THE EUROPEAN SOCIETY OF MEDICINE
Medical Research Archives, Volume 13 Issue 1

RESEARCH ARTICLE

Institutional Capacity of Long-Term Care Facilities in China During the COVID-19 Pandemic

Jun Zhang[1,2], Di Xiao [3], Yushan Yu[2], Jiehui Ren[4], Xiaomei Pei[1], Wei-Hong Zhang [2,5]

[1] Research Center for Medical Sociology, Tsinghua University, Beijing, China
[2] International Centre for Reproductive Health (ICRH), Department of Public Health and Primary Care, Ghent University, Gent, Belgium
[3] Department of Comprehensive Maternal and Child Health, Guangzhou Women and Children's Medical Center, Guangzhou Medical University, Guangdong Provincial Clinical Research Center for Child Health, Guangzhou, China
[4] Hebei University, Baoding, China
[5] School of Public Health, Université libre de Bruxelles (ULB), 1070 Brussels, Belgium

OPEN ACCESS

PUBLISHED
31 January 2025

CITATION
Zhang, J., Di, X., et al., 2025. Institutional Capacity of Long-Term Care Facilities in China During the COVID-19 Pandemic. Medical Research Archives, [online] 13(1). https://doi.org/10.18103/mra.v13i1.6126

DOI
https://doi.org/10.18103/mra.v13i1.6126

ISSN
2375-1924

ABSTRACT

Background: The coronavirus disease 2019 (COVID-19) pandemic has heavily impacted long-term care facilities (LTCFs) worldwide, resulting in extremely high infection and death rates within these settings. One major factor is the limited institutional capacity of long-term care facilities to respond effectively to such public health emergencies. However, there is limited research on this topic, especially concerning China. Therefore, this study seeks to examine the institutional capacities of long-term care facilities of China to better understand these challenges and identify measures for improving long-term care provision in future public health emergencies.

Objective: To assess the institutional capacity of Chinese long-term care facilities during public health emergencies.

Methods: A cross-sectional study collected data from 104 long-term care facilities across 20 provincial capitals or prefecture-level cities in China through questionnaires. Institutional capacity was measured with the social organization development index encompassing six dimensions: activity, resources, structure, environment, value and influence.

Results: Institutional capacity encompassing six dimensions showed scores of 76%, 63%, 95.9%, 75.4%, 63.1% and 74.1% in Activity, Resources, Structure, Environment, Value and Influence, respectively. These results indicate areas of strength, as well as notable gaps where improvements would be needed.

Conclusion: The social organization development index provides a comprehensive framework for assessing the institutional capacities of long-term care facilities and their roles during a public health crisis. The findings may offer insights into government policymaking related to the industry, particularly in enhancing institutional capacities to improve virus prevention and control during future public health emergencies.

Keywords: Institutional Capacity; Long-Term Care Facilities (LTCFs); Social Organization Development Index; Six dimensions; COVID-19; China

Introduction

COVID-19 pandemic has led to a significant high death rate among elderly population worldwide, especially among those in long-term care facilities (LTCFs). In the European region, the World Health Organization (WHO) reported that over 95% of COVID-19 fatalities were among individuals aged 60 and above.[1] In North America, residents in these facilities faced a fivefold higher mortality risk than seniors living within the community.[2] In the United States, the death rate of residents in LTCFs was over three times higher than the national average,[3] and in Canada, deaths within LTCFs accounted for more than 80% of the country's deaths.[4] These facilities have thus emerged as epicenter of COVID-19, struggling to protect residents from severe outcomes associated with the virus's morbidity and mortality.[5]

It has been globally recognized that long-term care facilities were "heavily impacted areas" of the COVID-19 pandemic, with mortality related to COVID-19 among their residents consistently exceeding that of the general population worldwide. COVID-19-related death rates in LTCFs have shown wide regional and international variation, ranging from 8% to 75% by early 2021. In Europe, COVID-19 related deaths exceeded 50% in Belgium and Netherlands, compared to less than 30% in Germany according to the European Centre for Disease Prevention and Control.[6] In North America, LTCFs accounted for 50% of total deaths in Canada and 34% in the Unites States.[7] Comparatively, Oceania reported higher death rates than Asia.[8] (Figure 1).

