit times for performing transactional activities.

Also, the study was limited by selection bias and coverage bias of the respondents to the survey invitation.

We decided to adopt the e-Delphi Technique to develop a set of open-ended questions by distributing them online to various experts, summarising and again submitting in the second set of questions to clarify areas of agreement and disagreement into the same group of experts[23,24].

We are aware of e-Delphi technique benefits (e.g., to be less costly, more effective by allowing online several experts to be called upon, providing a broad range of views, allowing sharing of information and reasoning among participants and enabling them to review, re-evaluate and revise all their previous statements), organisational efforts (e.g., the whole path is time-consuming, requires skill in written communication and adequate time and participant commitment) and methodological limitations (e.g., starting provided material and questions may not be representative; the process tends to eliminate extreme positions and force a middle-of-the-road consensus).

They all require future research investments to understand better and alleviate challenges in e-Delphi development.

The main novelty of our study is to support health care organizations in assessing the man-

Table I. Delphi First Round – Cost Questionnaire.

COST QUESTIONNAIRE (Source: Istat Multiscopo or modified Istat Multiscopo)	CRITERION				
QUESTIONS (Gen. Rel. = General relevance; Sci. Evid. = Scientific Evidence; Measur. = Measurability; Action. = Actionability)	Gen. Rel.	Sci. Evid.	Measur.	Action.	OVERALL
In the last 12 months, could you say, indicatively, how much did you spend overall on specialist visits related to your health problem? Total expenditure € 0-500 ☐ 500-2000 ☐ 2000-4000 ☐ 4000-6000 ☐ more than 6000 ☐ - modified Istat Multiscopo	1.8	2.0	2.4	2.8	**2.3**
Do you have any exclusion for the "ticket" for health procedures, visits and analysis? - modified Istat Multiscopo	2.0	1.9	2.0	1.8	1.9
Could you indicate the number of specialist visits made in the last few months? Less than 5 ☐ between 5 and 10 ☐ more than 10 ☐ of which private_____ - modified Istat Multiscopo	2.4	2.6	2.4	2.4	**2.5**
Could you indicate the specialist visits made in the last few months? _____/_____/_____/_____/ - modified Istat Multiscopo	2.0	1.8	1.8	1.4	1.8
Could you indicate the number of physical rehabilitations made in the last few months? _____ - modified Istat Multiscopo	2.0	1.8	2.2	1.6	1.9
Number of hospitalizations in the past 12 months? 1 ☐ between 2 and 4 ☐ more than 5 ☐ duration of each hospitalization: 1 ° ___ 2 ° ___ 3 ° ___ 4 ° ___ 5 ° ___ 6 ° ___ 7 ° ___ - modified Istat Multiscopo	2.4	2.0	2.8	2.2	**2.4**
What has been the cost, approximately, for the purchase of drugs in the last 12 months? 0-100 ☐ 100-300 ☐ 300-500 ☐ ☐ 500-1000 ☐ more than 1000 ☐ What types of drug did you use? _____ / _____ / _____ / _____ / - modified Istat Multiscopo	2.6	2.2	2.0	2.2	**2.3**
Again with reference to the last 12 months, he would also be able to say, indicatively, how much he spent on diagnostic test (X-rays, MRI, CTI, laboratory test) related to your illness euro 0-500 ☐ 500-2000 ☐ 2000-4000 ☐ 4000-6000 ☐ > 6000 ☐ - modified Istat Multiscopo	2.4	2.2	2.6	2.4	**2.4**
In the past 12 months, would you say, roughly, how much have you spent because of your health problem overall? Total expenditure euro 0-500 ☐ 500-2000 ☐ 2000-4000 ☐ 4000-6000 ☐ > 6000 ☐ - modified Istat Multiscopo	2.6	2.4	2.2	2.2	**2.4**
In the past 12 months, would you say, roughly, how much have you spent for blood analysis? Total expenditure euro 0-50 ☐ 500-200 ☐ 200-400 ☐ 400-600 ☐ > 600 ☐ - modified Istat Multiscopo	2.0	2.0	1.6	2.0	1.9
Do you have any private insurance that covers your medical expenses? - modified Istat Multiscopo	1.8	1.6	1.6	2.2	1.8

agement of CDI patients by applying a quantitative value-based approach.

