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Attributes and Organizational Factors that Enabled Innovation in Health Care Service Delivery during the COVID-19 Pandemic – Case Studies from Brazil, Canada and Japan

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ABSTRACT

Innovation by health service organizations can enable adaptation to and transformation of challenges caused by health shocks. Drawing on results from case studies in Brazil, Canada, and Japan, this study looked at innovations the study hospitals introduced in response to challenges caused by COVID-19 to identify: 1) attributes of the innovations that make them conducive to adoption; and 2) organizational factors that facilitate the creation and implementation of innovative health care approaches during health system shocks. Qualitative information was gathered using key informant interviews, participatory observations at the study hospitals and a review of relevant documentation. A thematic approach was used for analysis, and a cross-country comparison framework was prepared to synthesize findings from the case studies in the three countries. In response to the disruptions caused by COVID-19, the study hospitals undertook innovative changes in services, processes, organizational structures, and operational policy. The driving force behind the innovations was the need and urgency generated by the unprecedented nature of the pandemic. With COVID-19, if an innovation met the perceived needs of hospitals and provided an operational advantage, some level of complexity in the implementation appeared to be acceptable. The study findings suggest that for hospitals to create and implement innovations in response to health shocks, they need to: have adaptive and flexible organizational structures; build and maintain functioning communication systems; have committed leadership; ensure all staff share an understanding of hospital organizational and professional missions; and establish social networks that facilitate the creation and implementation of new ideas.

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Introduction

The COVID-19 pandemic has caused significant disruptions to health care service delivery at hospitals in countries throughout the world. In the initial stages of the pandemic, the unforeseen crisis placed enormous pressure on hospitals, which were required to plan and manage health care service delivery in response to a rapid increase in COVID-19 infections while also introducing measures to prevent nosocomial infection and continuing to provide routine care services.[1,2] A multi-country study[3] which examined hospital resilience during the early stages of the COVID-19 pandemic found that the study hospitals introduced innovations, a novel set of behaviors, routines, and processes[4] that helped them adapt and transform structures and processes to cope with the disruptions caused by COVID-19, enabling the hospitals to deliver COVID-19-related health care services while also providing limited non-COVID-19 health care services.

The resilience of health service organizations refers to their capacity to maintain their essential health care function during a crisis or "health shock," which involves a process of absorption, adaptation and transformation in response to the disruptions caused by the crisis.[5–7] While rarely examined in the literature on health systems resilience, innovation can influence resilience during health shocks because new approaches and practices help health service organizations to make incremental changes (adaptation) and/or longer-lasting systemic changes (transformation) to respond to the challenges caused by the health shock.[7,8] The unprecedented COVID-19 pandemic provides a unique opportunity to investigate how hospitals in different settings adopted new approaches to service delivery and whether

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the use of new approaches during the health shocks is different from that shown in the existing literature on the adoption and implementation of innovations when the health system is not experiencing a health shock.

While various innovation theories look at how innovations are created, adopted, and implemented, less attention has been paid to the organizational factors that are conducive to creating and implementing innovations.[9] Assuming that, for a range of reasons, hospitals do not implement all innovative ideas,[10,11] the present article draws on results from case studies in Brazil, Canada, and Japan to identify organizational factors that facilitate the creation and implementation of innovative health care approaches during health system shocks. Given that an innovation's characteristics can influence its adoption and implementation,[4] the analysis also looks at the attributes of innovations that make them conducive to adoption.

Materials and Methods

Conceptual Framework

Innovation in health care service management and delivery is defined as a novel set of behaviors, routines, and processes aimed at improving health outcomes, administrative efficiency, cost-effectiveness, or user experience, and implemented using planned and coordinated actions.[4] Innovations can be categorized as product innovations, process innovations, service innovations, organizational structure innovations, or policy innovations.[9]

Attributes associated with the successful adoption of an innovation include[4]: 1) relative advantage (clearly advantageous for operational or cost effectiveness); 2) compatibility (aligned with intended adopters' values, norms, and perceived need); 3) simplicity (perceived by key stakeholders as simple to use); 4) testability (innovations which intended users can experiment on a limited basis); 5) visibility (benefits apparent to intended adopters); and 6) adaptability (the ability of potential adopters to adapt, refine or modify innovations to meet their own needs).