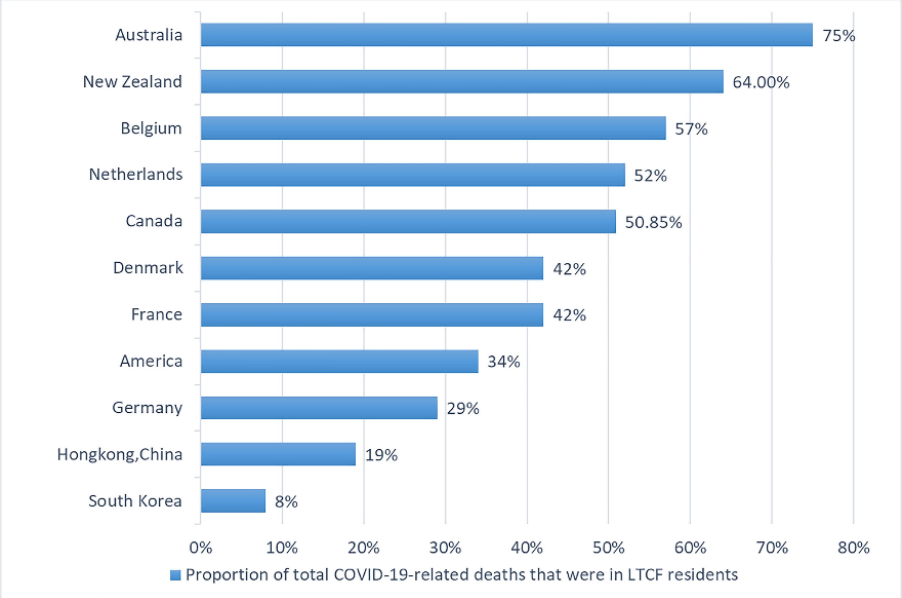

Figure 1: COVID-19-related Death Rates among Residents in LTCFs
(Data resource: European Centre for Disease Prevention and Control, 2021)

The pandemic also had a profound effect in China, particularly in Wuhan. The China Center for Disease Control and Prevention documented 82,545 COVID-19 cases in the first three months of the outbreak in 2020, with individuals aged 60 and older representing 30.2% of cases and accounting for over 80% of deaths, which indicated elderly were undoubtedly the most vulnerable group during the pandemic in China.[9]

These significant mortality differences across countries and regions highlighted that, in addition to acute medical interventions, the potential influence of preventive strategies on the outcomes in these facilities during public health emergencies. In many countries, the LTCFs residents faced higher risk due to the rapid spread of the COVID-19 virus.[10] Infected individuals were mostly transferred to hospitals for treatment, while those remaining in the facilities, along with caregivers and staff, adhered to strict quarantine measures.[11] Facilities with strict protocols reported lower infection rates compared to those that did not,[12] as well as reduced rates of COVID-related hospitalizations and deaths.[13,14]

The pandemic highlighted the need to examine the internal experience of these quarantined facilities and how the institutional factors, such as a strict lockdown measure, affecting the daily living of their residents and operational management.[15] Moreover, given the responsibilities of health system governance, it became essential to examine the relationship between resource allocation and its impact on the operations of LTCFs during the COVID-19 pandemic.[16]

Over the past three decades, China's rapidly aging population has spurred significant growth of LTCFs, with over 34,000 facilities registered in the country by the end of 2019.[17] This expansion bolstered institutional capacity, but the COVID-19 pandemic and subsequent quarantine requirements posed unforeseen challenges. Worse still, the prioritization of resources for hospitals and community prevention leaving LTCFs only with limited support,[18] resulting these facilities encountered many management challenges, including shortages of critical supplies, personal protective equipment (PPE), diagnostic tests, and staffing etc. during the pandemic.[19]

To understand how LTCFs adapted their risk management and managed the infection is also an added value for assessing the capacity of the healthcare system in aging societies. This study employs a comprehensive framework of institutional capacity to examine the resilience of Chinese LTCFs during the COVID-19 pandemic.

Methods

DATA COLLECTION

Data were collected through questionnaire surveys using a standardized instrument designed to measure capacity building efforts of long-term care facilities during the pandemic.

The questionnaire collected detailed information on resident demographic, facility characteristics, challenges encountered, the infection control measures implemented during the pandemic, as well as the current capacity-building efforts and outcomes.

A convenience sampling approach was employed, collecting data from 104 LTCFs across 20 provincial capitals or prefecture-level cities in China between November 2020 to March 2021 (Figure 2).

Figure 2: Geographical Distribution of the 104 LTCFs Surveyed

The questionnaire, intended for facility managers, was divided into four sections:

1) Characteristics of LTCFs (see Supplemental Table 1)
2) Characteristics of residents (see Supplemental Table 2)
3) Current status and challenges, measures implemented in LTCFs during the COVID-19 pandemic
4) Institutional capacity of nursing

Measures

Institutional capacity was evaluated using the Social Organization Development Index, encompassing six dimensions: activity, resource, structure, environment, value, and influence (United States Agency for International Development, 2021).[20] Specifically, the availability of key services and resources at each LTCF were examined, including health assessments for residents, full-time psychological support, diagnostic and treatment facilities, exercise equipment, hospice services, hospital affiliations, collaborations with other agencies, social support funding, tax exemptions, and media support. Additionally, the survey also investigated the strategies for public image management, resource acquisition, and employee qualifications assessment at the LTCFs.