Our tool has the potential to perform in a replicable way the measurement of all the relevant dimensions of the Critical Pathway according to Bodenheimer[7,16], also in order to pursue an analysis of the benefits and advantages of clinical outcomes and costs and show the Value created for implementation.

Such Value-Based approach expands on Evidence-Based Medicine in an effort to provide healthcare according to patients' values, with the ultimate goals of improving healthcare quality and assuring an effective and efficient utilization of healthcare resources[20].

Conclusions

By evaluating the pathway for patients with recurrent *Clostridioides difficile* infection, our study

Table II. Delphi First Round – Patient Satisfaction Questionnaire.

PATIENT SATISFACTION QUESTIONNAIRE (Source: Istat Multiscopo or modified Istat Multiscopo)	CRITERION				
QUESTIONS (Gen. Rel. = General relevance; Sci. Evid. = Scientific Evidence; Measur. = Measurability; Action. = Actionability)	Gen. Rel.	Sci. Evid.	Measur.	Action.	OVERALL
From 1 to 10, how do you rate the overall quality of the hospital treatment received (T0, T1, T2)? (1 = very dissatisfied, 10 = very satisfied) 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7 □ 8 □ 9 □ 10 □ - modified Istat Multiscopo	2.8	2.8	2.8	2.4	2.7
From 1 to 10, how much do you rate your satisfaction? (1 = very unsatisfied, 10 = very satisfied) 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7 □ 8 □ 9 □ 10 □ - modified Istat Multiscopo	2.6	2.4	2.2	2.4	2.4
From 1 to 10, how much do you rate the respect for your privacy? (1 = very unsatisfied, 10 = very satisfied) 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7 □ 8 □ 9 □ 10 □ - modified Istat Multiscopo	2.2	1.6	1.8	2.0	1.9
From 1 to 10, how much do you rate the indication you received at the moment of dimmisions? (1 = very unsatisfied, 10 = very satisfied) 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7 □ 8 □ 9 □ 10 □ - modified Istat Multiscopo	1.6	1.6	1.4	1.8	1.6
Which of the following expressions do you share? - Istat Multiscopo					
Have I seen a safe and clean environment? YES NO NOT ALWAYS - Istat Multiscopo	2.6	2.4	2.4	2.4	2.5
Have I been treated with dignity every time? YES NO NOT ALWAYS - Istat Multiscopo	2.6	2.4	2.4	2.4	2.5
Was my data treated with confidentiality? YES NO NOT ALWAYS - Istat Multiscopo	2.2	1.8	1.6	1.8	1.9
Was was my privacy respected? YES NO NOT ALWAYS - Istat Multiscopo	2.2	2.4	2.0	2.4	2.3
Were I and my family involved in the care plan? YES NO NOT ALWAYS - Istat Multiscopo	3.0	2.2	2.2	3.0	2.6
Did the staff listen to me carefully? YES NO NOT ALWAYS - Istat Multiscopo	2.6	3.0	2.2	2.4	2.6
What should we improve in your experience? - Istat Multiscopo					
Access to the services (parking, hospital path) YES NO modified Istat Multiscopo	2.8	2.8	2.2	3.0	2.7
Method and content of communication with doctors and health personnel YES NO - modified Istat Multiscopo	2.8	2.6	2.4	2.8	2.7
Better involvement of family members and caregivers YES NO - Istat Multiscopo	2.6	2.4	2.4	2.8	2.6
Better coordination in the activities of the nursing-technical staff YES NO - Istat Multiscopo	2.8	2.6	2.6	2.6	2.7
Better coordination between members of the medical staff (deliveries between doctor and nurse, coordination between nurses) YES NO - modified Istat Multiscopo - Istat Multiscopo	2,2	2,2	2,2	2,2	2,2
Quality of discharge (letter, contact with the general practitioner, subsequent appointment) YES NO - modified Istat Multiscopo	2.2	2.2	2.2	2.2	2.2

explores the four dimensions of Value-based Medicine structured by Bodenheimer and Sinsky[16]. The proposed evaluation tool is validated in its totality and can provide a comprehensive overview of the Value created by the Critical pathway for patients with *Clostridioides diffi-*

Table III. Delphi First Round – Burnout Questionnaire.