Organizational factors that can be linked with the successful routinization of innovations include[4]: 1) organizational structure (an adaptive and flexible organizational structure, and structures and processes that support devolved decision-making in the organization); 2) leadership and management (top-level management support, advocacy of the implementation process, continued commitment to the process); 3) human resources (including the motivation, capacity, and competence of individual practitioners); 4) funding (dedicated and sustained funding for implementation); 5) intra-organizational communication system (effective communication across structural boundaries within an organization); 6) inter-organizational networks (especially significant for innovations with more complex requirements); 7) feedback processes (accurate and timely information about the implementation's impact); and 8) adaptation/reinvention (adaptation of the innovation to the local context).

The conceptual framework for the study was developed using the above definition of innovations and factors associated with the adoption and implementation of innovations (Figure 1). The study looks at the use of innovative approaches for health care service delivery in response to COVID-19, and thus the adoption and

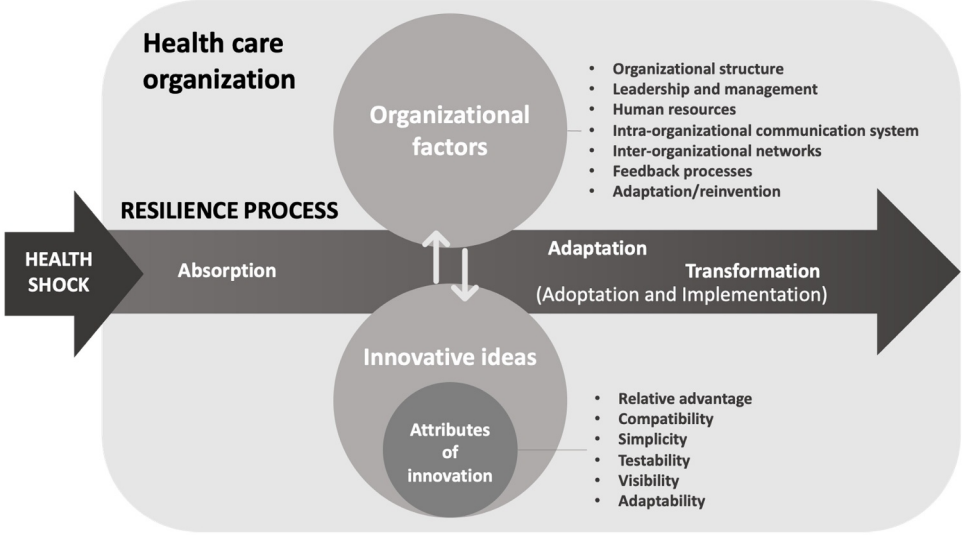

Figure 1. Conceptual framework.

implementation of those innovative approaches are part of the process in which hospitals applied absorptive, adaptative, and transformative strategies to overcome the disruptions caused by the pandemic, as shown in the figure. The conceptual framework guided the synthesis of results from the country case studies.

Data Collection

Case studies in Brazil, Canada, and Japan were undertaken as part of an overarching multi-country study looking at the resilience of hospitals during COVID-19 by examining how they responded to disruptions caused by the pandemic.[3] Of the five countries involved in the multi-country study, the findings from the case studies in Brazil, Canada and Japan found innovative approaches were used in health care service delivery in the study hospitals in the early stages of the pandemic. The three countries vary in terms of COVID-19 status, type of health system, and socio-economic context. At the end of November 2022, Brazil had recorded approximately 35 million confirmed COVID-19 cases, Canada, about 4 million confirmed cases, and Japan, 23 million confirmed cases.[12] Brazil has a population of 214 million, Canada has a population of 38 million and Japan has a population of 126 million.[13] While the core health systems in Brazil and Canada are tax-funded, the Japanese health system is largely funded by mandatory health insurance contributions, which are subsidized by the central and local governments.

