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Restructuring of a general hospital to face the Covid-19 pandemic: a Donabedian analysis

Reestruturação de hospital geral para o enfrentamento a pandemia Covid-19: uma análise donabediana

Reestructuración de un hospital general para combatir la pandemia de Covid-19: un análisis de Donabedian

Fabieli Borges[I]; Elizabeth Bernardino[II]; Aida Maris Peres[II]; Nelsi Salete Tonini[I];
Maria Fernanda Baeta Neves Alonso da Costa[III]; Esperança do Gago Alves Pereira[IV]; Clémence Dallaire[V]

[I] Universidade Estadual do Oeste do Paraná. Cascavel, PR, Brazil; [II]Universidade Federal do Paraná; Curitiba, PR, Brazil; [III]Universidade Federal de São Paulo. São Paulo, SP, Brazil; [IV]Universidade do Minho. Braga, Portugal; [V]Université Laval. Quebec, Canada

ABSTRACT
Objective: to analyze the restructuring of a general hospital in response to the Covid-19 pandemic across the components of "structure," "process," and "outcome" and their relationships with teaching, research, and patient care. **Method:** a single-case study conducted with 42 professionals from a general hospital in Paraná. Data were processed using MaxQda® software following the steps of Categorical Thematic Content Analysis based on Avedis Donabedian's framework. **Results:** three categories were obtained, represented by their respective subcategories: Structure – encompassing human, physical, and technological resources, materials and supplies, financial resources, and external support; Process – including protocols, workflows and care dynamics, and professional performance; Outcomes – covering immediate outcomes, changes in individuals' health status, lessons learned, fulfillment of workers' expectations, and planning for the post-Covid-19 period. **Final considerations:** in the face of the Covid-19 pandemic as a crisis, the hospital restructuring enabled meeting demand through the lens of structure, process, and outcome, with a stronger focus on patient care compared to teaching and research.
Descriptors: Pandemics; Covid-19; Health Services Administration; Hospital Administration.

RESUMO
Objetivo: analisar a reestruturação de um hospital geral frente à pandemia de Covid-19 nos componentes "estrutura", "processo" e "resultado" e suas relações com o ensino, a pesquisa e a assistência. **Método:** estudo realizado com 42 profissionais de hospital geral no Paraná, no formato caso único. Os dados foram operacionalizados pelo *software* MaxQda® seguindo as etapas da Análise de Conteúdo Temático Categorial à luz de Avedis Donabedian. **Resultados:** foram obtidas três categorias, representadas pelas respectivas subcategorias: Estrutura – recursos humanos, físicos; tecnológicos, materiais e insumos, financeiros e apoio externo; Processo, com protocolos, fluxos e dinâmica de atendimento, e atuação profissional; e Resultados, incluindo imediatos, mudanças no estado de saúde dos indivíduos, lições aprendidas, satisfação de expectativas dos trabalhadores e planejamento para o período pós-Covid-19. **Considerações finais:** diante da pandemia de Covid-19 como crise, a reestruturação do hospital permitiu atender a demanda sob olhar da estrutura, processo e resultado com maior relação assistencial quando comparado ao ensino e pesquisa.
Descritores: Pandemias; Covid-19; Administração dos Serviços de Saúde; Gestão Hospitalar.

RESUMEN
Objetivo: analizar la reestructuración de un hospital general durante la pandemia de Covid-19, considerando sus componentes de estructura, proceso y resultados, y su relación con la docencia, la investigación y la asistencia. **Método:** este estudio se realizó con 42 profesionales de un hospital general de Paraná, sobre la base de un diseño de caso único. Los datos se procesaron con el *software* MaxQda®, siguiendo los pasos del Análisis de Contenido Temático Categórico, a la luz de lo dispuesto por Avedis Donabedian. **Resultados:** se obtuvieron tres categorías, representadas por sus respectivas subcategorías: Estructura: recursos humanos y físicos; recursos tecnológicos, materiales y suministros; recursos financieros; y apoyo externo; Proceso: incluye protocolos, flujos y dinámicas de atención, y desempeño profesional; y Resultados: incluye resultados inmediatos, cambios en el estado de salud de los individuos, lecciones aprendidas, cumplimiento de las expectativas de los trabajadores y planificación para el período pos-Covid-19. **Consideraciones finales:** al considerar la pandemia de Covid-19 como una crisis, la reestructuración del hospital permitió satisfacer la demanda desde una perspectiva que contempla estructura, proceso y resultados, con prevalencia del aspecto asistencial, en comparación con la docencia y la investigación.
Descriptores: Pandemias; Covid-19; Administración de los Servicios de Salud; Administración Hospitalaria.

INTRODUCTION

The pandemic caused by the SARS-CoV-2 virus, which causes Covid-19, represented an enormous stress test for global health, particularly for healthcare systems. Even countries with well-structured healthcare systems collapsed under the overwhelming demand for treating patients requiring complex care[1].

This article is derived from the PhD Dissertation "*Restruturação de um hospital geral para o enfrentamento à pandemia Covid-19: o caso do CHC/UFPR*," presented to the Graduate Program in Nursing at Universidade Federal do Paraná.
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Corresponding author: Fabieli Borges. E-mail: fabieliborges6@gmail.com.
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Among various aspects, the impact negatively affected operational capacity and the availability of Intensive Care Unit (ICU) beds, as well as ventilators, which became among the main challenges of the period, as they became scarce in several countries during the first epidemic wave of Covid-19. Considering that 5% of patients affected by Covid-19 required complex care, once categorized as severe cases, concern arose due to the high demand for healthcare at tertiary health levels. If waiting list bottlenecks were already evident in the country before the pandemic, with Covid-19, these concerns were intensified, considering the virus transmission rates, which expose healthcare professionals and intensify the possible exposure of patients with other health conditions when using healthcare services[2].

