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Research

Home care for COVID-19 positive cases: suitability of the residential setting and ability of cases to adhere to the required preventive measures

Dalal Youssef[1,2,3,4] · Abir Abou Naja[5] · Suzan Farhat[5] · Linda Abou-Abbas[4,6] · Hamad Hassan[5]

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Abstract

Introduction With the upsurge of COVID-19 cases, Lebanese hospitals were overburdened and hospital care was prioritized for COVID-19 patients with the highest probability of poor outcomes. This paper aimed to assess the suitability of residential settings for home isolation and to explore the patient's ability to adhere to the required precautions measures.

Methods All COVID-19 cases reported between February, 21 and the end of June 2020 and who had mild or moderate symptoms, were contacted via phone calls by a healthcare professional to fill out a standardized questionnaire developed to assess the suitability of the residential setting for home care. Inpatient cases were required, before their discharge from the hospitals, to sign consent related to their adherence to the mandatory precautionary measures. They were also asked to complete, on daily basis, the symptoms monitoring log form. A referral system to health facilities was established to manage cases with worsening health status. A collaborative framework to address violations of home isolation rules was also put in place.

Results Of the 600 cases assessed, 44.7% of them were isolated in a living building apartment (67.2%) with one entrance (85.5%) including four to eight rooms (71%). Around one-quarter of patients have children (< 5 years) and 75% of them were living with elderly people. Most of the patients confirmed the availability of a well-ventilated single room (96.2%) and a separate bathroom (80.17%). As for infrastructure, more than 90% of patients confirmed the availability of drinking and tank water, heating facilities, electricity, and safe trash elimination. Similarly, more than 90% of them had access to personal hygiene items, disinfectants, and personal protective equipment. The bulk of homes care were rated as easily reachable. As for awareness and ability to self-serving, 94.5% of patients were knowledgeable about the required preventive measures, able to serve themselves and to adhere to the isolation requirements as well. Only 51.8% of them had access to psychological support.

Conclusion Proper assessment of the residential setting for home care of COVID-19 cases combined with close monitoring of the adherence of patients to the required precaution measures are highly needed for limiting the spread of infection within the household and the community.

Keywords Home isolation · Assessment · Residential setting · COVID-19

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✉ Dalal Youssef, dyoussef@moph.gov.lb; dalalyoussef.esu@gmail.com | [1]Preventive Medicine Department and Clinical Trial Program, Ministry of Public Health, Beirut, Lebanon. [2]Bordeaux Research Center for Population Health, Institut de Santé Publique, d'épidémiologie et de Développement (ISPED), Bordeaux University, Bordeaux, France. [3]Clinical Trial Program, Ministry of Public Health, Beirut, Lebanon. [4]Institut National de Santé Publique, Epidémiologie Clinique et Toxicologie (INSPECT-LB), Beirut, Lebanon. [5]Ministry of Public Health, Beirut, Lebanon. [6]Neuroscience Research Center, Faculty of Medical Sciences, Lebanese University, Beirut, Lebanon.

Abbreviations

COVID-19	Coronavirus Disease 2019
MOPH	Ministry of Public Health
IPC	Infection prevention and control
WHO	World Health Organization
IHR	International Health Regulations
CDC	Centers for Disease Control and Prevention
HBC	Home-based care
SPSS	Statistical Package for Social Sciences

1 Introduction

COVID-19 was an acute illness caused by a novel coronavirus that was initially identified in Wuhan, China, in late 2019 [1, 2]. On January 20, 2020, it was confirmed that SARS-CoV-2 could be transmitted from human to human [3]. However, since this virus was entirely new to humans, there was no preexisting immunity. Consequently, the virus rapidly spread across the Globe, leading the World Health Organization (WHO) to declare it a pandemic on March 11, 2020 [4]. With no preexisting immunity, the virus swiftly spread worldwide, necessitating isolation measures. Traditionally implemented in hospital settings, isolation involves separating individuals with contagious illnesses to prevent transmission [5]. Isolation involves separating or limiting the activities of individuals with contagious illnesses from those who are uninfected. However, when it's not possible to isolate patients in healthcare facilities, it becomes essential to prioritize hospital care for those at a high risk of experiencing severe outcomes [6–8].