Data collection was undertaken in the period between April–October 2020 in Brazil, between June –November 2020 in Canada, and between September –December 2020 in Japan. During the study period in Brazil, the absence of coherent national strategies to control COVID-19 led to large variations in the management of the pandemic between both states and municipalities,[14] and hospitals often led the development of measures to minimize the impact of the pandemic by creating protocols and workflow systems for case management, nosocomial infection prevention, and health promotion.[15]

In Canada, while the federal government managed economic and border control policies, provincial governments were responsible for public health efforts to control COVID-19 infection. Control measures varied between provinces but, in general, a rapid response by provincial governments in surveillance and case detection at the onset of the pandemic contributed to a relatively low number of COVID-19 cases in Canada. However, in the early stages of the pandemic, Canada, and especially the province of Québec, where the case study was conducted, experienced a high death rate among senior citizens[16] resulting in the introduction of policy measures to control outbreaks in long-term care facilities.[17]

In Japan, during the study period, while the central government introduced the measures stipulated under the Infectious Disease Law to facilitate the delivery of COVID-19-related care, prefectural governments coordinated local healthcare providers to increase bed numbers to accommodate COVID-19 patients.[18] At the beginning of the pandemic, many cases involving emergency transport had difficulties finding hospitals that accepted COVID-19 patients.[19] Whenever COVID-19 case numbers increased, there were issues securing hospital beds for patients due to structural and institutional issues in the Japanese health system, including low numbers of medical doctors and nurses per hospital bed, high hospital bed occupancy rates, and a legal framework that determines the governance of bed control for infectious diseases.

A case study approach[20] was applied in which a hospital that provided COVID-19 related care was the case, and the processes of absorption, adaptation, and transformation through which the hospital responded to the COVID-19 pandemic were units of the analysis. Each of the three country teams chose one or two cases

Table 1. Characteristics of the case study hospitals in Brazil, Canada and Japan.

	Brazil	Canada	Japan
Number of cases	1 hospital	1 hospital	2 hospitals
Ownership	Public	Public	Public
Hospital types	Teaching hospital	Pediatric, teaching hospital	National hospital; Regional hospital
Number of beds in the case study hospitals	400	550	Hospital 1: 750 Hospital 2: 520
Number of hospital staff (both medical and administrative staff)	3,180	5,500	Hospital 1: 1,400 Hospital 2: 850
COVID-19 patient types receiving care	Moderate and severe cases	Pediatric patients with all levels of symptoms	Hospital 1: Mainly severe cases Hospital 2: Mainly moderate cases

All figures are rounded to the nearest 10.

Table 2. Data collection in Brazil, Canada and Japan.

	Brazil	Canada	Japan
Period of data collection	April—October 2020	June—November 2020	September—December 2020
Number of interviews	18	15	Hospital 1: 37 Hospital 2: 19
Interview participants	Physicians, nurses, infection prevention and control advisers, social workers, managers, executives	Physicians, nurses, infection prevention and control advisers, social workers, managers, executives	Physicians, nurses, laboratory technicians, pharmacists, radiologist, clinical engineer, administrative staff, managers
Language used in interviews	Portuguese	French	Japanese
Types of documentation reviewed	Hospital records and documentation, policy documentation (national and provincial governments)	Hospital documentation, policy documentation (provincial government)	Hospital records and documentation, media reports, academic publications; policy documentation (national and prefectural governments)
Location of participatory observation	The hospital wards and intensive care units where COVID-19 patients were treated.	N/A	N/A

from hospitals that played a key role in providing COVID-19-related services in the early stages of the pandemic. Table 1 provides the characteristics of the study hospitals.

Qualitative information was gathered using key informant interviews that were supplemented by the review of relevant documentation. Additionally, the case study in Brazil undertook participatory observation in the study hospitals. The key informant interviews used a semi-structured questionnaire, which was based on the framework for the multi-country study, and a common set of questions was asked in interviews in all country case studies. Interview participants were recruited from hospital staff across a range of professional categories, hospital roles, and levels of involvement in COVID-19 service provision. The interviews were recorded with the consent of the interview participants and transcribed verbatim for analysis. Table 2 presents a summary of the data collection in Brazil, Canada, and Japan, including the number of interviews, interview participants, types of documentation reviewed, and location of participatory observations undertaken in each case study.

Data Analysis

Drawing on the findings of the case studies in Brazil, Canada, and Japan, key innovations employed to adapt to and transform the disruptions caused by the COVID-19 pandemic in the study hospitals were identified. The conceptual framework was used to prepare a cross-country comparison template to synthesize the study findings. Pattern matching was undertaken using a pre-coded template to identify the attributes of innovations and organizational factors that were conducive to the adoption and implementation of innovations in the three case studies. The analysis also used an inductive approach to explore factors that were not anticipated prior to the analysis.