The availability of services and resources at the LTCFs were determined using binary codes, which “absent” ("no" = 0) and “present ("yes" = 1) were assigned. Specific factors evaluated included the presence of full-time psychological consultants, medical diagnostic and treatment facilities, exercise equipment, medical services, partnership agreement or with hospitals, telemedicine services, health and disease management for residents, hospice care, funding support, tax reductions or exemptions, media publicity, policy recommendations or proposals to governments or local authorities, cooperation with other agencies, and health assessment for the residents. Further areas of investigation included promotional slogan of LTCFs, resource demands, decision-making processes, conflict resolution methods, and organizational structures of the LTCFs.

Six dimensions

For each dimension different indicators were used to assess the institutional capacity, and the result of each dimension was calculated as the average of these indicators.

1) **Activity**
   Calculated by the average responses and activities undertaken by LTCFs across two phases: during the first outbreak (January 23 to April 7, 2020) and phased success in controlling (April 8 to June 30, 2020) of the COVID-19 pandemic.
2) **Resource**
   Measured based on the average score of the indicators of technical assistance, government and non-governmental organizations.
3) **Structure**
   Determined by averaging responses across organizational systems, encompassing staff employment, financial management, project management, and records management systems.

4) Environment

Calculated by averaging factors such as tax exemptions, information and media support, and registration status.

5) Value

Assessed through the average score of the indicators, identified as presence of corporate culture elements (e.g., mottos or slogans) and staff awareness, which encompassed the awareness levels of key leaders, internal staff, residents as well as the residents' family and social support departments.

6) Influence

Gauged by the average level of LTCFs' promotional materials, media coverage, policy recommendations submitted to governmental authorities, and information exchange and resource-sharing initiatives with other LTCFs.

STATISTICAL ANALYSIS

Data were managed and analysed using Microsoft Excel 2017 and SPSS version 20.0 (IBM SPSS, Chicago, IL). Descriptive and univariable analyses were performed to identify LTCFs' resident characteristics, current facility conditions, and COVID-19 pandemic related challenges.

Results

Activity

Onset of 1st COVID Outbreak (January 23 to April 7, 2020)

Table 1 (see below) presents the responses and activities of LTCFs at different stages of the COVID-19 pandemic. At the onset of the outbreak (January 23 to April 7, 2020), 94.2% of the 104 LTCFs reviewed relevant policies and regulations issued by government and industries, and 96.1% established specific measures and detailed regulations. Additionally, 38.8% of LTCFs provided COVID-19 knowledge training for residents, while 44.7% offered similar training for staff.

During this period, 71.8% of LTCFs organized cultural activities, and 91.4% facilitated residents to maintain interaction with families via video and phone calls. Social welfare activities, such as public education, were held by 61.2% of the facilities. Furthermore, 68.9% LTCFs carried out nucleic acid testing and 95.1% required residents to wear masks and undergo regular temperature checks. The average activity rate across these measures during the initial outbreak was calculated as follows: (94.2% + 96.1% + 38.8% + 44.7% + 71.8% + 91.4% + 61.2% + 68.9% + 95.1%) / 9 **= 73.6%.**

Table 1: Responses and activities of LTCFs during different stages of the COVID-19 pandemic (N=104)

Variables	2020.01.23-04.07		2020.04.08-06.30		P
	N	%	N	%	
Learn policies and regulations (issued by government and industries)					
No	6	5.8	5	4.9	0.757
Yes	97	94.2	98	95.1	
Missing data	1		1		
Formulate Measures and **detailed rules**					
No	4	3.9	5	4.9	0.733
Yes	99	96.1	98	95.1	
Missing data	1		1		
Carry out COVID-19 knowledge training for residents					
No	63	61.2	61	59.2	0.776
Yes	40	38.8	42	40.8	
Missing data	1		1		
Carry out COVID-19 knowledge training for staff					
No	57	55.3	55	53.4	
Yes	46	44.7	48	46.6	0.780
Missing data	1		1		
Conduct cultural activities					
No	29	28.2	14	13.6	0.010*
Yes	74	71.8	89	86.4	
Missing data	1		1		
Allow interaction with family (via video and phone calls)					
No	7	6.8	4	3.9	0.353
Yes	96	91.4	99	96.1	
Missing data	1		1		
Organize social welfare (public education, etc.)					
No	40	38.8	32	31.1	0.242
Yes	63	61.2	71	68.9	
Missing data	1		1		
Provide COVID-19 nucleic acid testing					
No	32	31.1	18	17.5	0.023*
Yes	71	68.9	85	82.5	
Missing data	1		1		
Require mask-wearing and temperature detection					
No	5	4.9	2	1.9	0.249
Yes	98	95.1	101	98.1	
Missing data	1		1		