Chronologically, new and numerous cases emerged rapidly in Asian countries such as Thailand, Japan, South Korea, and Singapore, spreading to European countries and other continents[3], increasing international concern. There were devastating proportions represented in epidemiological disease curves in Italy, Spain, and the United States, surpassing China in death records. Such records align with delays in adopting measures influenced by behavioral and collective elements[2].

In Spain, a public teaching hospital partnered with the University of Barcelona created a "Health Hotel" to provide medical assistance to hospitalized patients with mild Covid-19 symptoms. As soon as the hospitalization period reached its peak, specialized units were filled, and nurses and doctors were directed to Covid-19 patients. Additionally, local daycare centers were converted into ICUs. All adaptations generated the need to hire healthcare professionals, mainly nurses. As an alternative, nursing students were hired as Health Assistants, a workforce that was integrated with full working conditions, benefits, a monthly salary, and supervision by a qualified nurse[4].

In Brazil, the impact was similar. The restructuring of hospitals for exclusive care of Covid-19 patients required a complete rearrangement of infrastructure, such as bed reconfiguration and conversion of non-clinical spaces to clinical ones[5]. Federal, state, and municipal health resources were combined for hiring healthcare professionals and acquiring equipment and supplies, such as oxygen, sedatives, and personal protective equipment[6].

The initial major challenges for hospitals, particularly for university hospitals integrated with the SUS, were to "*reorganize care, expand ICU beds, stock up on personal protective equipment, especially masks and protective gowns, which were scarce in the market, and have sufficient tests*"[7:2]. Resource limitations, infection control, healthcare professional protection, and service adaptation to a pandemic situation were placed alongside the rapidly evolving virus[8].

In this sense of restructuring, Brazilian hospitals regained their centralizing role in confronting the pandemic. Supporting this logic, a study from Rio Grande do Sul conducted during the initial period of the pandemic presented 495 actions for confronting the Covid-19 pandemic, distributed among care (38.99%), management (37.58%), extension (16.16%), and teaching and research (7.27%). In Care, the suspension of non-Covid-19 related consultations and elective surgeries stood out, as well as changes in routines with reinforcement of biosafety issues to prevent virus transmission. In the management sphere, new professionals were hired and health teams were trained. In the extension dimension, educational materials about Covid-19 prevention measures were mainly developed. Regarding teaching and research, there was suspension of educational-formative activities, with hospitals' engagement in developing research on the topic standing out[9].

The relevance of this study is anchored in the university hospital's mission of care, teaching, and research, as well as the commitment to contribute with diverse strategies in uncertain scenarios for managing future crises such as the scenario of this study. For this purpose, it is important to (re)visit the events so they can support future reflections.

Given the above, the question arises: how did a general hospital located in the capital of Paraná restructure itself to confront the Covid-19 pandemic in its mission of teaching, research, and care?

The objective thus consisted of analyzing the restructuring of a general hospital in response to the Covid-19 pandemic in the components of structure, process, and outcome in their relationships with teaching, research, and care.

THEORETICAL FRAMEWORK

Using a theoretical model based on service evaluation with a broad and interdependent perspective can be substantial for other realities, such as the Donabedian triad[10]. This study used the concepts of structure, process, and outcome in health services[10], classically considered as a triad, which is operationalized by three components with a causal relationship among themselves.

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The Structure component refers to the relatively stable characteristics necessary for the care process, encompassing physical area, human resources, material and financial resources, information systems and technical-administrative normative instruments, and political support. The Process component corresponds to the provision of care using available resources. For this purpose, problems, diagnostic methods, diagnosis, and the care provided must be recognized. The Results component corresponds to the consequences of activities performed in health services, or by professionals in terms of verified changes in patients' health status, added to changes related to knowledge and behaviors. This includes user and worker satisfaction linked to receiving and providing care, respectively[10,11].

The theoretical framework of Avedis Donabedian has been adopted in health studies, constituting a reference in quality evaluation of organizations, which is desired by managers of these services. For this reason, using it as a framework to analyze an organization with the profile of this study's scenario fosters the essential aspects that compose a hospital organization. In this case, it shows the structural design of the organization, its processes and results that can be identified in the face of required restructuring.

Under this premise, a study from Rio de Janeiro analyzed nurses' performance in hospital management facing Covid-19 using Donabedian's triad. The results showed the reconfiguration of hospital structure based on material and people management; the restructuring of the work process to achieve goals with safety and quality; and the focus on nurses' experiences in describing achieved and expected results[5].

METHOD

This is a descriptive study of qualitative nature and single case study, guided by the theoretical model of the structure, process, and outcome triad[10], derived from a doctoral thesis elaborated, developed, and reported under the recommendations of the *Consolidated Criteria for Reporting Qualitative Research* guide.

The studied case should be a complex and contemporary social phenomenon to be investigated in depth and in its real context, allowing better evidence of its limits, added to the search for answers to questions of "how" and "why" things happen that way[12].

The study site was a general hospital in the public network of Paraná. The hospital restructuring was selected as the unit of analysis, that is, the case to be studied, and its Structure, Process, and Result components were the subunits of analysis integrated into the single case[12], articulated with the hospital's mission – Teaching, Care, and Research. Until 2021, the hospital had 650 beds in the national health establishment registry.

The participants were professionals who develop care and administrative activities with or without positions, from various areas of the studied scenario. The participants comprised areas of Medicine, Nursing, Biochemical Pharmacy, Nutrition, Physiotherapy, Public Management, and Psychology. The eligibility criteria included professionals belonging to the institution's organizational chart, from the multiprofessional team, in administrative and care positions during the pandemic period. As exclusion criteria, professionals who were on leave, vacation, or any type of absence during the data collection period and professionals who did not attend the interview after three appointments were considered. There were no losses.

Recruitment was done via institutional email, with an invitation letter and, attached, the project approval opinion from the Research Ethics Committee (CEP). After acceptance in response, a meeting was scheduled on the Microsoft Teams® platform, according to the participant's availability and preference, where an exclusive channel was created for the interviews. The selection of participants was intentional and used the snowball technique to compose the participant sample[13], justified by the diversity of professional categories added to the identification of key representatives to deepen the study phenomenon.