In the context of the prevailing circumstances, the implementation of home care isolation has emerged as a pivotal strategy for the management of mild to moderate COVID-19 cases, concurrently optimizing the utilization of hospital resources [9]. Home care isolation for individuals diagnosed with COVID-19 offers a myriad of advantages, encompassing the alleviation of strain on hospital facilities and a reduction in the potential for infection transmission within healthcare settings [10, 11]. Particularly, patients exhibiting mild symptoms or those who remain asymptomatic stand to benefit significantly, convalescing in the familiar and supportive environment of their own homes. Beyond the immediate physical considerations, home isolation holds promise for enhancing mental well-being by mitigating the psychological stress typically associated with hospital stays [12]. Nevertheless, the adoption of home care is not without its inherent challenges [10]. Ensuring strict adherence to isolation measures, especially in cases where individuals cohabit with others, assumes paramount importance [13]. It becomes imperative to address the psychological and emotional needs of patients, particularly during instances of prolonged isolation crucial [14]. Additionally, the establishment of a well-defined protocol for hospital referral in cases of deteriorating health is essential to safeguard the continuum of care [15]. To effectively navigate these challenges, healthcare systems must engage in a meticulous assessment of eligibility criteria, evaluating the suitability of the home environment. Concurrently, the provision of comprehensive education and ongoing monitoring becomes instrumental. This comprehensive approach enables healthcare systems to adeptly manage mild to moderate COVID-19 cases, thereby conserving critical hospital resources for severe cases.

In Lebanon, the first case of COVID-19 was confirmed on February 21, 2020 [16]. Since the early stages of the pandemic, the country has diligently strengthened and maintained its national capacities in accordance with the International Health Regulations (IHR 2005) [17]. A holistic approach, involving all stakeholders and proactive measures, was adopted to prevent and control the spread of COVID-19 and effectively respond to its further dissemination. This approach included the isolation of COVID-19 cases in designated hospitals. However, the surge in COVID-19 infection rates and associated fatalities in the country coincided with a dire economic crisis, amplified by the lockdown measures implemented to contain the virus. Healthcare facilities, already strained by the economic situation, were operating at maximum capacity both in terms of space and staff. As a result, the feasibility of isolating all COVID-19 cases in hospital settings became unsustainable, prompting an immediate need to prioritize hospitalization for severe cases, particularly those with critical illnesses and individuals at risk, such as those over 60 years old and those with underlying medical comorbidities [18]**.** According to data from the Ministry of Public Health (MOPH), as of April 2020, 74% of cases were asymptomatic, 18% were mild, while 8% were severe or critical cases necessitating hospitalization. By June 23, 2020, Lebanon had reported a total of 1,622 confirmed cases and 32 fatalities from COVID-19, with 58% of cases being males [19, 20].

In light of the abovementioned circumstances, home isolation emerged as a practical option to alleviate the strain on healthcare facilities. However, ensuring effective adherence to home isolation requirements for COVID-19 cases

necessitated coordinated efforts by public health authorities as well with other stakeholders. Home care for COVID-19 patients involved several essential components, such as evaluating eligibility, outlining care protocols, establishing medical monitoring procedures, defining referral pathways to healthcare facilities when needed, and establishing criteria for recovery assessment [21]. Following the WHO's guidelines for home care, a critical evaluation of the health status stability of positive cases and an assessment of the suitability of their residences for home isolation became imperative [21]. The suitability of the residential setting for home care for COVID-19 positive cases refers to the assessment and determination of whether a patient's home environment is conducive and appropriate for the effective management of their condition outside of a hospital setting. This evaluation considered various factors, including the patient's health status, the presence of adequate facilities and resources for isolation, the ability to adhere to precautionary measures, and the overall suitability of the home environment to minimize the risk of virus transmission. It aimed to ensure the well-being of the individual, contain the spread of the virus, and optimize the utilization of healthcare resources [22]. The ability to adhere to precautionary measures referred to the individual's capacity to consistently follow and comply with recommended or prescribed safety and preventive measures outlined by the guidelines provided by health authorities to prevent the spread of the virus. Assessing the ability to adhere to precautionary measures considered factors such as the individual's knowledge of the guidelines, willingness to follow them, and the availability of resources and support to facilitate compliance [23].

Given the importance of effective home care management for COVID-19 cases, the process of evaluating eligibility and appraising the home environment serves as a critical measure in ensuring comprehensive care. Beyond individual well-being, this approach plays a pivotal role in controlling the transmission of the virus and optimizing the utilization of strained healthcare resources. Through this assessment, valuable insights are gained into the unique circumstances and challenges faced by individuals in Lebanon during home isolation for COVID-19.