While country case studies were undertaken in the local languages (i.e., Portuguese in Brazil, French in Canada, Japanese in Japan), the cross-country comparison was undertaken in English, with the information extracted from the country case studies translated from the local language to English by the researchers and the translation validated using an iterative process by the researchers.

To ensure robustness in the qualitative analysis, the study used a diverse range of information sources (e.g., interviews with different professional groups) and used various types of information to verify the study results (e.g., comparison of information obtained from interviews with published literature). In addition, the study teams presented preliminary results to study participants to confirm and validate the results of the qualitative data analysis.

Results

Innovations in Service Delivery

Table 3 describes the key innovations in service delivery identified in the case study countries. Innovations relating to service provision, processes, organizational structure, and hospital operations policy were identified in the three case studies.

In relation to service innovation, in Brazil, in an attempt to prevent COVID-19 infections, a digital communication service was introduced at a study hospital to facilitate communication between patients and their families while avoiding direct contact with those infected by COVID-19. In Japan, the "total pain approach," which aims to improve patients' quality of life by defining pain from the physical, psychological,

Table 3. Descriptions of the innovations implemented in the study hospitals.

Innovation	Country	Purpose	Type of innovation	Beneficiaries	Form of innovation
ComVida project—a partnership with the community that mobilizes available resources	Brazil	To support health care providers in service delivery	Process innovation	Frontline health care providers/ patients	• Resource mobilization • Community support
Creation of a digital communication service for family members of hospitalized patients	Brazil	To facilitate communication between patients and their families	Service innovation	Patients and their families	• Communication • Use of IT
Inter-hospital sharing of infection control equipment	Canada	Infection control and service delivery	Process innovation	Other hospitals	• Redistribution of infection control equipment • Resource sharing between hospitals
In-house video training on IPC and PPE use.	Canada	On-line training for infection control	Process innovation	Hospital staff	• Training and knowledge transfer • Use of IT
Development of project plans (in-house preparedness plans for continuation of service delivery in hospitals and long-term care facilities) and expansion to Québec's health and social services network	Canada	Knowledge transfer for infection control and continuation of service delivery	Policy innovation	Hospitals and long-term care facilities	• Strategic planning and knowledge sharing • Development of standard guidelines
Use of the total pain approach to maintain the motivation of nursing staff caring for COVID-19 patients	Japan	To improve staff motivation in service delivery	Service innovation	Nursing staff	• Approach to service delivery • Service quality improvement
Temporary referral system for allocating COVID-19 patients to hospitals within the district	Japan	To share health care service delivery resources within a district	Organizational structure innovation	Hospitals and clinics in a district	• District-wide resource mobilization for service delivery

social, and spiritual perspectives, was used in the care of COVID-19 patients to facilitate self-care after discharge and to revive the motivation of nursing staff caring for COVID-19 patients.

Process innovation was seen in Brazil, where one of the study hospitals mobilized additional resources to respond to COVID-19 through a partnership with community groups that offered financial resources and in-kind support for in-hospital infection risk prevention and treatment of COVID-19 patients (the ComVida project). The pediatric hospital in Québec (Canada) established a system to share in-hospital infection control materials with all hospitals in the region to enable the on-going delivery of services and in-hospital infection control through the redistribution of materials to meet required demand. The hospital also developed online training on infection prevention and control, which was subsequently disseminated to other hospitals in the region.

In terms of innovation in organizational structure, in Japan, under the initiative of one of the study hospitals, a community testing center and a temporary district-level referral system were established to share and re-distribute resources (including space, beds, and human resources) to enable delivery of COVID-19-related services throughout the district.

In terms of policy innovation, in Québec (Canada), strategic planning and knowledge transfer for infection prevention and control and continuity in service delivery were undertaken when the study hospital developed a "project plan" (in-house preparedness plan for the continuation of services). The plan was subsequently shared across Québec's health and social service network.

Attributes of Innovations Facilitating Implementation

Table 4 provides the key attributes of the innovations identified in the case studies in Brazil, Canada, and Japan. The need and urgency generated by the COVID-19 pandemic were the driving force behind the innovation, which were supported by the acceptability to stakeholders and the values of those involved in the innovation. Most of the innovations presented an operational advantage for service delivery during the pandemic.

If an innovation met the perceived needs of hospitals and staff and had an operational advantage, some level of complexity (e.g., involvement of multiple stakeholders, coordination of stakeholders) in the implementation appeared to be acceptable. The ComVida project

Table 4. Attributes of the innovations.