BURNOUT QUESTIONNAIRE (Maslach Burnout Inventory Test)	CRITERION				
QUESTIONS (Gen. Rel. = General relevance; Sci. Evid. = Scientific Evidence; Measur. = Measurability; Action. = Actionability)	Gen. Rel.	Sci. Evid.	Measur.	Action.	OVERALL
I feel emotionally involved in my work - Maslach Burnout Inventory	2.4	2.4	2.2	2.2	2.3
At the end of a working day, I feel like an object - Maslach Burnout Inventory	2.8	2.6	2.6	2.2	2.6
I feel tired from the morning on the idea of having to face another day of work - Maslach Burnout Inventory	2.2	2.0	2.3	2.2	2.2
I easily identify with the feelings of my patients - Maslach Burnout Inventory	2.4	2.6	2.0	2.0	2.3
I realize that I treat some patients like objects - Maslach Burnout Inventory	2.6	2.4	2.0	1.8	2.2
Working with people all day is a real stress for me - Maslach Burnout Inventory	2.0	2.4	1.8	2.2	2.1
I deal with my patients' problems very well - Maslach Burnout Inventory	2.6	2.8	2.2	2.2	2.5
I feel consumed by my job - Maslach Burnout Inventory	2.6	2.2	2.8	2.2	2.5
I feel positively influenced by the experience of others in my work - Maslach Burnout Inventory	2.8	2.6	2.0	2.2	2.4
I have become / or more insensitive to others since I do this job - Maslach Burnout Inventory	2.0	2.4	2.8	2.0	2.3
I worry that this job is hardening me - Maslach Burnout Inventory	2.4	2.4	2.0	1.8	2.2
I feel full of energy - Maslach Burnout Inventory	2.8	2.0	2.4	2.4	2.4
I feel very frustrated with my job - Maslach Burnout Inventory	2.8	2.0	2.4	2.0	2.3
I don't care what happens to my patients - Maslach Burnout Inventory	2.2	2.4	2.0	2.4	2.3
I seem to be working too hard - Maslach Burnout Inventory	2.4	2.2	2.4	2.2	2.3
Working in direct contact with people is very stressful - Maslach Burnout Inventory	2.4	2.2	2.0	2.2	2.2
I can easily create a relaxed atmosphere with my patients - Maslach Burnout Inventory	2.6	2.4	2.4	2.0	2.4
I feel exhausted after a day of working in contact with patients - Maslach Burnout Inventory	2.0	2.2	2.6	2.4	2.3
I have had many gratifications from this job - Maslach Burnout Inventory	2.8	2.8	2.2	2.0	2.5
I feel on the edge of the abyss - Maslach Burnout Inventory	2.4	2.0	2.0	2.2	2.2
In my work, I deal with emotional problems very calmly - Maslach Burnout Inventory	2.6	2.2	2.2	2.8	2.5
It seems to me that patients are letting go of their problems with me - Maslach Burnout Inventory	2.4	2.4	2.2	2.2	2.3

cile. This type of approach allows a comparative analysis between the conservative treatment of recurrent *Clostridioides difficile* infection and the cohort of patients undergoing faecal microbiota transplantation. We can extend the approach illustrated in this study can also to evaluate other Critical pathways.

Our tool also lends itself to further adaptations and is modifiable and applicable for analysing other critical pathways.

Table IV. Delphi First Round – Clinical Questionnaire.