This article aimed to assess the suitability of the residential settings for home care and the patient's ability to adhere to the necessary precautionary measures during home care. By shedding light on these aspects, this article contributes to the broader understanding of the complexities involved in managing COVID-19 cases outside of hospital settings, offering insights that can inform more effective healthcare strategies and interventions.

2 Methods

This assessment was conducted to assess the suitability of the intended isolation setting of all individuals in Lebanon who tested positive for COVID-19 between February 21 (the date of first case recorded in the country) and June 30, 2020, exhibiting mild or moderate symptoms, and did not require hospitalization. The criteria for discharge and home-based isolation are determined by the Ministry of Public Health based on expert insights. To qualify for discharge and home-based isolation, cases must meet specific criteria established by the MOPH, including a laboratory-confirmed COVID-19 diagnosis, either being asymptomatic or displaying mild COVID-19 symptoms, the absence of comorbidities, and access to a suitable space for home-based isolation and care. Patients with compromised immune systems, such as transplant recipients or those undergoing cancer therapies, are ineligible for home isolation. Individuals aged 60 years or older and those with underlying medical conditions may be considered for home isolation only after a thorough evaluation by the attending medical officer, in adherence to the MOPH guidelines.

3 Assessment tool

A questionnaire designed to evaluate the suitability of the home environment for providing care, following the guidelines outlined by the Centers for Disease Control and Prevention (CDC) for home care was developed [24]. The initial version of the questionnaire was created in English and subsequently underwent a forward–backward translation process [25]. Two proficient bilingual translators independently translated the questionnaire into Arabic. One translator, an epidemiologist well-versed in communicable diseases and currently working in the response against COVID-19, collaborated with a second translator selected from the language department at the Lebanese university, who was unaware of the concept. Discrepancies between the translations were discussed, and a synthesized version was created. The Arabic version was then back-translated into English by two translators lacking backgrounds in COVID-19 and communicable diseases and without access to the English questionnaire.

A committee of experts with diverse backgrounds in public health and infectious diseases scrutinized item clarity and suitability within the Lebanese context. Through individual reviews, a subsequent expert panel meeting, and iterative revisions, the instrument was refined to ensure clarity, relevance, and comprehensiveness. Any discrepancies in translated versions were resolved in consultation with the translators. The translators implemented changes, resulting in the pre-final version of the questionnaire. To assess the comprehensibility of the pre-final version, a pilot test was conducted, and feedback from participants led to minor revisions aimed at enhancing clarity and relevance. In order to ensure applicability and understanding among patients and their caregivers, technical terms were substituted with slang language.

The reliability of the questionnaire was systematically evaluated using internal consistency, which gauges the extent to which each test item measures the same construct. Cronbach's alpha was employed as the reliability coefficient, with a value of $\alpha \geq 0.70$ deemed satisfactory [26]. The Arabic version of the questionnaire was finalized, resulting in a comprehensive tool designed for a nuanced assessment of various dimensions related to home care for COVID-19 positive cases (Additional file 1). This questionnaire, structured with closed-ended questions, navigated through seven essential domains:

- The first domain delved into socio-demographic characteristics, encompassing gender, age, nationality, occupation, marital status, and educational level.
- Moving forward, the household composition during home isolation became a focal point of inquiry. Patients were methodically questioned about the presence of specific household members, including children, elderly individuals, and family members with comorbidities at the intended place of isolation. This detailed exploration was pivotal for assessing potential risks and vulnerabilities, providing a basis for tailored public health strategies, particularly in the context of crowded living conditions.
- The housing conditions and infrastructure section covered key aspects such as the location of residence, type of residence, number of entrances, presence of an elevator, number of rooms, and the availability of toilets. Assessing the "type of residence" helped gauge the physical layout and shared spaces, impacting the potential for intra-household transmission. The "number of entrances" and "presence of an elevator" items were crucial for understanding contact points and transmission risks in multi-story buildings. The "number of rooms" directly influenced available space for isolation, and the "availability of toilets" was essential for maintaining hygiene standards. Collectively, these variables offered a comprehensive understanding of housing conditions, enabling tailored interventions to enhance the effectiveness of COVID-19 home isolation practices.
- The availability of basic services emerged as a critical domain, scrutinizing the presence of fundamental necessities such as heating, drinking water, tank water, electricity, safe trash disposal, hygiene facilities, personal items, protective equipment (masks, gloves, etc.), and communication tools. Heating is essential for maintaining a suitable living environment, particularly during colder periods, while access to drinking water is fundamental for hydration and overall health, especially for those exhibiting COVID-19 symptoms. Tank water serves as an alternative water source, important in situations of main supply disruptions. Electricity is vital for powering essential devices and maintaining communication. Safe trash disposal is integral to preventing infection spread within the household, and hygiene facilities ensure personal cleanliness and infection control. Personal items contribute to comfort, and protective equipment, including masks and gloves, is crucial for preventing viral transmission. This domain not only gauged the preparedness of the home for isolation but also assessed factors crucial for hygiene, safety, and communication resources, forming the backbone of a well-prepared and supportive environment for effective COVID-19 isolation practices.
- Isolation room characteristics came under scrutiny in the following domain, examining the presence of an individual room, toilet, balcony, and windows available for isolation. This careful evaluation was pivotal in determining if the necessary facilities were in place, contributing significantly to the effective and safe execution of self-isolation practices. The assessment of "Isolation room characteristics" was pivotal in gauging the adequacy of the designated space for COVID-19 isolation. The presence of an individual room ensured a degree of privacy, minimizing the risk of viral transmission within the household. Access to a dedicated toilet facility contributed to infection control, allowing for proper sanitation without sharing spaces with other household members. The availability of a balcony provided an additional confined space for patients to get fresh air and sunlight while maintaining isolation. Windows contributed to ventilation and the overall well-being of individuals in isolation. Evaluating these characteristics helped ascertain if the isolation space met the necessary standards for effective and safe self-isolation practices. The presence of communication tools facilitated connectivity, enabling individuals in isolation to stay in touch with healthcare providers, family, and emergency services, ensuring a well-prepared and supportive environment for effective COVID-19 isola-