Data saturation and absence of key respondent indications were considered as criteria for ending the interviews. For this type of research, sample size is determined from the need for information. Thus, it is sampled to the point where no new information was obtained and responses began to repeat[14], aspects that composed the discussion of data saturation by the research authors.

Data collection in case studies should be composed of three collection sources[12]. Therefore, the following techniques were adopted: “Interviews” with a sample composed of 42 participants; “Documentary” (380 files) and “Logbook” (35 personal impressions of the researcher). The collection was performed by the first author of this study, a nurse, who at the time of the study was a doctoral student in the graduate program, from June 2022 to February 2023.

The interview, primary data source, occurred remotely, video-audio recorded through the Teams platform, in a private environment, the first author's home, remotely and synchronously. The participants, when present in

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the work environment, were in a private room, without communication noise for the interview. With the exception of the second author, who had ties with the hospital, the other authors involved in this study had previous relationships with a small part of the nurse participants who were members of the same graduate program and research group. The credentials, objectives, and motivation for the adopted theoretical framework were explained. A pilot test was conducted with a nurse who participated in a crisis committee of a hospital with a similar profile; no adjustments were necessary, however, since it was not the study scenario, care was taken not to include it in the sample.

The interview was guided by a semi-structured script of own elaboration, aligned with the theoretical framework of the Donabedian triad: Structure, Process, and Outcome. The first part of the script was composed of participant characterization variables. The second part contemplated open questions, namely: *When did the hospital restructuring to face the pandemic begin and who was responsible for it? Can you tell me how the hospital was restructured regarding supplies, material resources, technological equipment, physical facilities, human resources? Can you tell me how the hospital restructured regarding processes, for example flows, care dynamics, interface with the health network? What were the impacts of this restructuring? Hidden question: for teaching, research, and care? What is your impression regarding the objectives proposed for the restructuring? Can you tell me what the immediate result of this restructuring was? Hidden question: What were the identified facilitators and barriers? Tell me what lessons were learned and what are the biggest challenges for recovery. Hidden question: What were the most affected activities?*

In parallel, a Logbook was adopted as a strategy to take notes on aspects of service reorganization, interactions between management and care in facing the pandemic, and other aspects that stood out during the interview evaluated with potential contribution to research data.

For the documentary stage, computerized materials from the institution were used, concentrated in a guide script following the same logic as the open questions. First, a formal letter was sent via email to management requesting an online copy of the institution's documents prepared during the pandemic period – or remote access to them. The files, arranged in a zipped folder, were granted by digital storage cloud sharing. Once received, they were stored in an offline folder on the first author's restricted-access computer and, after the research ended, were permanently deleted.

It is appropriate to emphasize that data collection was adapted to online mode during the Research Ethics Committee procedures. The choice was considered given the still concerning pandemic situation in the state and study location, added to strong recommendations for prevention measures with social distancing and social isolation.

For data analysis, speeches from participant interviews were transcribed in Microsoft Office Word® document. The chosen analytical technique was Thematic-Categorical Content Analysis (TCCA), which presupposes three stages: (1) Pre-analysis: development of preparatory operations for analysis; (2) Material exploration or coding: raw data are systematically transformed and aggregated into smaller units, allowing exact description; (3) Treatment of results, inference and interpretation: information provided by analysis is highlighted, with simple quantification, presenting data in diagrams, figures, among others. Inference, in turn, allows analyzed data to be theoretically reconstructed. Using systematization through defined procedures, it has as principle the reduction of data[15].

After data transcription, in light of Donabedian's theoretical framework, these were organized into categories and subcategories named Registration Unit (RU) and Significance Unit (SU), respectively, following TCCA stages[15].

The operationalization of these stages occurred with MaxQDA® Analytics Pro 22 software. Documentary content and Logbook records also incorporated the document indexed in the used software. They represented, therefore, a synthesized grouping of interview data, documents, and logbook, configuring data triangulation as presupposed by case study[12].

The study respected ethical principles, having approval from the Ethics and Research Committee. All participants agreed to participate in the study voluntarily and signed the Free and Informed Consent Form. To ensure anonymity and confidentiality, when presenting results, participants were identified by letters followed by a number in ascending order, according to the order of interview completion. For example, the letter "I" and numerical sequence represent participants (Interview 1: I1; Interview 2: I2 and so on). Regarding secondary sources, they were identified by the initial "D" for Documents, and "LB" for Logbook.

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RESULTS

Of the total 42 participants, 26 (62%) were professionals who occupied positions designated in this study as administrative (management, coordination, and unit leadership) and 16 (38%) were professionals working in care. Regarding training, 23 (54.7%) nurses, 7 (16.7%) doctors, 4 (9.5%) pharmacists, 3 (7.2%) public managers, 2 (4.8%) nutritionists, and 1 (2.3%) psychologist. There was a higher number of participants in the age range of 45 to 54 years (42.86%), female gender (73.8%), and 54.8% participants with specialization, master's, and doctoral qualifications.

During the pandemic period, slightly more than half of the participants had work time of 5 to 10 years (54%), in their then current function (with or without position and care) for more than 5 years (62%). Work time proves relevant from the perspective of professionals' expertise in detriment to coping measures in a scenario that required agile and assertive decisions during the pandemic period.

The interview obtained RU=622; documentary with RU=380 and Logbook Notes with RU=35. Interviews had a minimum duration of 12 minutes and a maximum of one hour and 15 minutes. 1067 RU were obtained.

The volume of materials produced and used during the pandemic in the study scenario was significant (n=380). Regarding the characterization of computerized files that constituted the documentary stage, the highest frequency of Epidemiological Bulletins made available by the hospital was perceived (68.95%), composed of chronology and epidemiological data about Covid-19. This data can be justified by the daily, and later weekly, preparation of the material.