*P<0.05

The second period (April 8 to June 30, 2020)

As China achieved phased success in controlling COVID-19, 95.1% of LTCFs reviewed policies and regulations issued by government and industry bodies and developed corresponding measures and detailed regulations. COVID-19 knowledge training was offered to residents by 40.8% of the facilities and to staff by 46.6%. Cultural activities were held by 86.4% of LTCFs, and 96.1% facilitated residents maintaining interactions with families through video and phone calls. Social welfare activities were held by 68.9% of the LTCFs, while 82.5% provided nucleic acid testing. Nearly all LTCFs (98.1%) enforced the practice of mask-wearing and temperature-checking. Hence, during this period the average activity rate was: (95.1% + 95.1% + 40.8% + 46.6% + 86.4% + 96.1% + 68.9% + 82.5% + 98.1%) / 9 **= 78.4%.**

The overall activity dimension, calculated by averaging levels across both stages, was 76%. In addition, the proportion of LTCFs conducting cultural activities and nucleic acid tests during the second period was significantly higher than that during the initial outbreak phase ($P<0.05$), while no statistical significance was found between the two stages in the activities carried out ($P>0.05$).

Resource

During the COVID-19 pandemic, LTCFs frequently encountered resource shortages, particularly in foundational support (55.9%), volunteers (48.0%), nurses (44.7%), non-governmental organization support (44.0%), information and media support (37.3%), government support (33.7%), technical support such as training (33.3%), and staffing (29.4%) (Table 2).

Table 2. Characteristics of LTCFs' demand during the COVID-19 pandemic (N=104).

Variables	Number	Proportion (%)
Foundation		
Shortage	57	55.9
Meeting needs basically	38	37.3
Meeting the needs	7	6.9
Missing data	2	
Staff		
Shortage	30	29.4
Meeting needs basically	61	59.8
Meeting the needs	11	10.8
Missing data	2	
Nurses		
Shortage	46	44.7
Meeting needs basically	48	46.6
Meeting the needs	9	8.7
Missing data	1	
Volunteers		
Shortage	49	48.0
Meeting needs basically	42	41.2
Meeting the needs	11	10.8
Missing data	2	
Technical support (e.g. training)		
Shortage	34	33.3
Meeting needs basically	59	57.8
Meeting the needs	9	8.8
Missing data	2	
Information and media		
Shortage	38	37.3
Meeting needs basically	57	55.9
Meeting the needs	7	6.9
Missing data	2	
Government support		
Shortage	34	33.7
Meeting needs basically	56	55.4
Meeting the needs	11	10.9
Missing data	3	
Non-governmental organization support		
Shortage	44	44.0
Meeting needs basically	49	49.0
Meeting the needs	7	7.0
Missing data	4	

Resources of LTCFs are evaluated based on the support they have received across different sectors. Results showed that 66.7% of the facilities received technical support and 66.3% received government support and 56% were supported by non-governmental organizations. Therefore, the average resources accessibility for LTCFs was: (66.7% + 66.3% + 56%) / 3 **= 63%.**

Structure

During the COVID-19 pandemic, LTCFs reported having clear and comprehensive systems in place for staff employment (96.2%), financial management (97.1%), project management (94.2%), and records management (96.0%) (Table 3). The average value of institutional construction was: (97.1% + 96.2% + 96% + 94.2%) / 4 **= 95.9%.**

Table 3: The Organization system of LTCFs during the COVID-19 pandemic

Variables	None	Yes, but not clear	Yes, clear and complete
Staff employment system, n (%)	2(1.9)	2(1.9)	100(96.2)
Financial management system, n (%)	1(1.0)	2(1.9)	101(97.1)
Project Management system, n (%)	2(1.9)	4(3.8)	98(94.2)
Records management system, n (%)	2(1.9)	2(1.9)	100 (96.0)

Environment

Based on the quantitative questionnaire, 63.5% of LTCFs reported benefiting from tax exemptions (see Supplemental Table 4), while 37.3% indicated a lack of information and media support (see Table 2). All LTCFs in the study were registered (100%). The calculated social environment score was: (63.5% + 62.7% + 100%) / 3 = 75.4%.