tion practices. The presence of entertainment tools is crucial for assessing the mental well-being of individuals during home isolation. These tools, such as books, television, or recreational activities, provide a positive and engaging environment, helping alleviate stress and loneliness. Entertainment tools contribute to mental resilience, offering a distraction from the challenges of isolation and promoting a positive mindset

- Geographical accessibility stood out as a critical dimension, evaluating factors such as proximity to the Red Cross, delivery services, and the distance to the nearest hospital. Understanding the geographical accessibility factors ensured that individuals could readily access support and healthcare services when needed, contributing to the overall effectiveness of home isolation measures.
- Finally, the assessment of individual skills and support delved into the nuanced realm of patients' awareness of preventive measures, their ability to adhere to self-isolation requirements, self-servicing capabilities, the presence of someone to assist with material needs, and the availability of psychological support. The assessment of "Individual skills and support" was pivotal in understanding patients' ability to adhere to preventive measures and manage self-isolation effectively. This domain evaluated factors such as awareness of preventive measures, self-servicing capabilities, the presence of assistance for material needs, and access to psychological support.

4 Data collection procedure

A systematic and well-defined protocol was established to ensure effective data collection. Interviewers underwent comprehensive training encompassing communication skills, empathy, and strict adherence to privacy regulations. Interviewers were equipped with the necessary tools to conduct calls in a professional and sensitive manner. The training also addressed specific scenarios, such as patient unavailability or when caregivers answered, outlining protocols for these situations. The calling process involved multiple attempts, strategically spaced, to maximize the likelihood of reaching patients. Instances of failure to follow up were diligently documented, categorizing reasons such as non-response or disconnected lines. Protocols were in place to address patterns of failure, with adjustments made to the calling strategy as needed. When patients were unavailable during initial attempts, subsequent calls were scheduled. For calls where caregivers answered, stringent identity verification and consent procedures were followed. Specialized protocols were implemented for pediatric patients, ensuring compliance with legal and ethical considerations. Emergency situations were handled with urgency, and the entire calling process was extensively documented, including the number of attempts, outcomes, and relevant notes. Continuous quality assurance measures, involving feedback from interviewers, and input from patients or caregivers, were employed to refine the calling protocol and enhance the efficiency of the research study.

4.1 Statistical analysis

The collected data underwent a thorough review to ensure completeness and consistency before the initiation of the analysis process. Subsequently, the data were subjected to analysis using the statistical software SPSS (Statistical Package for Social Sciences), specifically version 22.0. Descriptive statistics were reported using frequency and percentages for categorical variables. To enhance comprehension and presentation, the analyzed data were organized and conveyed through tables, graphs, and narrative descriptions as deemed appropriate. A scoring system that assigns points to different aspects of the suitability of the residential settings for COVID-19 home care was developed. A four-points likert scale from 0 to 3 was used, with 0 indicating "Not Suitable at all" and 3 indicating "Highly Suitable."