CLINICAL QUESTIONNAIRE (Long-term Durability and Safety of FMT)	CRITERION				
QUESTIONS (Gen. Rel. = General relevance; Sci. Evid. = Scientific Evidence; Measur. = Measurability; Action. = Actionability)	Gen. Rel.	Sci. Evid.	Mea-sur.	Action.	OVERALL
In general, how has your overall health been since the last six months? a. Excellent b. Very good c. Good d. Fair e. Poor - Long-term durability and safety of fecal microbiota transplantation questionnaire	2.6	2.8	2.8	2.4	2.7
Please rate your health now compared to your health six months ago? a. Much better now compared to six months ago b. Somewhat better now compared to six months ago c. About the same now compared to six months ago d. Somewhat worse now compared to six months ago e. Much worse now compared to six months ago	2.6	2.8	2.6	2.4	2.6
What is your current weight? _____ kg - Long-term durability and safety of fecal microbiota transplantation questionnaire	2.4	2.6	2.8	2.4	2.6
In the last six months, have you been on any antibiotics? a. Yes b. No - Modified Long-term durability and safety of fecal microbiota transplantation questionnaire	2.8	2.2	3.0	2.6	2.7
If you answered "Yes" to the previous question, please list the antibiotic(s), how long you had been on the antibiotic(s) for, and for which infection(s). _____ _____ - Long-term durability and safety of fecal microbiota transplantation questionnaire	2.2	2.4	2.2	2.6	2.4
In the last six months, have you experienced any new episodes of Clostridium difficile infection? a. Yes b. No - Modified Long-term durability and safety of fecal microbiota transplantation questionnaire	2.8	2.8	2.8	3.0	2.9
If you answered "Yes" to the previous question, please list when and how the episode(s) was/were treated. _____ - Long-term durability and safety of fecal microbiota transplantation questionnaire	2.4	2.8	2.8	2.4	2.6
In the last six months, have you developed any new medical condition(s), such as: a. Irritable bowel syndrome b. Cancer c. Diabetes d. Heart disease e. High blood pressure f. Arthritis (such as rheumatoid, lupus) g. Other condition due to "autoimmune" h. Other - Modified Long-term durability and safety of fecal microbiota transplantation questionnaire	2.6	3.0	2.8	2.8	2.8
In the last six months, has there been any resolution or improvement of any medical conditions you had prior to the fecal transplant, such as: a. Irritable bowel syndrome (resolution/improvement/no disease) b. Diabetes (resolution/improvement/no disease) c. Parkinson's (resolution/improvement/no disease) d. Arthritis (resolution/improvement/no disease) e. Other autoimmune condition (resolution/improvement/no disease) f. Other - Modified Long-term durability and safety of fecal microbiota transplantation questionnaire	2.4	2.4	2.2	2.6	2.4

Table V. Delphi First Round – Hospital perspective outcome, cost evaluation methods and KPI's.

CLINICAL DATA	CRITERION				
QUESTIONS (Gen. Rel. = General relevance; Sci. Evid. = Scientific Evidence; Measur. = Measurability; Action. = Actionability)	Gen. Rel.	Sci. Evid.	Measur.	Action.	OVERALL
Mortality rate	2.8	2.6	2.6	2.8	**2.7**
Readmission	2.6	2.6	2.6	2.8	**2.7**
Complication related to the illness and the treatment (toxic colon, perforation, ICU admission)	2.8	2.6	2.4	2.6	**2.6**
Length of stay	2.8	2.8	2.6	2.6	**2.7**
Charlson Comorbidity Index	2.8	2.8	2.6	2.6	**2,7**
COST CONSUMPTION	CRITERION				
QUESTIONS (Gen. Rel. = General relevance; Sci. Evid. = Scientific Evidence; Measur. = Measurability; Action. = Actionability)	Gen. Rel.	Sci. Evid.	Measur.	Action.	OVERALL
Activity based costing (ABC)	1.8	1.8	1.6	1.6	1.7
Time-driven Activity based costing (TDABC)	2.8	2.8	2.6	2.4	**2.7**

Table VI. Delphi Second Round – Cost Questionnaire.