Value

In assessing the value of LTCFs, the highest awareness level regarding COVID-19 related knowledge was observed among internal staff (62.1%), followed by key leaders (61.2%), residents (57.3%), residents' family members (35.9%), and social support departments (34.0%), resulting in an average awareness level of 50.1% (see Supplemental Table 4). Furthermore, 76% of the LTCFs employed mottos or slogans, suggesting a focus on cultivating a corporate philosophy that highlights their values and vision (see Supplemental Table 5). These mottos or slogans served as key elements of corporate culture and symbols of unity. Therefore, the average value of LTCFs was: (50.1% + 76%) / 2 = 63.1%.

Influence

Among the LTCFs in this study, 87.5% reported having their own promotional materials, and 88.5% reported media coverage of their activities, while 52.9% had made policy recommendations to national or local government departments, and 67.3% engaged in resources and information sharing with other LTCFs (see Supplemental Table 5). Therefore, the average social impact of LTCFs was: (87.5% + 88.5% + 52.9% + 67.3%) / 4 **= 74.1%.**

The study revealed several key aspects of LTCFs' institutional capacity in China as depicted in Figure 3.

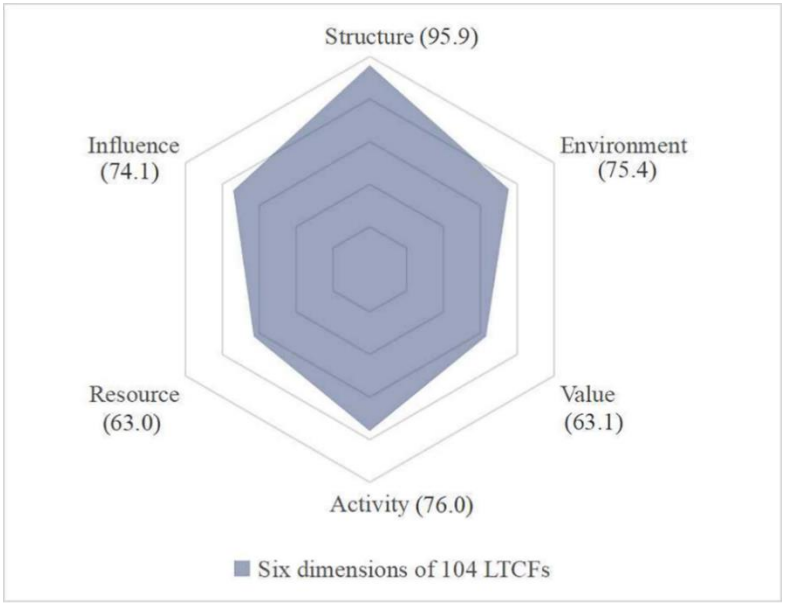

FIGURE3 The Six Dimensions of the Value of Long-term Care Facilities

Discussion

In this study, the six dimensions – activity, resource, structure, environment, value, and influence – were measures across 104 LTCFs, with scores of 76%, 63%, 95.9%, 75.4%, 63.1% and 74.1%, respectively, highlighting both strengths and areas for improvement across the facilities.

Throughout the COVID-19 pandemic, LTCFs implemented various measures, including reviewing policies and regulations, introducing prevention and control measures, training residents and staff on COVID-19 related knowledge, organizing cultural activities, facilitating family interactions, providing public education, organizing nucleic acid testing, and enforcing mask-wearing and temperature checks. During the initial outbreak, the average LTCF activity score for LTCFs was 73.6%, which increased to 78.4% following China's initial success in countering COVID-19. Besides, 76% of the LTCFs conducted various well-targeted activities aimed at combating the pandemic. According to the survey, these measures proved effective in preventing and controlling the virus spread as well as supporting residents' health and well-being. This indicated that LTCFs effectively prioritized and executed their responsibilities. By comparing the figures before and after the COVID-19 pandemic, we found that LTCFs intensified their efforts in the prevention and control of the virus during the outbreak.

However, the study identified that resources received the lowest score among the six dimensions at 63%, pointing

to a need for increased support in technical resources, government support, and NGO engagement. While government support was considerable significant, enhancing contribution from NGOs and volunteer involvement remained a critical area for further development.

The social impact of LTCFs has shown considerable improvement over time, reflecting an ongoing evolution in their role in society. The recent score of 74.1% in social impact indicates that LTCFs have made significant strides in policy advocacy, public relations, and industry integration, which were the keys for enhancing LTCFs' social acceptance and public awareness of LTCFs' role in providing care to the vulnerable population, especially the elderly and those with long-term health condition. However, additional efforts are required to further strengthen public awareness and acceptance, as well as to substantially enhance the media presence and informational support for LTCFs.