Category 1: Structure

This category presented 482 RUs from 470 interviews, eight documents, and four logbook notes, encompassed in the subcategories: human resources, physical resources, financial resources, technological resources, and external support, as exemplified by the following reports:

> *A crisis committee was established. (I1)*
>
> *[...] the 6th floor was transformed into an ICU exclusively for Covid-19 care, and immediately isolated from other flows, restricting access and organized with logistical support teams for material delivery, housekeeping, cleaning, floating staff, etc. (D)*
>
> *There was a report about resource scarcity for supplies and materials, however, overall, it was perceived that the intention was to refer to the difficulty with the absence of product/raw material available in the market, which was beyond the hospital's scope. (LB)*
>
> *[...] we had anesthetics, neuromuscular blockers. In times when we were seeing that the stock wouldn't be sufficient, there was a clinical meeting, protocol discussion" (I10) "[...] to give you an idea (name omitted) we had a 120% increase in items, dispensed medications. (I18)*
>
> *[...] we have the friends' association that raises money to use at the Clinical Hospital [...] it was what saved us many times, they bought many ventilators, many CT scanners, all the equipment we needed and that, being a public agency, we couldn't just go out buying with succession money. (I1)*
>
> *Regarding research, what I can tell you is that the Clinical Hospital, as a center, received a series of research propositions from national and international entities, in addition to many of our professionals here developing various research projects [...] Dr. [name omitted] is our infectologist who was invited to participate in the research involving one thousand four hundred participants. It was the location in Brazil that had the most volunteer participants in the CoronaVac research. (I4)*
>
> *[...] regulatory agencies provided support with conducts, guidelines oriented by the Ministry of Health, in addition to making financial resources available involving centralized purchases. (I12)*
>
> *The academy [teaching] was more distant from the response (I36). [...] the pandemic response was handled by EBSERH and not by the academy". (I42)*

Category 2: Process

This category represented 398 RUs, from 49 interviews, 337 documents, and 12 logbook notes. The first subcategory was characterized by Protocols, Workflows, and Care Dynamics:

> *In total, 24 Protocols were developed to support actions, from the clinical part of the Covid-19 patient to support services in the work process, and 39 workflows in the form of schemes, schematic representation/flowcharts/diagrams. (D)*

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> *[...] undergraduate students had their classes interrupted, later, the interns. But in the same way, they also lost, right? Because not all laboratories and wards were functioning. So they lost quite a bit with this. (I3)*
>
> *Observed conduct of senior management and Crisis Committee through phases (waves) of Covid-19 at the CHC (LB).*
>
> *Regarding teaching, the balance is terrible. (I42)*

In the Professional Performance subcategory, it is noted that there was visibility of other professionals who are members of the multidisciplinary team, in addition to procedures related to complex patient care.

> *[...] support by infectologist professionals was one of the first measures taken. (I1)*
>
> *[...] important performance by occupational therapists, physiotherapists, educators, and psychologists who previously did not have such visibility. (D)*
>
> *The clinical management of the patient was (re)learned given the complexity of care. (LB)*
>
> *The hemodialysis area needed to readjust due to the clinical condition of Covid-19 patients (I42)*
>
> *Two Rapid Response Teams (Clinical and Covid-19) were organized to offer agile operationalization, mainly in cases of rapid intubation. (I3)*
>
> *Pharmacists did not come into contact with the care team; contact isolations were coupled as a barrier in this sector. (I4)*
>
> *Medication reconciliation, studied by intensivists, anesthesiologists, and clinical pharmacists, allowed evaluating the non-rational use of anesthetics and, from this study, there was an optimization of their use allowing to meet the demand. (LB)*
>
> *As support tools for continuing education, videos were developed to make available and assist in professional training. (D)*
>
> *Medical residency in the specialty of infectology acquired important expertise with the pandemic (I3) [...] although other specialties needed to be allocated to care for Covid-19 patients, mainly in ICUs, compromising the competencies required in these other specialties. (LB)*
>
> *Graduate students with employment ties at [hospital name omitted] had to pause their research, temporarily, due to work demands. (I38)*

Category 2: Outcome

In this category, 157 RUs were obtained from 103 interviews, 35 documents, and 19 logbook notes. The subcategories encompassed Immediate outcomes; Changes in individuals' health status; Lessons learned; Fulfillment of workers' expectations; and Planning for post-Covid-19.

From a care perspective, the objectives proposed by management for restructuring, since the beginning of the pandemic, were specific: to care for the patient, but also to protect those providing care. As new information emerged, issues focused on the safety of both were considered to minimize contamination. An immediate outcome mentioned by participants was the work overload for frontline professionals. All sectors and units needed to reorganize, as was the case with the Hospital Infection Control Sector and related commission, as indicated by one of the participants:

> *We monitored up to 70 Covid patients/day and we also had other sector demands. (I5)*
>
> *[...] the CCIH didn't stop, we continued having multidrug-resistant microorganisms. Study and study very quickly everything about the disease. (I5)*

It was possible to perceive that immediate outcomes occurred in phases.

> *[...] the first phase: understand the scenario, map and operationalize structure for care. The second phase: there was pressure for beds. Aspects related to palliative care (end-of-life care) began to require greater discussions and conducts were based on international extubation protocols, such as the protocols developed at the hospital. It was the phase of severe and rapid clinical conditions of Covid-19. Third phase: The fear of medication shortage. Covid-19 patients were sedated with "Propofol" (2,6-diisopropylphenol) which led to fear of scarcity. One strategy was sedation harmonization. (LB5)*

Within the conditions of (re)adequate structure and processes, the hospital was able to meet the Covid-19 demand. The hospital institution assumed its social responsibility, considering management expertise and the relationship with the network; it responded better, as there was good mobilization to successfully care for many patients. Even in the face of crisis, there was mention of a leap in quality of care; although, in counterpoint, other reports pointed to the need to resume previously implemented protocols on patient safety.

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In September 2022, there was planning to resume activities suspended at the hospital, such as resuming elective surgeries, for example. With medical residency specialties directed to Covid-19 care, there were significant delays in elective surgeries, quantitatively. Teaching and research showed themselves to be weakened missions during this period with focus directed to laboratory clinical research.