COST QUESTIONNAIRE (Source: Istat Multiscopo or modified Istat Multiscopo)	CRITERION				
QUESTIONS (Gen. Rel. = General relevance; Sci. Evid. = Scientific Evidence; Measur. = Measurability; Action. = Actionability)	Gen. Rel.	Sci. Evid.	Measur.	Action.	OVERALL
In the last 12 months, could you say, indicatively, how much did you spend overall on specialist visits related to your health problem? Total expenditure € 0-500 ☐ 500-2000 ☐ 2000-4000 ☐ 4000-6000 ☐ more than 6000 ☐ - modified Istat Multiscopo	2.0	2.4	3.0	2.8	**2.6**
Could you indicate the number of specialist visits made in the last few months? Less than 5 ☐ between 5 and 10 ☐ more than 10 ☐ of which private_____ - modified Istat Multiscopo	2.4	2.6	2.4	2.4	**2.5**
Number of hospitalizations in the past 12 months? 1 ☐ between 2 and 4 ☐ more than 5 ☐ duration of each hospitalization: 1 ° ___ 2 ° ___ 3 ° ___ 4 ° ___ 5 ° ___ 6 ° ___ 7 ° ___ - modified Istat Multiscopo	2.4	2.8	2.8	2.2	**2.6**
What has been the cost, approximately, for the purchase of drugs in the last 12 months? 0-100 ☐ 100-300 ☐ 300-500 ☐ 500-1000 ☐ more than 1000 ☐ What types of drug did you use? _____ / _____ / _____ / _____ / - modified Istat Multiscopo	2.6	2.2	2.4	2.2	**2.4**
Again with reference to the last 12 months, he would also be able to say, indicatively, how much he spent on diagnostic test (X-rays, MRI, CTI, laboratory test) related to your illness euro 0-500 ☐ 500-2000 ☐ 2000-4000 ☐ 4000-6000 ☐ > 6000 ☐ - modified Istat Multiscopo	2.4	2.6	2.6	2.4	**2.5**
In the past 12 months, would you say, roughly, how much have you spent because of your health problem overall? Total expenditure euro 0-500 ☐ 500-2000 ☐ 2000-4000 ☐ 4000-6000 ☐ > 6000 ☐ - modified Istat Multiscopo	2.6	2.6	2.2	2.8	**2.6**

Table VII. Delphi Second Round – Patient Satisfaction Questionnaire.

PATIENT SATISFACTION QUESTIONNAIRE (Source: Istat Multiscopo or modified Istat Multiscopo)	CRITERION				
QUESTIONS (Gen. Rel. = General relevance; Sci. Evid. = Scientific Evidence; Measur. = Measurability; Action. = Actionability)	Gen. Rel.	Sci. Evid.	Measur.	Action.	OVERALL
From 1 to 10, how do you rate the overall quality of the hospital treatment received (T0, T1, T2)? (1 = very dissatisfied, 10 = very satisfied) 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7 □ 8 □ 9 □ 10 □ - modified Istat Multiscopo	2.6	2.4	2.2	2.4	2.4
From 1 to 10, how much do you rate your satisfaction? (1 = very unsatisfied, 10 = very satisfied) 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7 □ 8 □ 9 □ 10 □ - modified Istat Multiscopo	2.6	2.0	2.2	2.8	2.4
Which of the following expressions do you share? - Istat Multiscopo					
Have I seen a safe and clean environment? YES NO NOT ALWAYS - Istat Multiscopo	2.6	2.2	2.4	2.6	2.5
Have I been treated with dignity every time? YES NO NOT ALWAYS - Istat Multiscopo	2.6	2.4	2.2	2.4	2.4
Was was my privacy respected? YES NO NOT ALWAYS - Istat Multiscopo	2.2	2.4	2.0	2.4	2.3
Were I and my family involved in the care plan? YES NO NOT ALWAYS - Istat Multiscopo	3.0	2.2	2.2	2.8	2.6
Did the staff listen to me carefully? YES NO NOT ALWAYS - Istat Multiscopo	2.6	2.6	2.2	2.4	2.5
What should we improve in your experience? - Istat Multiscopo					
Access to the services (parking, hospital path) YES NO modified Istat Multiscopo	2.8	2.8	2.2	3.0	2.7
Method and content of communication with doctors and health personnel YES NO - modified Istat Multiscopo	3.0	2.6	2.0	2.8	2.6
Better involvement of family members and caregivers YES NO - Istat Multiscopo	2.6	2.4	2.4	2.8	2.6
Better coordination in the activities of the nursing-technical staff YES NO - Istat Multiscopo	2.8	2.8	2.2	2.2	2.5
Better coordination between members of the medical staff (deliveries between doctor and nurse, coordination between nurses) YES NO - modified Istat Multiscopo - Istat Multiscopo	3.0	2.6	2.2	2.4	2.6
Quality of discharge (letter, contact with the general practitioner, subsequent appointment) YES NO - modified Istat Multiscopo	2.4	2.2	2.2	2.4	2.3

Ethical Standards

All procedures performed in studies involving human participants were by the Institutional and National Research Committee's Ethical Standards and the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Table VIII. Delphi Second Round – Burnout Questionnaire.