In addition, the assessment also revealed LTCFs generally had a well-defined corporate culture, as evidenced by the value score of 63.1%. This highlighted the importance of institutional values and areas for improvement. The high awareness level among leaders and staff underscored their professional knowledge and commitment to humanistic care. However, engagement with residents and their families was relatively modest, suggesting a need for enhanced communication with residents and their families, which could help LTCFs better understand residents' backgrounds and health conditions, facilitating the provision of higher-quality care.

Moreover, staff awareness of LTCFs still needed Reinforcement, especially in social support, where the LTCFs scored the lowest. To bridge this gap, the recommendation included strengthening public relations and promoting volunteer involvement in welfare activities. The prevalence of organizational mottos and slogans in LTCFs indicated a focus on cultivating a distinct philosophy aligning with their identity and service principles.

In the structure dimension, LTCFs showed strength with an average score of 95.9%, demonstrating robust system that benefited for both management and operations resilience during the COVID-19 crisis. Meanwhile, an environmental dimension score of 75.4% showed positive social support and recognition, though suggested a need of increasing volunteer participation and public awareness concerning LTCFs.

The capacity building assessment further identified significant gaps in certain areas. Specially 62.5% of the LTCFs reported a deficit in employing full-time counselling staff, highlighting the urgent need for strengthened mental health support. This was particularly critical during lockdown periods when residents were more likely to experience anxiety and other mental health challenges. Psychological counselling was essential support for ensuring residents' compliance with the infection prevention and control measures.

Additionally, 43.3% of LTCFs lacked on-site medical diagnosis and treatment facilities, though 61.0% had established their own or affiliated age-care hospitals. Telemedicine connections facilitated prioritized ("green channel") services with 80.8% of general hospitals. However, 78.6% of LTCFs had not set up general clinics within these partner hospitals, suggesting a gap in the integration of healthcare services.

While most LTCFs (91.3%) were equipped with physical exercise and rehabilitation equipment, showing a strong commitment to residents' physical fitness and rehabilitation needs. Developing tailored prevention and rehabilitation programs for residents, based on their age, health conditions, and individual needs, could ensure that residents receive the most suitable and up-to-date services.

Furthermore, 81.7% of LTCFs indicated their capability in health and disease management for their residents, and 88.8% reported the capability for conducting physical health assessments for new admissions, allowing for customized care plans and appropriate fee structures.

However, the study found that hospice care services were available in only 51.9% of the LTCFs. facilities (see Supplemental Table 3). This highlights the critical need to expand and enhance hospice services, ensuring that end-of-life care is available to all residents who require it. Improved collaboration with medical institutions was recommended to provide residents with comprehensive support, including pain management and appropriate medication.

Limitations

This study acknowledged certain limitations. First, the small sample size might not fully represent the diverse landscape of LTCFs, potentially limiting the generalizability of the findings. In addition, the survey's scope did not thoroughly address all aspects of LTCF operations, which restricted the understanding of their foundational situations. Given that this study primarily assessed the impact of closed management and the overall institutional capacity of LTCFs in China during the COVID-19 pandemic, future research should aim to expand both the detail and breadth of data collection. Furthermore, exploring the relationship between LTCFs' capacity building and pandemic outcomes would be valuable in identifying effective and practical strategies for infectious diseases management within such settings.

Conclusions

The development of a six-dimension Social Organization Development Index has enabled a more systematic and comprehensive evaluation of the institutional capacity of LTCFs in managing public health emergencies. This framework has proven to be an invaluable tool for policymakers in designing targeted policies that address the specific needs of LTCFs effectively during public health crises.

Future research should focus on identifying strategies and methods to enhance medical services in LTCFs during pandemics, with particular emphasis on improving the integration of medical and hospice care. Strengthening these areas will be crucial in providing more holistic support to residents' comprehensive needs.

Research Implications

Basing on the six dimensions and capacity building of the LTCFs, the government could develop a Social Organization Development Index to serve as a comprehensive framework for assessing the institutional capacity and role of LTCFs during public health crises.
In addition, society should direct more attention and resource toward older adults in LTCFs, providing greater support and assistance for the growth and development of these facilities.

Finally, LTCFs should enhance collaboration with medical institutions, especially during the times of public health crisis.

Author Contributions

Study design: ZJ, ZWH;
data collection: ZJ, R JH, YYS;
data analysis: XD;
study supervision: PXM, ZWH;
manuscript writing: ZJ;
critical revisions for important intellectual content: ZWH, ZJ, XD.