1. Assessment criteria were defined including home conditions, access to necessary resources, and support systems. Each criterion has a specific set of questions or statements for evaluation. Given that some criteria may be more critical for home care eligibility than others, therefore, weights were assigned to each criterion based on its importance. For example, the availability of basic services may carry more weight than the availability of entertainment tools.
2. The assigned weights for each domain in the assessment reflect their perceived importance in evaluating the suitability of residential settings for COVID-19 home care. These weights are adjusted based on expert opinion, and specific contextual considerations. Socio-demographic characteristics, encompassing gender, age, nationality, occupation, marital status, and educational level, collectively contributed 25% to the overall assessment, emphasizing the significance of understanding the demographic profile of individuals in home care. Household Composition, with a 5% weight, acknowledged its role in assessing potential risks and vulnerabilities within the household. Hous-

ing conditions and infrastructure, carrying a weight of 20%, highlighted the importance of evaluating the physical infrastructure for effective home isolation. The availability of basic services, assigned 30%, underscored the critical role of basic services in supporting home isolation. Isolation room characteristics, with a 15% weight, acknowledged their impact on creating a conducive environment for self-isolation. Geographical Accessibility, with a 10% weight, recognized the importance of accessibility to essential services during home care. Individual Skills and Support, contributing 15%, highlighted the significance of individual capabilities and support structures. These weightings, totaling 100%, provide a proportional representation of the importance of each domain in the COVID-19 home care assessment, with the flexibility to adjust based on specific priorities or contextual factors.

3. For each question, an appropriate score was assigned based on the patient or his/her caregiver response.
4. To calculate the total score of suitability, the scores for all criteria were summed. Then, we established a minimum score that indicates the suitability of residential settings for home care. The absence of predefined thresholds in clinical guidelines or best practices prompted a consultation with healthcare experts to determine a relevant minimum score aligned with the unique characteristics of COVID-19 cases in the country. Of note, the ethical implications of home care eligibility were considered to ensure that the scoring system does not inadvertently disadvantage vulnerable populations. In this context, ethical implications referred to the potential consequences of the scoring system on specific groups within the population, particularly those who may already face challenges or disadvantages. By evaluating these ethical aspects, the goal was to ensure that the scoring system does not unfairly disadvantage individuals or communities that may be more vulnerable due to various factors such as socioeconomic status, access to resources, or health disparities. This proactive approach aligned with ethical principles of fairness, justice, and equity in healthcare. Residential settings scoring above the established minimum are deemed suitable for home care for COVID-19 patients, emphasizing the importance of ethical considerations in the development and application of the scoring criteria.
5. The eligibility score for patient discharge was based on both the health status of the patient and the suitability score of the residential settings. Of note, the health status which is assessed by healthcare providers based on well-established clinical criteria relevant to COVID-19 has the primary role in determining the eligibility. The health status assessment relied on established clinical criteria specifically relevant to COVID-19. In other words, healthcare professionals evaluated various clinical indicators and symptoms associated with COVID-19 to determine whether individuals are suitable for home care. This approach ensures that decisions about eligibility are grounded in well-established medical standards and guidelines, emphasizing the importance of clinical criteria in the decision-making process.

To calculate the ability of each patient to adhere to self-isolation, each individual is scored based on factors such as their awareness of preventive measures, ability to adhere to self-isolation requirements, self-servicing capabilities, the availability of assistance for material needs, and access to psychological support. For awareness, a score of 0 indicates limited understanding, 1 denoted a partial awareness, and 2 signified full comprehension. Similarly, the ability to adhere to self-isolation is scored 0 for non-compliance, 1 for partial adherence, and 2 for full compliance. Self-servicing capabilities are evaluated on a scale from 0 for limited ability to 2 for full self-sufficiency. Assistance for material needs is scored based on the level of support, ranging from 0 for none to 2 for adequate assistance. Lastly, availability of psychological support is scored 0 for none, 1 for limited support, and 2 for strong and readily available support. By summing up these individual scores, a total score is derived, offering a quantitative measure of the individual's overall ability to adhere to precautionary measures during the self-isolation period.

5 Results

5.1 Baseline characteristics

Table 1 provides a summary of the baseline information for COVID-19 home-isolated cases. Among all the assessed COVID-19 cases, 52.3% were male. The majority of patients (89.5%) were Lebanese, and 30% of them were aged over 50 years. Only 2.3% were aged less than 5 years. Approximately half of the cases were married, employed, and had a secondary level of education or lower.