BURNOUT QUESTIONNAIRE (Maslach Burnout Inventory Test)	CRITERION				
QUESTIONS (Gen. Rel. = General relevance; Sci. Evid. = Scientific Evidence; Measur. = Measurability; Action. = Actionability)	Gen. Rel.	Sci. Evid.	Measur.	Action.	OVERALL
I feel emotionally involved in my work - Maslach Burnout Inventory	2.4	2.6	2.2	2.2	2.4
At the end of a working day, I feel like an object - Maslach Burnout Inventory	3.0	2.6	2.6	2.4	2.7
I feel tired from the morning on the idea of having to face another day of work - Maslach Burnout Inventory	2.7	2.3	2.3	2.7	2.5
I easily identify with the feelings of my patients - Maslach Burnout Inventory	2.6	2.6	2.0	2.0	2.3
I realize that I treat some patients like objects - Maslach Burnout Inventory	2.6	2.4	2.0	1.8	2.2
Working with people all day is a real stress for me - Maslach Burnout Inventory	3.0	2.4	1.8	2.2	2.4
I deal with my patients' problems very well - Maslach Burnout Inventory	2.6	2.6	2.2	2.2	2.4
I feel consumed by my job - Maslach Burnout Inventory	2.6	2.2	2.2	2.4	2.4
I feel positively influenced by the experience of others in my work - Maslach Burnout Inventory	2.8	2.6	2.0	2.2	2.4
I have become / or more insensitive to others since I do this job - Maslach Burnout Inventory	2.6	2.4	2.0	2.0	2.3
I worry that this job is hardening me - Maslach Burnout Inventory	2.6	2.4	2.0	1.8	2.2
I feel full of energy - Maslach Burnout Inventory	2.8	2.0	2.2	2.4	2.4
I feel very frustrated with my job - Maslach Burnout Inventory	3.0	2.0	1.7	2.0	2.2
I don't care what happens to my patients - Maslach Burnout Inventory	3.0	2.4	2.0	2.4	2.5
I seem to be working too hard - Maslach Burnout Inventory	2.4	2.4	2.4	2.2	2.4
Working in direct contact with people is very stressful - Maslach Burnout Inventory	2.4	2.2	2.0	2.2	2.2
I can easily create a relaxed atmosphere with my patients - Maslach Burnout Inventory	2.6	2.4	2.0	2.0	2.3
I feel exhausted after a day of working in contact with patients - Maslach Burnout Inventory	2.8	2.2	2.2	2.4	2.4
I have had many gratifications from this job - Maslach Burnout Inventory	3.0	2.6	2.2	2.2	2.5
I feel on the edge of the abyss - Maslach Burnout Inventory	2.4	2.0	2.0	2.4	2.2
In my work, I deal with emotional problems very calmly - Maslach Burnout Inventory	2.6	2.2	2.2	2.4	2.4
It seems to me that patients are letting go of their problems with me - Maslach Burnout Inventory	2.6	2.0	1.8	2.2	2.0

Table IX. Delphi Second Round – Clinical Questionnaire.

CLINICAL QUESTIONNAIRE (Long-term Durability and Safety of FMT)	CRITERION				
QUESTIONS (Gen. Rel. = General relevance; Sci. Evid. = Scientific Evidence; Measur. = Measurability; Action. = Actionability)	Gen. Rel.	Sci. Evid.	Measur.	Action.	OVERALL
In general, how has your overall health been since the last six months? a. Excellent b. Very good c. Good d. Fair e. Poor - Long-term durability and safety of fecal microbiota transplantation questionnaire	2.6	3.0	3.0	2.4	2.8
Please rate your health now compared to your health six months ago? a. Much better now compared to six months ago b. Somewhat better now compared to six months ago c. About the same now compared to six months ago d. Somewhat worse now compared to six months ago e. Much worse now compared to six months ago	2.6	3.0	2.8	2.4	2.7
What is your current weight? _____kg - Long-term durability and safety of fecal microbiota transplantation questionnaire	2.2	2.4	3.0	2.6	2.6
In the last six months, have you been on any antibiotics? a. Yes b. No - Modified Long-term durability and safety of fecal microbiota transplantation questionnaire	2.4	2.6	3.0	2.4	2.6
If you answered "Yes" to the previous question, please list the antibiotic(s), how long you had been on the antibiotic(s) for, and for which infection(s). _____ _____ - Long-term durability and safety of fecal microbiota transplantation questionnaire	2.4	2.4	2.6	2.6	2.5
In the last six months, have you experienced any new episodes of Clostridium difficile infection? a. Yes b. No - Modified Long-term durability and safety of fecal microbiota transplantation questionnaire	2.6	3.0	3.0	2.8	2.9
If you answered "Yes" to the previous question, please list when and how the episode(s) was/were treated. _____ - Long-term durability and safety of fecal microbiota transplantation questionnaire	2.4	2.6	2.4	2.2	2.4
In the last six months, have you developed any new medical condition(s), such as: a. Irritable bowel syndrome b. Cancer c. Diabetes d. Heart disease e. High blood pressure f. Arthritis (such as rheumatoid, lupus) g. Other condition due to "autoimmune" h. Other - Modified Long-term durability and safety of fecal microbiota transplantation questionnaire	2.6	3.0	3.0	2.8	2.9
In the last six months, has there been any resolution or improvement of any medical conditions you had prior to the fecal transplant, such as: a. Irritable bowel syndrome (resolution/improvement/no disease) b. Diabetes (resolution/improvement/no disease) c. Parkinson's (resolution/improvement/no disease) d. Arthritis (resolution/improvement/no disease) e. Other autoimmune condition (resolution/improvement/no disease) f. Other - Modified Long-term durability and safety of fecal microbiota transplantation questionnaire	2.4	3.0	2.8	2.8	2.8