Funding Information

This research study was funded by the Tsinghua University Spring Breeze Foundation under Grant No: 20203080032.

Ethical Considerations

Data were collected, anonymized, and processed for analysis. The study was approved by the Institutional Review Board of Tsinghua University (No. 2020019). Participation was voluntary, with all participants fully informed about the purpose of this study.

Conflict of Interest Statement

The authors declare no conflict of interest.

Acknowledgments

The authors extend their sincere appreciation to all the participating long-term care facilities involved in this study.

Data Availability Statement

Data supporting the findings of this study are available from the corresponding author upon reasonable request.

Supplemental Table

Supplemental Table 1: Basic characteristics of participated long-term care facilities (LTCFs) (N=104).

Variable	N (%)
Type of institutions	
Government owned and operated	25(24.0)
Government owned but privately operated	21(20.2)
Privately owned and operated	53(51.0)
Privately owned but government supported	5 (4.8)
Year of establishment time	
1950-1960	6(5.8)
1961-1970	2(1.9)
1971-1980	1(1.0)
1981-1990	2(1.9)
1991-2000	5(4.9)
2001-2010	22(21.4)
2011-2020	65(63.1)
Missing data	1
Geographical distribution	
Eastern region	45(43.3)
Central region	40(38.5)
Western region	19(18.3)
Bed numbers	32,101(100)
Bed occupancy rates, % (Mean±SD)[a]	67.7±24.7
Mode of Combination of Medical Treatment and Endowment	
Hospitals run nursing homes	10(10.9)
Nursing homes run hospitals	19(20.7)
Contract hospital services	36(39.1)
Combination of medical care and health	27(29.3)
Missing data	12

[a] Missing data =3

Supplemental Table 2: Characteristics of residents (N=19,914).

Variables	Number	Proportion (%)
Residents	19,914	100
Gender		
Male	8147	41.7
Female	11,389	58.3
Missing data	808	
Age, year		
60 to 69	2413	13.7
69 to 79	4049	23.0
80 to 89	8623	49.0
> 90	2505	14.2
Missing data	2754	
Physical condition		
Self-reliant	6356	32.5
Partial loss of self-care	5338	27.3
Unable to self-care	7887	40.3
Missing data	808	

Supplemental Table 3: The cognitive degree level for COVID-19 related knowledge of staff in long-term care facilities during the COVID-19 epidemic.

Variables	Unclear	Not quite clear	Preliminary understanding	More familiar	Very familiar	Missing data
Key leaders, n (%)	1(1.0)	3(2.9)	4(3.9)	32(31.1)	63(61.2)	1
Internal staff, n (%)	1(1.0)	3(2.9)	2(1.9)	33(32.0)	64(62.1)	1
Residents, n (%)	1(1.0)	3(2.9)	10(9.7)	30(29.1)	59(57.3)	1
Residents' family members, n (%)	0	5(4.9)	19(18.4)	42(40.8)	37(35.9)	1
Social support departments, n(%)	2(1.9)	13(12.6)	30(29.1)	23(22.3)	35(34.0)	1

Supplemental table 4: Characteristics of capacity of LTCFs during the COVID-19 epidemic (N=104)

Variables	Number	Proportion (%)
Full-time psychological consultant		
No	65	62.5
Yes	39	37.5
Medical diagnostic and treatment facilities		
No	45	43.3
Yes	59	56.7
Physical exercise and rehabilitation equipment		
No	9	8.7
Yes	95	91.3
With medical qualification and establish care hospital		
No	40	38.5
Yes	64	61.5
Establishment of Medical Service Agreement with General Hospital (Green Channel)		
No	20	19.2
Yes	84	80.8
Telemedicine services		
No	80	76.9
Yes	24	23.1
Establish a general clinic with cooperative hospitals		
No	82	78.8
Yes	22	21.2
Health and disease management for residents		
No	19	18.3
Yes	85	81.7
Provide physical health assessment for the newly residents		
No	11	11.2
Yes	87	88.8
Missing data	6	
Provide palliative care (hospice care) services		
No	50	48.1
Yes	54	51.9
Enjoy tax relief treatment		
No	19	18.3
Yes	66	63.5
Unclear	19	18.3

Supplemental Table 5: The publicity status of long-term care facilities during the COVID-19 epidemic (N=104)