Innovation	Relative advantage (advantage in either operational or cost effectiveness)	Compatibility (with intended adopters' values, norms, perceived needs)	Simplicity (ease of use by key stakeholders)	Testability (intended users' ability to experiment with the innovation on a limited basis)	Visibility (benefits apparent to intended adopters)	Adaptability (potential adopters' ability to adapt, refine, or modify innovations to meet their own needs)
ComVida—a partnership with the community that mobilizes available resources	Operational advantage	Perceived needs Social values	Easy to adhere to, logistically complex	N/A	Benefits quickly apparent	A temporary approach to mobilize community resources in the initial stages of the pandemic
Creation of a digital communication service for family members of hospitalized patients	Operational advantage	Perceived needs Social values	Easy to understand and adhere to	N/A	Benefits quickly apparent	Adapted and expanded to create a larger scheme
Inter-hospital sharing of infection control equipment	Cost-effectiveness (maximum use of available resources)	Perceived need (urgency caused by the pandemic) Social values	Simple, easy to use	Expansion from one hospital to multiple hospitals and long-term care facilities	Preventing in-hospital infection	COVID-19 specific initiative
In-house video training on IPC and PPE use; expansion of training to Québec's hospital network	Operational advantage	Perceived need (urgency caused by the pandemic)	Some practical challenges	Training video disseminated to other hospitals	Preventing in-hospital infection	COVID-19 specific initiative
Development of project plans and expansion to Québec's health and social service network	Operational advantage	Perceived need (urgency caused by the pandemic)	Initially, some resistance from managers of long-term care facilities	Project plans disseminated to other hospitals	Benefits apparent	Plans not easily transferable to long-term care settings
Use of the total pain approach to maintain the motivation of nursing staff caring for COVID-19 patients	Operational advantage	Perceived need Professional values	Complex, required considerable coordination	N/A	Displaying a summary of the discussion with patients in the ward helped hospital staff and patients to visualize the benefits of the initiative	Potential for approach to be transferred to other hospitals
Temporary referral system for allocating COVID-19 patients to hospitals within the district	Operational advantage	Perceived need (urgency caused by the pandemic)	Quite complex, involving various actor groups	N/A	Benefit quickly apparent; media coverage widely informed the community of benefits	A temporary approach to redistribute health resources in a community at the initial stages of the pandemic

in Brazil and the sharing of infection control materials with other facilities in Canada were examples of innovations developed in response to the need for resources that would allow hospitals to maintain service delivery during the pandemic, even though the innovations involved various actor groups, including people in the community (Brazil). In Japan, while prefectural governments coordinated local health care providers and endeavored to increase bed numbers to accommodate COVID-19 patients, not all hospitals accepted COVID-19 patients at the beginning of the pandemic; consequently, those that did treat COVID-19 patients bore the burden of the increased workload resulting from the pandemic. As the number of cases increased in March and April 2020, the workload of those providing care to COVID-19 patients also increased, and hospital staff grew increasingly concerned about the ability to continue service delivery. The need to expand hospital capacity to provide care to COVID-19 patients was addressed through the creation of a community COVID-19 testing center and the introduction of temporary referral arrangements for allocating patients within the district, especially during the initial stages of the pandemic when there was a sudden rise in case numbers.

Many innovations identified in the case studies were specific to COVID-19 and/or to a particular setting, but some innovations have potential for expansion to other

Table 5. Key organizational factors conducive to innovation during health shocks.