> *Regarding teaching, the balance is terrible. (I42)*
>
> *[...] there was no headspace to think about research. But as time passed, data collection was in an insane volume, we collected a lot, infection control, profile, prognosis...example: techniques, adaptations made, validation. (I5)*
>
> *The need for discovery of a vaccine/medications raised interest in clinical research at the hospital. Subsequent research was constituted by care professionals, who are also teachers and took on Covid-19 related research. (LB)*

In care, rapid intubation and also intubation in the wards was evidence due to the rapid evolution of Covid-19 patients, around the seventh/tenth day they were hospitalized. Directly or indirectly, the number of professionals assisting the intubated patient, in pronation, is one of the aspects that can influence the health status of this profile – up to seven professionals were cited as an example to prone a patient, with Positive End-Expiratory Pressure (PEEP), high Positive End-Expiratory Pressure (FiO2), in a synchronized manner in the ICU.

As a form of humanized attention to Covid-19 patients, nutrition sought to meet patient particularities regarding food and metabolism, considering the patient's personal tastes. The fast acquisition of equipment during the pandemic, which enabled the performance of magnetic resonance and X-ray, may have favored care. Perhaps at another time, from the participants' perspective, there would not be such agility.

With regard to research, the vaccine allowed patients who contracted the virus to experience milder symptoms or even avoid a worsening of their health condition. With each new wave, new discoveries about the virus allowed acting fast, thus implying more assertive care for the clientele.

The partnership with the Couto Pereira football stadium provided accommodation for professionals who were afraid to return home due to fear of contaminating their children, spouses, and family members, as well as concerns about living with groups considered vulnerable, serving as a safety strategy. Additionally, measures such as telemonitoring were adopted for those who were away from the hospital due to the Covid-19 scenario.

Although participants generally reported a negative psychological impact, the hospital also created a listening channel with psychiatrists and psychological support available every Friday. Regarding worker health and rights, CHC prepared through medical and psychological care protocols to respond to legal and administrative processes, professional death audits, and collective action regarding unhealthy working conditions. For unhealthy conditions, forms were developed to record and monitor patients who had been in Covid-19 areas.

In contrast, there was a positive impact related to the sense of belonging to the workplace, through utilizing knowledge and expertise, teamwork, and willingness to participate in collective and multiprofessional meetings. This last aspect was an important gain for the hospital from a care perspective: for example, social work and dentistry professionals, previously in reduced numbers at the hospital, were able to increase their staff through new hires. Furthermore, some scenarios for practical undergraduate and graduate internships became restricted due to contamination risk.

> *Teaching stopped. (I3)*

Gradually, internships returned; however, residencies suffered many losses. Coloproctology surgery, general surgery, plastic surgery, dermatology, urology, neurosurgery, and pediatric surgery, for example, were severely affected because they could not develop their respective competencies, generating frustration among this group, who were also part of the CHC team.

> *The newly arrived resident at the hospital, who perhaps had never performed an intubation, learned to do so on Covid patients. Learning under pressure is difficult. It's enriching, but it's painful. (I5)*

Being a teaching hospital, it was disappointing for the frontline team that the academy was absent in providing operational support for the pandemic response; for them, the response was handled by EBSERH, not by UFPR, which represented a significant missed learning opportunity. As part of CHC, the hospital's visibility in its research mission was also important to workers. Due to research activities, they also benefited from rapid testing and Covid-19 vaccination.

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The first phase of the pandemic, throughout the first months of 2020, was frightening: fear and situations required rapid decision-making. Redesigning pre-existing physical facilities was one of the first strategies considered; however, the lesson lies in the need to assess the risks of restructuring so that it can accommodate an even greater demand than expected. Mild Covid-19 cases quickly transformed into severe cases and overwhelmed the hospital system:

> *It was an emergency within our emergency. (I42)*
>
> *With the Omicron variant, decision-making became easier, although it again demanded more resources and operationalization. Therefore, a contingency plan in crisis management is needed given the dynamics that the context may require, also designed for teaching. (O)*

There is always potential for professionals to develop; with the pandemic, a better understanding of protocol development, resource optimization, bed turnover, and agile ways to care for patients was (re)learned. The challenge was embedded in the hospital's new reality at the time. Many experts retired, many new professionals joined the team, temporary professionals were later dismissed, many critically ill patients, and the hospital was pressured by the Health Network, in a situation where now – after the context of greater demand, which mainly affected 2022 – it finds itself without the financial resources from the beginning of the pandemic.

However, as an ally, technology brought patients closer to the health team, addressing delays in contacting them that existed before the pandemic. Connected to technology, it opened space to consider investments in simulated learning environments, also as a strategy to contribute to professional "maturation" and training. In research, the pandemic required researchers to always be ready for situations requiring flexibility and methodological adaptation of their studies, when faced with scenarios such as adapting to remote data collection. Another highlight revolved around "*believing in science*" (I2) This highlights the importance of the teaching and research mission, articulated with care practices and in fostering management conducts.

It became evident that, in care, over time, chronic and elective patients were left unattended, hence the return to this patient profile. A Post-Covid-19 Outpatient Clinic was planned for patients and implemented in 2022 due to the emergence of Covid-19 sequelae cases, particularly in pulmonology, cardiology, and neurology specialties. Patients discharged from the hospital (both Covid-19 and other chronic patients) were also telemonitored by the hospital as a form of continued care through the discharge management service.

Patients with delayed diagnoses (such as oncology patients) who arrived with more complex clinical conditions resulted in higher financial costs. The post-Covid-19 period involved opening day-care beds, monitoring oncological cases, interconsultations, priority care pathways, protocol updates, intensive work with hospitalists, implementation of the Post-Covid House, studies for strategies to address surgical backlogs, and audiometry and MRI campaigns through private partnerships.