Table X. Delphi Second Round – Hospital perspective outcome, cost evaluation methods and KPI's.

CLINICAL DATA	CRITERION				
QUESTIONS (Gen. Rel. = General relevance; Sci. Evid. = Scientific Evidence; Measur. = Measurability; Action. = Actionability)	Gen. Rel.	Sci. Evid.	Measur.	Action.	OVERALL
Mortality rate	2.8	2.4	2.4	2.4	2.5
Readmission	2.4	2.4	2.8	2.8	2.6
Complication related to the illness and the treatment (toxic colon, perforation, ICU admission)	2.8	2.4	2.8	3.0	2.8
Length of stay	3.0	2.8	2.6	2.8	2.8
Charlson Comorbidity Index	2.6	2.4	3.0	2.2	2.6
COST CONSUMPTION	CRITERION				
QUESTIONS (Gen. Rel. = General relevance; Sci. Evid. = Scientific Evidence; Measur. = Measurability; Action. = Actionability)	Gen. Rel.	Sci. Evid.	Measur.	Action.	OVERALL
Time-driven Activity based costing (TDABC)	3.0	2.6	3.0	2.6	2.8

Formal Consent

This is a study without sensible data. Formal consent is not required.

References

1) Keller JM, Surawicz CM. Clostridium difficile Infection in the elderly. Clin Geriatr Med 2014; 30: 79-93.
2) McFarland LV, Ozen M, Dinleyici EC, Goh S. Comparison of pediatric and adult antibiotic-associated diarrhea and Clostridium difficile infections. World J Gastroenterol 2016; 22: 3078.
3) Ianiro G, Bibbò S, Gasbarrini A, Cammarota G. Therapeutic modulation of gut microbiota: current clinical applications and future perspectives. Curr Drug Targets 2014; 15: 762-770.
4) Cammarota G, Ianiro G, Bibbò S, Gasbarrini A. Fecal microbiota transplantation: a new old kid on the block for the management of gut microbiota-related disease. J Clin Gastroenterol 2014; 48: 80-84.
5) Ianiro G, Murri R, Sciumè GD, Impagnatiello M, Masucci L, Ford AC, Law GR, Tilg H, Sanguinetti M, Cauda R, Gasbarrini A, Fantoni M, Cammarota G. Incidence of Bloodstream Infections, Length of Hospital Stay, and Survival in Patients With Recurrent Clostridioides difficile Infection Treated With Fecal Microbiota Transplantation or Antibiotics: A Prospective Cohort Study. Ann Intern Med 2019; 171: 695-702.
6) Lawal AK, Rotter T, Kinsman L, Machotta A, Ronellenfitsch U, Scott SD, Goodridge D, Plishka C, Groot G. What is a clinical pathway? Refinement of an operational definition to identify clinical pathway studies for a Cochrane systematic review. BMC Med 2016; 14: 35.
7) Cammarota G, Ianiro G, Magalini S, Gasbarrini A, Gui D. Decrease in surgery for Clostridium difficile infection after starting a program to transplant fecal microbiota. Ann Intern Med 2015; 163: 487-488.
8) Cammarota G, Masucci L, Ianiro G, Bibbò S, Dinoi G, Costamagna G, Sanguinetti M, Gasbarrini A. Randomised clinical trial: faecal microbiota transplantation by colonoscopy vs. vancomycin for the treatment of recurrent Clostridium difficile infection. Aliment Pharmacol Ther 2015; 41: 835-843.