Innovation	Organizational structure	Leadership and management	Human resources issues	Funding	Intra-organizational communication	Inter-organizational networks	Feedback system	Adaptation/Re-invention
ComVida project—a partnership with the community that mobilizes available resources	Adaptive and flexible to change	Supportive of new ideas	Strong sense of solidarity	No specific funding; donations from the community	Daily meetings between hospital managers and department heads	Long history of hospital service in the community	Project widely covered by media	Short-term initiative
Creation of a digital communication service for family members of hospitalized patients	Culture of learning	Involvement of department heads in decision-making	Shared values in caring for patients and their families	Equipment purchased through the ComVida project	Daily meetings between hospital managers and department heads	N/A	N/A	Expanded to a larger scale in the hospital
Inter-hospital sharing of infection control equipment	Adaptive and flexible to change due to the hospital's level of autonomy	Timely and consistent support from hospital management	Strong motivation of hospital management and IPC team	On-going budget	Functional communication between IPC team and supply unit	Presence of provincial health and social services network; staff contacts in other hospitals	Existing communication channels	Ongoing discussions on implementation of a centralized provincial system for sharing hospital equipment
In-house video training on IPC and PPE use; expansion of training to Québec's hospital network	Adaptive and flexible to change due to the level of autonomy given to the hospital	Timely and consistent support from hospital management	Strong motivation of hospital management and IPC team	On-going budget	Functional communication between IPC team and hospital departments	Video shared with existing network between hospitals, then extended to other hospitals	Data on video views not tracked	Short-term initiative
Development of project plans and expansion to Québec's health and social services network	Adaptive and flexible to change due to the level of autonomy given to the hospital	Advocacy from hospital project managers involved in staff deployment to long-term care facilities	Strong motivation of hospital management, IPC team, and deployed staff	On-going budget	Functional communication between IPC team and hospital departments	Temporary relationship between hospitals and long-term care facilities; managers' personal contacts in other facilities	Existing communication channels	N/A
Use of the total pain approach to maintain the motivation of nursing staff caring for COVID-19 patients	Adaptive and flexible to change	Flexible and supportive attitude of managerial staff	Presence of hospital staff with palliative care knowledge and experience	On-going budget	Functional communication between those involved in the initiative and hospital managers. The team shared the approach with other departments	Experience of the initiative disseminated through workshop and conference presentations	Feedback questionnaire for patients used to assess the program	Initially small but expanded as more hospital staff saw how the initiating team undertook care and the benefits of the approach
Temporary referral system for allocating COVID-19 patients to hospitals within the district	Adaptive and flexible to change	Strongly supported by top-level management	Shared understanding of hospital mission among staff in the initiating hospital	Dedicated funding from the district	Functional communication between hospital managers, IPC team, department heads	Existing close relationships between hospitals in the district. The initiating hospital has a team dealing with external affairs.	Interaction among those participating in the initiative; initiative covered by media	Short-term initiative

settings and/or for application in future health shocks. For example, in Brazil, the use of digital communication between patients and their families was expanded with the creation of a "parents room," where families of patients from remote areas could spend time talking to hospitalized family members using digital devices. In Japan, the total pain approach was used to provide care to COVID-19 patients in the study hospital and those involved in the innovative health care service delivery for COVID-19 patients disseminated information on their experience within and outside the hospital, creating opportunities for the approach to be used in other hospitals or in the care of patients with similar diseases.

Organizational Factors that Promote Innovation in Service Delivery

Table 5 presents organizational factors that facilitated the implementation of innovations. The key organizational factor highlighted in the case studies was an adaptive and flexible organizational structure that allowed new ideas and operational changes to be created in a short time frame. Such adaptability and flexibility can be facilitated when hospitals are given autonomy in management and decision-making.

For instance, the case study hospital in Canada is a pediatric hospital in Québec that has a high level of autonomy in decision-making, in contrast to other Québec hospitals that have similar levels of service delivery but are not given authority for independent decision-making and resource management. In fact, most of Québec's hospitals operate within "integrated health and social services networks" (centers intégrés de santé et de services sociaux [CISSS, or CIUSSS if university-affiliated]). These are centralized decision-making entities that, during the COVID-19 crisis, had cumbersome administrative procedures that even, for example, hindered requests for transferring PPEs to health facilities.

> We gave some [products] to other hospitals . . . People [working in the hospitals] are very proactive. We are a small hospital, not part of a CIUSSS, so are able to be agile, and we are. I'll just take, as an example [a hospital which is a part of a CIUSSS] . . . [a hospital staff member] knew exactly what to do, and said, "We've been waiting for weeks for guidance from the CIUSSS that doesn't come, and we don't have the autonomy to act, to go and get equipment and do what we have to do" (Physician, Canada).

The implementation of innovations also required strong, consistent, and timely support from the hospital leadership. For example, to create a temporary, district-level referral system in Japan, the top-level management, fearing that the delivery of care to COVID-19 patients would have a detrimental impact on hospital operations, strongly supported the sharing of roles and responsibilities for COVID-19 care between the health care providers operating in the district. The support of top-level management in the initiating hospital played an important role in effective coordination across the district. The top-level management team successfully introduced the plan to other hospital directors, the head of the medical association, and others.