With classes resumed remotely, undergraduate curricula sought to include Covid-19 patient care in their academic programs, with CHC serving as a training center for this demand as part of its teaching mission. Numerous research studies were processed through the Hospital's Ethics Committee, focusing on patients' post-Covid-19 conditions across diverse specialties including maternal-infant care, intensive care, obstetrics, neurology, and others. In total, there were approximately 600 research studies. Additionally, a notable development at the hospital was that allergologists became a reference point for Covid-19 vaccine reactions.

DISCUSSION

It was observed that the structure component comprised the largest contingent of RUs. In parallel reflection, one can consider that this component requires organizations to have a consolidated structure to provide care according to contextual needs. Moreover, it represents the first element of the Donabedian triad.

Consistent with the findings of this thesis, a study showed two aspects for evaluating the structural component of a tertiary wound treatment center: 1) facilities and 2) providers. As discussed by the authors, intrapandemic barriers were implemented to protect both patients and care providers against disease spread while maintaining easy and free communication through secure virtual methods, such as WhatsApp Messenger® (attributed name in Mountain View, California). In-person consultations were reduced with most consultations transferred to remote telemedicine consultations, using telehealth as a valuable resource[16], which can be understood as an important gain, especially when combined with the implementation of electronic patient records (EPR) during the pandemic.

In Brazil, regarding space and physical facilities for care, some municipalities established field hospitals, while others became reference centers for care or reorganized bed regulation systems interfacing with the health

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network[17]. Having physical facilities already available to designate a specific location for Covid-19 patient care represented an important advantage for the hospital. This availability enabled specific patient flows that prevented contact and cross-contamination, consistent with other published experiences[18-20].

The urgent need to expand hospital bed capacity was not unique to Brazil or restricted to CHC. Rising international infection rates warned of necessary actions in Brazil, compounded by a fragile pre-existing bed infrastructure[21]. Therefore, creating additional beds reserved for diagnosed patients in specific hospital locations required careful (and expensive) planning, as it needed to be linked to specialized technological infrastructure that connected to other resources necessary for hospital bed operation[22].

A renovated technological infrastructure alongside the pre-existing Bed Management service or Internal Regulation Center (IRC) can be identified as a key strength of the hospital in this study. Having this service already established, with health network integration, defined regulatory flows, and agreements (financing, contracts, accreditation)[18], provided advantages for quickly optimizing and operationalizing hospital beds.

Health system restructuring requires effective transformations in care practices and hospital organization functioning, which must coordinate with other services that compose the system, such as the RAS. The health network was considered in this research as an important support resource for pandemic response. The network's absence during the pandemic's initial phase, particularly Primary Care, reinforced a culture of hospital-centered care, including emergency and urgent care services for health needs. In contrast, there was a shift toward monitored health surveillance actions combined with reinforced non-pharmacological measures – such as the "stay at home" movement – and population vaccination, all crucial elements in the pandemic response trajectory. Furthermore, Primary Health Care (PHC) also needed to reorganize itself for Covid-19 patient care flows[22,23].

Due to the complexity of physical-functional infrastructure and the diversity of specialized human and material resources necessary for operation, hospitals require high and constant financial investment, which often exceeds revenues and creates sustainability challenges[24,25]. The financial obstacles identified in the findings related to existing financial resources facing reduced or unavailable materials, products, and supplies in the market, in addition to processes becoming less efficient due to the particular characteristics of public hospital purchasing procedures.

In early 2021, various states across the country experienced a generalized health system collapse due to high numbers of cases and hospitalizations. In Amazonas state, the situation became even more critical due to oxygen shortages in hospital units, leading many people to suffer from asphyxiation due to absent or reduced gas flow as facilities attempted to conserve oxygen. This situation resulted in 19 deaths in a single night (between January 13 and 14, 2021), not counting the large number of people who suffered permanent sequelae from hypoxia[26]. Undoubtedly, the experiences with such resource shortages (or complete lack thereof) and their consequences represented negative health outcomes, contrary to what was observed in this study scenario.

Another structural concern that warrants attention relates to participant reports about excluding care professionals from discussions that informed crisis committee decision-making. This raises an important question: should care professionals be included in decision-making processes? Health organizations have historically been concerned with establishing health management models that reflect the most appropriate ideology for their members' work processes[27].

This context proved important in the process component, when frontline professionals identified a weakness in not participating in discussions for decisions they would need to implement in practice. Literature shows diverse Management Models, recognizing the centrality of hegemonic Scientific and Classical Administration models in Nursing and Health care organization, while also acknowledging models that are gaining attention for focusing on care improvement, service efficiency, and hospital costs[28]. The Discharge Management Model, implemented in 2017 before the pandemic, actually served as an important ally in planning actions that enabled self-regulation and care for clinical patients with multiple comorbidities and complex management needs, similar to the Covid-19 patient profile[29].

The structural component of the triad demonstrated many strengths. Along with essential resources, the rapid vaccination of frontline professionals also served as a positive and strengthening element for hospital infrastructure. Worldwide, hospital challenges for Covid-19 pandemic management related to human and logistical resources, finance and budget, psychological issues, and infection prevention[29-31], all elements that structurally compose an organization. These factors affect the context in which care is provided: physical care, psychosocial

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care, and relational care when directly related to patients, for example, and these impacts reflect throughout the organization's entire operational process[5,32,33].

Process is a component that concerns actions performed by professionals and users when offering and receiving care, respectively[10]. The entire series of activities that occur among those involved typically results in written records. Direct care or care management[18], in this category, resulted in numerous development and updates of materials and documents that supported conduct by those involved. Furthermore, this measure is understood as a strength of CHC, while highlighting the importance of protocols as guidance for actions.

Aligned with this, nursing emerges as a key strength within the team. Nurses helped develop and produce protocols that were crucial for systematizing care and management actions based on scientific evidence, serving as support for the entire working team[18,19].

Studies have demonstrated that using updated protocols on diverse subjects involving management and care was essential for guiding health professionals on appropriate conduct for Covid-19 patients[34,35]. In a crisis scenario, having nursing staff—representing the largest workforce contingent—allocated to strategic points supporting care management as well as on the frontlines can be considered a hospital advantage. There is strong evidence that nursing action and practice as mediators of interprofessional activities was tested during the pandemic [36].