9) Ianiro G, Valerio L, Masucci L, Pecere S, Bibbò S, Quaranta G, Posteraro B, Currò D, Sanguinetti M, Gasbarrini A, Cammarota G. Predictors of failure after single faecal microbiota transplantation in patients with recurrent Clostridium difficile infection: results from a 3-year, single-centre cohort study. Clin Microbiol Infect 2017; 23: 337.
10) Ianiro G, Mullish BH, Kelly CR, Kassam Z, Kuijper EJ, Ng SC, Iqbal TH, Allegretti JR, Bibbò S, Sokol H, Zhang F, Fischer M, Costello SP, Keller JJ, Masucci L, van Prehn J, Quaranta G, Quraishi MN, Segal J, Kao D, Satokari R, Sanguinetti M, Tilg H, Gasbarrini A, Cammarota G. Reorganisation of faecal microbiota transplant services during the COVID-19 pandemic. Gut 2020; 69: 1555-1563.
11) de Belvis AG, Barbara A, Giubbini G, Traglia S, Angioletti C, Ianiro G, Masucci L, Sanguinetti M, Laurenti P, Cambieri A, Gasbarrini A, Ricciardi W, Cammarota G. Impact evaluation of a Critical Pathway for patients with Clostridium difficile infection: A pre-post analysis in a Third Level Referral Center. Int J Infect Dis 2019; 80: 105-110.
12) Drymalski WM. Implementing the Quadruple Aim in Behavioral Health Care. J Clin Outcomes Manag 2021; 28: 35-38.
13) Porter ME, Teisberg EO. Redefining Health Care: creating Value-Based competition on results. Harvard Business School Press, 2006.
14) Porter ME. What is value in health care? N Engl J Med 2010; 363: 2477-2481.
15) Skulmoski GJ, Hartman FT, Krahn J. The Delphi Method for Graduate Research. JITE: Research 2007; 6: 1-21.

16) Bodenheimer T, Sinsky C. From triple to quadruple aim: care of the patient requires care of the provider. Ann Fam Med 2014; 12: 573-576.

17) Lee CH, Chai J, Hammond K, Jeon SR, Patel Y, Goldeh C, Kim P. Long-term durability and safety of fecal microbiota transplantation for recurrent or refractory Clostridioides difficile infection with or without antibiotic exposure. Eur J Clin Microbiol Infect Dis 2019; 38: 1731-1735.

18) Indagine Statistica Multiscopo Sulle Famiglie, Condizioni di salute e ricorso ai Servizi sanitari 2012-2013, Mod. ISTAT IMF-8. Istituto Nazionale di Statistica, 2016.

19) Maslach C, Schaufeli WB, Leiter MP. Job burnout. Annu Rev Psychol 2001; 52: 397-422.

20) Bae JM. Value-based medicine: concepts and application. Epidemiol Health 2015; 37.

21) Morar PS, Hollingshead J, Bemelman W, Sevdalis N, Pinkney T, Wilson G, Dunlop M, Davies RJ, Guy R, Fearnhead N, Brown S, Warusavitarne J, Edwards C, Faiz O. Establishing Key Performance Indicators [KPIs] and Their Importance for the Surgical Management of Inflammatory Bowel Disease-Results From a Pan-European, Delphi Consensus Study. J Crohns Colitis 2017; 11: 1362-1368.

22) Kaplan RS, Anderson SR. Time-driven activity-based costing. Harv Bus Rev 2004; 82: 131-138.

23) Toronto C. Considerations when conducting e-Delphi research: a case study. Nurse Res 2017; 25: 10-15.

24) Donohoe H, Stellefson M, Tennant B. Advantages and Limitations of the e-Delphi Technique. Implications for Health Education Researchers. Am J Health Educ 2013; 43: 38-46.