> About two days before we were to go to the head of the district . . . Before meeting with the head of the district, our hospital director and chairman met with the directors and deputy directors of other hospitals in the district and explained the background of the plan, and almost all of the other directors and deputy directors agreed to do it. The other directors and vice-directors agreed to cooperate without any complaints (Physician, Japan).

Similarly, in the Québec hospital case, support from hospital management enabled decision-making and subsequent action to be undertaken quickly.

> Here in our hospital things move fast, we [decision-making units] are agile . . . because there is support from all departments, because the CEO [chief executive officer] and the Assistant CEO are with us in this situation. Things are moving (Physician, Canada).

Furthermore, when the innovation involved actor groups outside the hospital, existing networks and relationships, including those with other health facilities, local health administrators, etc., were important in facilitating the implementation of initiatives. For example, the study hospital in Brazil had a long history as a referral hospital, particularly in the area of infectious and parasitic diseases, which created strong ties between the hospital and the surrounding community and contributed to innovative collaboration in mobilizing community resources for the continuation of service delivery at the hospital during the COVID-19 pandemic.

> We started to receive suspected [COVID-19] cases that were all referred from the emergency department of the State public service . . . I think it's also important to point out that there was a high level of participation from the general population. The community felt sorry for all that was happening and assisted a lot with donations, not only for us, but also for all other hospitals. So, that was also very important; this community mobilization made a lot of difference, and not only with materials for hospital use, but we also received a lot of messages, messages of affection, messages of strength (Medical coordinator, Brazil).

In terms of human resources, the successful implementation of some innovations required that hospital staff have shared values, including a shared understanding of the hospital's mission and an awareness of the importance of providing services to meet patient needs. For example, in Japan, a shared understanding of the hospital's mission among staff in the initiating hospital facilitated the introduction of the district-level referral model and the operation of the district-wide PCR testing site. The hospital's pathology department was particularly supportive and played a leading role in establishing district-wide PCR testing by helping to prepare the site and training laboratory technicians who came to the testing site from other hospitals. In facing the challenges caused by COVID-19 in Brazil, a sense of solidarity grew among hospital staff, which, in turn, strengthened the professional values of staff and facilitated action to help patients.

> Because issues like COVID give us the opportunity to see people as people, not as the diseases they carry, right? To see others as people who need help . . . And so, I think I only strengthened this feeling that I always had (as a health professional) (Physiotherapist, Brazil).

The study hospitals in all three countries had functional communication mechanisms between hospital management, department heads, and frontline hospital staff, which facilitated the implementation of innovations. For example, in Brazil, the study hospital's risk management committee held daily meetings where changes to service delivery were discussed. The meeting outcomes were subsequently disseminated to frontline health care providers through established communication mechanisms.

> Before the first cases in Brazil, we had weekly meetings at the hospital about the protocols for coronavirus and, after the first cases, this meeting practically became daily. So, every day, at lunchtime, they [crisis committee] met to define the processes, and each process that was discussed was defined in that meeting and a new process was made. Afterwards, there was a whole job of spreading it [the new process] through the team groups. The person who was key in each sector passed on the new guidelines to professionals in the sector (Physician, Brazil).

In Canada, in addition to creating a central committee on emergency measures and a sub-committee to facilitate communication between hospital management and frontline staff, the case study hospital also developed communication tools to ensure all hospital staff received up-to-date information about the hospital's status during the pandemic.

> You know, it was more about being up-to-date, making sure communications were in place. Our hospital made a big effort in communications . . . in terms of the 'InfoCoronavirus' newsletters, [that were] sent every day, which usually were on a website where they were . . . only accessible if you have a computer. But since most of our staff on the frontline don't have computers, they quickly made it . . . accessible from a cell phone . . . to really try to make sure . . . the information was flowing (Social worker, Canada).

Most of the innovations in the case studies were undertaken using existing, on-going budgets, but where additional funding was required, resources were mobilized from outside the hospital. For example, in Japan, the district head decided to use the district budget to implement the wide referral model and PCR testing site, which helped move the plan forward quickly. In Brazil, some equipment used for digital communication between patients and their families was purchased using community resources (funding) mobilized through the ComVida project.

> We managed to raise a very good amount of funds. We were able to buy tablets and smartphones so that the children had greater contact with their families . . . We got eight tablets and, I think, two or three cell phones (Physiotherapist, Brazil).