Among the difficulties perceived regarding structure, the suspension of teaching and research activities for undergraduate and graduate programs stands out, which may have been an action that affected other hospital operations. However, university hospitals traditionally characterize themselves as being at the forefront of conducting research and developing health technologies. Thus, even at the beginning of the pandemic period, it was possible to perceive the commitment of this study's scenario, like other federal hospitals, to producing new knowledge about Covid-19[9].

Other hospital realities highlighted actions that align with this research's findings: suspension and/or postponement of consultations and outpatient care, restriction and/or suspension of visits, and suspension and/or postponement of elective surgeries in patient care. In management, the main strategies were training professionals for Covid-19 management, emergency hiring of health professionals, and offering psychological support for workers[37].

In extension activities, the main focus was developing educational materials about prevention measures. In the teaching and research mission, there was suspension of undergraduate and graduate activities, but new Covid-19 related research projects began[9]. Contrary to these losses, medical residencies stood out, especially in infectious diseases, which acquired important expertise during the pandemic. Therefore, they were less affected in the hospital's teaching mission.

Many professionals affiliated with the hospital in this study were also developing their research in graduate programs and, given the demand and work overload, needed to pause their productions. This reveals an important direct challenge for professionals: the dual role of worker-researcher, or in other contexts, identified as a triple burden: professional, family, and educational[38]. This situation can be identified as a gap requiring greater and future discussions in professional, organizational, and academic spheres.

Although CHC sought to ensure professional safety, there was substantial loss in terms of deaths, as found in this study. The personal and professional well-being of health workers was affected due to "*daily contact with disease, death, exhausting workload, and changes in professional routine.* Among alterations in daily life: sleep disturbance, irritability/crying/general disorders, and inability to relax/stress"[39:2972]. Professional satisfaction and expectations should be elements considered by the organization[40], consistent with the Donabedian model.

In this research, the work overload experienced by hospital professionals was explicit. A strength for CHC was that, despite everything, there was only one employee death and all measures were taken to minimize risks. This aligns with literature data about extensive work overload that occurred due to absences of employees belonging to risk groups and those infected by the disease, unit overcrowding, and increased working hours. Consequently, working conditions deteriorate, as overload generates professional burnout, risk of impaired care quality, and increased absences due to diseases other than Covid-19[41,42.] From a Donabedian perspective, therefore, if there is weakness in this resource, there may be harm to patient safety levels as an outcome[43,44]. This affects the necessary human resources that can influence the process, either negatively or positively depending on the demonstrated structure.

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As another important outcome, the context of patients diagnosed with Covid-19 after discharge prompted strategies designed for their continued care. During this period, an important strength for the hospital was post-discharge telemonitoring and follow-up of the public with chronic conditions (or acute exacerbations) who were underserved, with the creation of an outpatient clinic, in addition to establishing a care pathway for people with Covid-19. The care pathway included initial screening, care in referenced units, wards, and ICUs. Discharge was counter-referred by the hospital's discharge management service for follow-up in the outpatient clinic designated for post-Covid-19 care[18].

In addition to the above, bed management, clinical management, multidisciplinary team case discussions, continuing health education actions, and a nurse responsible for discharge coordination are identified as strategies for care continuity[45]. Efficient counter-referral mechanisms were created for hospitalized patients, investing in hospital discharge management with the introduction of the Liaison Nurse role, serving as a bridge for post-discharge patient care at RAS points in the territory and operationalized as support during the pandemic period[46].

In this regard, it is recognized that despite losses, the hospital achieved important gains in the face of the established crisis. A universal, comprehensive, and free health system came to be recognized in an unprecedented way[5], which may have highlighted the strengthening of the social role as a public and free hospital for the population. It must be acknowledged that, with the structure it accommodated and the way it organized its processes, Covid-19 patients were cared for.

Quantifying the outcomes obtained in terms of management and care indicators was not the focus of this research. However, it is appropriate to mention data when reports evidenced aspects that lead to indicator construction, for example: significant numbers of surgical cancellations (elective); worker health indicators; number and turnover of beds to accommodate Covid-19 patients and, therefore, hospital occupancy rates and length of stay. Furthermore, indicators such as elevated healthcare-associated infection (HAI) rates[47], pressure injuries (PI), observed in greater volume in patients infected with the SARS-CoV-2 virus, possibly related to the compromise the virus causes in the cardiovascular system and skin[48], and procedures performed to improve the condition such as prone positioning[49], were some data obtained from literature.

In the course of negative impacts, on the other hand, the acquisition of complex technological equipment at an opportune moment was observed, which could serve as facilitating elements to contribute to the health condition of Covid-19 patients, given the agility in access, equally contributing to more decisive clinical conduct by the team. Moreover, an important part of the reports mentioned nursing gains in space in contrast to lessons learned.

Nurses in this area, beyond the frontline, were allocated to strategic management positions and also integrated into the Crisis Committee itself. In response to the pressures imposed, new care models could be conceived, namely: changing functions, responsibilities, and combining competencies; introducing more technology-assisted care; and expanding the role of informal caregivers or assistants in care[50]. Such experiences require consideration: what to maintain and what to refine?

Regarding professional performance, lessons learned addressed the importance of multiprofessional work and expanded the need for constant debate toward interprofessional collaboration, still ongoing. A Danish study revealed that nurses stated they did not feel part of decision-making about Covid-19 conduct, as management did not encourage engagement with nursing professionals, bringing a sense of lack of recognition. Additionally, the lack of formal management education demonstrated that some managers were not able to handle the situation as they would have liked. This brings to light that not only technical procedure skills should be on the continuing education agenda, but simultaneously, the development of management competencies[50].

The teaching and research mission was partially present in subcategories across all three components of the triad. Regarding the teaching mission as a mission of the hospital in this study, there was modest participation from the academic community in pandemic response. Nonetheless, it is important to recognize that, although their role on the front lines was less apparent, universities were also engaged in reorganizing their workflows by transitioning to remote teaching and implementing diverse strategies to disseminate emerging knowledge about the virus — including live streams, health education efforts, and other means that evolved alongside scientific understanding.