Variables	Number	%
Information on the LTCFs' own promotional materials		
No	13	12.5
Yes	91	87.5
Media coverage of activities organized by LTCFs		
No	9	8.7
Yes	92	88.5
Unclear	3	2.9
Make policy recommendations to the authorities of the state or local government		
No	49	47.1
Yes	55	52.9
Share resources and information with other LTCFs		
No	33	32.7
Yes	68	67.3
Missing data	3	
Top support for LTCFs		
Media	11	11.3
Academic community	11	11.3
Business authorities	71	73.2
Registration and annual review authorities	3	3.1
Other parts of government	1	1.0
Missing data	7	
Established motto or slogan for LTCFs		
No	25	24.0
Yes	79	76.0

References

1 Kluge H. Older people are at highest risk from COVID-19, but all must act to prevent community spread. World Health Organization statement. Published April 3, 2020. https://www.who.int/europe/news/item/03-04-2020-statement-older-people-are-at-highest-risk-from-covid-19-but-all-must-act-to-prevent-community-spread.

2 Fisman DN, et al. Risk factors associated with mortality among residents with coronavirus disease 2019 (COVID-19) in long-term care facilities in Ontario, Canada. *JAMA Netw Open*. 2020;3(7):e2015957. doi:10.1001/jamanetworkopen.2020.15957.

3 Canadian Institute for Health Information. Long-term care and COVID-19: international comparisons. Published 2023. https://www.cihi.ca/en/long-term-care-and-covid-19-international-comparisons.

4 Barnett ML, Grabowski DC. Nursing homes are ground zero for COVID-19 pandemic. *JAMA Health Forum*. 2020;1(3):e200369. doi:10.1001/jamahealthforum.2020.0369.

5 Cronin CJ, Evans WN. Nursing home quality, COVID-19 deaths, and excess mortality. *J Health Econ*. 2022;82:102592. doi:10.1016/j.jhealeco.2022.102592.

6 European Centre for Disease Prevention and Control. Surveillance data from public online national reports on COVID-19 in long-term care facilities. Published 2021. https://www.ecdc.europa.eu/en/all-topics-z/coronavirus/threats-and-outbreaks/covid-19/prevention-and-control/LTCF-data.

7 Curiskis A, et al. What we know—and what we don't know—about the impact of the pandemic on our most vulnerable community. Published 2021. https://covidtracking.com/analysis-updates/what-we-know-about-the-impact-of-the-pandemic-on-our-most-vulnerable-community.

8 Comas-Herrera A, et al. Mortality associated with COVID-19 in care homes: international evidence. International Long-term Care Policy Network (ILPN); 2021.

9 Lu Q, et al. Social policy responses to the Covid-19 crisis in China in 2020. *Int J Environ Res Public Health*. 2020;17(16):5597. doi:10.3390/ijerph17165597.

10 Cazzoletti L, et al. Risk factors associated with nursing home COVID-19 outbreaks: a retrospective cohort study. *Int J Environ Res Public Health*. 2021;18(16):8696. doi:10.3390/ijerph18168696.

11 Li Z. How can private elderly care institutions get out of the epidemic "swamp" after their income plummeted by 20%. Published April 29, 2020. https://m.gmw.cn/baijia/2020-04/29/33794113.html.

12 Dykgraaf SH, et al. Protecting nursing homes and long-term care facilities from COVID-19: a rapid review of international evidence. J Am Med Dir Assoc. 2021;22(10):1969-1988. doi:10.1016/j.jamda.2021.06.027.

13 Ham C. A home by any other name: building an understanding of infection prevention in small residential care facilities. Public Policy & Aging Report. 2022;32(4):140-145.

14 Létourneau J, et al. Identifying performance factors of long-term care facilities in the context of the COVID-19 pandemic: a scoping review protocol. *Syst Rev*. 2022;11(1):203. doi:10.1186/s13643-022-01975-6.

15 Fleming SP, et al. COVID-19 cases, hospitalizations, and deaths in nursing homes: factors impacting the second surge. *Innov Aging*. 2021;5:15-16.

16 Yin C, et al. Factors associated with nursing home residents' COVID-19 infections: a systematic review of literature. *Innov Aging*. 2021;5:16-16.

17 Ministry of Civil Affairs of the People's Republic of China. China Civil Affairs Statistical Yearbook. Beijing, China: China Social Press; 2020.

18 Frank L, Concannon T, Patel K. Health care resource allocation decision-making during a pandemic. Santa Monica, CA: RAND Corporation; 2020.

19 Abbasi J. "Abandoned" nursing homes continue to face critical supply and staff shortages as COVID-19 toll has mounted. *JAMA*. 2020;324(2):123-125.

20 United States Agency for International Development. Organizational performance index: definitions and measurements. https://pdf.usaid.gov/pdf_docs/PA00XM82.pdf .