Discussion

The country case studies in Brazil, Canada, and Japan found that, to respond to the disruptions caused by COVID-19, the study hospitals undertook innovative changes in service provision, processes, organizational structure, and hospital operational policy. The need and urgency generated by the COVID-19 pandemic were the driving force behind these innovations. To maintain their function in health care service delivery when faced with the magnitude of the challenges caused by the pandemic, hospitals introduced innovative practices in health care service delivery which involved coordination of multiple groups of actors within, and sometimes outside, the hospitals. While previous studies suggest that simplicity in using and/or implementing innovations is an important characteristic in the adoption of an innovation,[4] with COVID-19, if an innovation met the perceived needs of hospitals and staff and provided an operational advantage, some level of complexity in the implementation appeared to be acceptable.

Among the organizational factors, an adaptive and flexible organizational structure, supported by hospital autonomy in management and decision-making, was found to be conducive to the creation of new ideas and operational changes within a short time frame. The

implementation of innovative changes in service delivery was also facilitated by functional communication mechanisms; strong, consistent, and timely support from hospital leadership; and shared values in service provision among hospital staff. These findings share commonalities with the existing literature on the adoption of innovations in health care service organizations.[21–24] While the availability of sufficient resources in a hospital is usually an enabler for implementation of innovation,[25] most of the innovations in the case studies were undertaken using existing, on-going budgets, but where additional funding was required, resources were often mobilized from outside the hospital. The availability of external resources may depend on the magnitude of the health shock in the population, the existence of functional relationship between hospitals and other health system actors, and the socio-economic context in which the hospital operates.

Furthermore, the social networks that hospitals had previously established with various actors in the health system played an important role in the successful adoption of innovations.[21] Important enablers of the implementation of the innovative actions in the ComVida project in Brazil, the sharing of infection control equipment between hospitals in Canada, and the development of a temporary, district-level referral mechanism in Japan were: the involvement of actor groups outside the hospital, existing networks and relationships, including relationships with other health facilities, local health administrators, etc.

Many of the innovations identified in this study were short-term, COVID-19-specific initiatives and the study did not look at the implementation process and dissemination of information relating to the innovative actions. However, some actions, such as the digital communication service for family members of hospitalized patients in Brazil, the in-house video training on IPC in Canada, and the wider application of total pain approach in Japan, should be considered for long-term adoption and dissemination to other settings to address issues inherent in health systems. To inform innovation in hospitals and health systems, further study is necessary to examine the subsequent implementation and/or discontinuation of the innovative actions identified in this study and to identify what determines whether an implementation will be long- or short-term or disseminated further within the health system.

This study focused on in-hospital factors that are conducive to the adoption of innovations in response to health shocks. However, the use of and types of innovative health care service delivery that help to adapt and transform challenges caused by health shocks can be impacted by broader health system factors, such as the structure of health care service delivery in a country, health care financing mechanisms, etc.[26–28] Consequently, further study is necessary to investigate the organizational and broader health system factors that enable the creation and adoption of innovative ideas to respond to health shocks.

Conclusions

The need and urgency created by the COVID-19 pandemic were the driving forces behind most of the innovative actions identified in the case studies in Brazil, Canada, and Japan. These innovations were adaptive and transformative actions that produced incremental and systemic changes, contributing to resilience in organizations facing disruptive challenges.[8,22] The synthesis of the three country case studies suggests that, for hospitals to create and implement innovations to respond to future health shocks and to strengthen hospital resilience, they need to have adaptive and flexible organizational structures; build and maintain well-functioning communication systems; have committed leadership; ensure all staff share an understanding of the hospital's organizational and professional mission; and establish social networks that facilitate the ability to create and implement ideas that ensure functioning during health shocks.

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Ethical Approval (If Applicable)

In Brazil, the study was approved by the National Research Ethics Commission (Comissão Nacional de Ética em Pesquisa (CONEP); CAAE: 30982620.8.0000.0008). In Canada, ethics approval was granted by the Science and Health Research Ethics Board at the University of Montréal (CERSES-20-061-D). In Japan, ethics approval was obtained from the Sophia University Ethics Committee for Research on Human Subjects (No. 2020-42).

Informed Consent From Participants (If Applicable)

All participants provided written informed consent for their interviews to be used in the study.

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