The relevance of research development became evident through participation in clinical studies seeking medications and vaccines to combat Covid-19. During a period when only non-pharmacological recommendations were available as mitigation strategies, assuming a contributory role in medication and vaccine development was an aspect that enhanced the role of a federal hospital in its research mission, as was the case in this study.

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Beyond dealing with structural changes, hospitals utilized procedural and functional reforms[51], intertwined with professionals' modus operandi. In the research sphere, publications about the pandemic served as tools to reinforce professional conduct. Although there were few initial publications about Covid-19, as new discoveries occurred and were published within the core of scientific research, they were consumed by care practice, providing a "voice" for Evidence-Based Practice. Hence the relationship between teaching and research as a mechanism for hospital care as a conducive structure for the work process.

Although the epidemiological scenario demanded greater performance from hospital services, added to the existing challenges of multidrug-resistant microorganisms from before, the fact that a teamwork task force emerged in the scenario stood out. The resilience of workers in support services for care management showed the importance of seeking research tools to enhance their competencies, that is, studying extensively in such a short time available for this purpose. This, combined with expertise in care management from managers and leaders in multi-area care, was a potentiating element that leaves a positive legacy for the health sector. Transnational health crises require an international response and can offer windows of opportunity to introduce changes.

Future perspectives include the emergence of new challenges and, thus, it is necessary to learn from the past and develop sustainable health crisis management structures, while pointing to the primary strategy of solid investment in health systems[31,52].

This final reflection highlights the health system, such as the hospital in this study, in rearranging its resources in the pursuit of professional and managerial practice, where the outcome sought to satisfy the individual as the center of care against Covid-19 while simultaneously seeking survival for its structure. Therefore, there is a causal relationship between the triad components, such that the available structure must be sufficient to support the execution of processes inherent to plans, which in turn trigger different outcomes[10,11].

Study limitations

Methodologically, adapted for online mode, the limitation may contrast in the abstraction of aspects that might have emerged differently in a face-to-face approach. Additionally, the need to use technology has the potential to generate selection bias.

Regarding the theoretical framework used, in terms of satisfaction and expectations as a component of the Donabedian triad, an analysis from the perspective of patients, students, and faculty would be pertinent for greater appropriation of the teaching mission as well as research, since the hospital's care mission had greater focus.

This highlights a gap for future studies with this design and applicable to field studies. Together, conducting an analysis based on the Donabedian triad in a "post-pandemic" context could bring consolidated learning aspects from the restructuring the hospital underwent.

FINAL CONSIDERATIONS

Overall, due to the restructuring through which the hospital responded to pandemic demand, gains and losses, strengths and weaknesses, as well as challenges undertaken during and with future implications were perceived.

Structurally, efforts were made to enhance operational capacity through emergency hiring, training/capacity building, workforce (re)allocation given the vulnerability the virus demanded, in addition to optimizing existing operations, from administrative functions to frontline work. To enable care delivery, infrastructure needed to be reconsidered, utilizing existing physical spaces and improving them.

Technological resources, materials, and supplies required forecasting and provision studies, and technological park renewal consistent with the target population profile. While the challenge prevailed in possible raw material scarcity affecting the hospital's resource deficit, it also benefited from agility in acquiring complex equipment that would also assist in future care. The crisis served as motivation for teamwork to find solutions in the face of fear of possible medication shortages, in addition to involvement in research to discover a cure for Covid-19.

The process was also observed to be (re)conceived, instrumentalized, and designed in how professionals acted. Notably, in an adverse situation, frontline professionals, even while concerned, collaborated to care for patients within a prioritization of possible care, despite fear of contamination and death. In care management, managerial decision-making was categorical given the necessary agility. The synchronized multiprofessional team, combined with previous expertise, already consolidated services such as bed management and discharge

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management, and predisposition to mobilize actions for care, were differentials, even if misaligned with discussion by all (care-management) in decision-making, as pointed out by some members.

The combination resulted in offering beds and care for Covid-19 patients. Although with elective procedures paused, affecting specific underserved populations, the existence of deaths and severity of cases requiring intensive care; there was, in contrast, the provision of resources, resulting in positive changes in these patients' health status.

In conclusion, it is imperative to point out that the hospital, within its reorganized conditions, met demand according to the objective proposed by managers. The triad of structure, process, and outcome is perceived as operationalized in a practical mechanism, without which an organization's mission becomes inefficient. As it unfolded, this record contributed to the planning of actions that may be necessary in similar or future situations — whether in the near or distant future—within the healthcare landscape and in support of hospital sustainability. This aligns with a common goal shared by many organizations and reinforces the importance of using contingency models and plans for pandemics or crises arising in hospital settings.

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Research Article
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Author's contributions

Conceptualization, F.B. and E.B; methodology, F.B e E.B; software, F.B.; validation, F.B., E.B. and N.S.T.; formal analysis, F.B e E.B; investigation, F.B.; resources, F.B. and E.B.; data curation, F.B. and E.B.; manuscript writing, F.B.; review and editing, F.B.; E.B.; A.M. P.; N.S.T.; M.F.B.A.C.; E.G.P. and C.D.; visualization, F.B.; E.B.; A. M. P.; N.S.T.; M.F.B.A.C.; E.G.P. and C.D.; supervision, E.B.; project administration, F.B. and E.B.; financing acquisition, E.B. All authors read and agreed with the published version of the manuscript.

Open Data

Research data is available in the digital library repository of the Universidade Federal do Paraná, Brasil. Health Sciences Sector. Post-Graduation Program in Nursing, website: https://hdl.handle.net/1884/87490.

Use of artificial intelligence tools

Authors declare that no artificial intelligence tools were used in the composition of the manuscript "*Restructuring of a general hospital to face the Covid-19 pandemic: a Donabedian analysis*".