Table 1 Baseline information of home isolated cases

	n	%
Gender		
Male	314	52.30
Female	286	47.70
Age (years)		
< 5 years	14	2.30
5–18 years	79	13.20
19–29 years	137	22.80
30–49 years	190	31.70
50–65 years	112	18.70
> 65 years	68	11.30
Nationality		
Lebanese	537	89.50
Syrian	40	6.70
Other	23	3.80
Status (profession)		
Student	100	16.70
Working	268	44.70
Retired	22	3.70
Not working	64	10.70
Not applicable	146	24.30
Social status		
Single	271	45.20
Married	303	50.50
Other	26	3.50
Education level		
Illiterate	52	8.60
Secondary level or less	319	53.20
University level or more	229	38.20

5.2 Information about household members at home isolation

Table 2 summarizes the characteristics of household members present in the intended residential isolation setting. Only 5.3% of COVID-19 cases were living alone. However, 72.5% of them were isolated with 2–5 family members in the household, and 51.3% of them had children (<18) living with them during home isolation. Around one-quarter of them had a child less than 5 years old. In addition, 25% of patients had a family member aged over 65 years old in home isolation, and 43.67% of patients had a household member with comorbidities. Lastly, 4.3% of them had a family member with disabilities in the isolation setting.

5.3 Housing conditions and infrastructure

Out of the total, 67.2% of the patients were isolated in an apartment within a multi-unit building. The majority of residences (85.5%) had one entrance, and 71% had 4 rooms or more. Only 44% of homes intended for isolation were equipped with an elevator. A single room was available in 96.2% of these residences (Table 3).

Table 2 Characteristics of household members at home isolation

	n	%
Number of family members at the home of isolation		
Alone	32	5.30
2–5	435	72.50
More than 6	133	22.10
Number of kids at the place of isolation		
None	234	39.00
1–4	308	51.30
More than 4	58	9.70
Kids less than 5 years old		
No	460	76.70
Yes	140	23.30
People > 65 years at the home of isolation		
No	447	74.50
Yes	153	25.50
People with comorbidities at the home of isolation		
No	338	56.34
Yes	262	43.67
People with disabilities at home isolation		
No	574	95.70
Yes	26	4.30

N, frequency; %, percentage

Table 3 Information about isolation residence

	n	%
Type of residence		
Apartment in a living building	403	67.20
Individual home	197	32.80
Housing permanency		
Temporary	32	5.30
Permanent	568	94.7
Number of entrances		
1	513	85.50
2 or more	87	14.50
Presence of elevator		
No	336	56
Yes	264	44
Number of rooms		
Less than 3 rooms	174	29.00
4 rooms or more	426	71.00
Number of toilets		
1	181	30.17
2 or more	419	69.83
Availability of individual room		
No	23	3.80
Yes	577	96.20

N, frequency, %, percentage

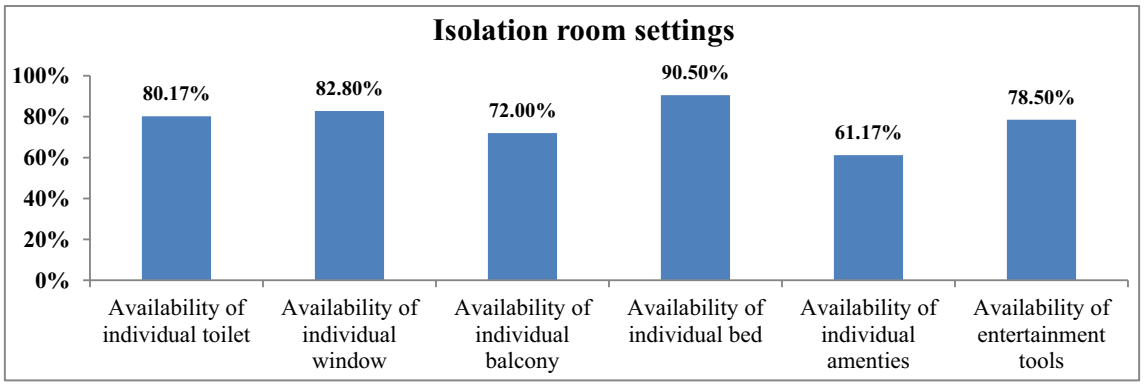


Fig. 1 Isolation room settings

Table 4 Availability of basic services at intended home of isolation

	No n (%)	Yes n (%)
Availability of basic services and needed items		
Availability of water		
Water for use	22 (3.7%)	578 (96.3%)
Drinking water	3 (0.5%)	597 (99.5%)
Heating facilities	8 (1.4%)	592 (98.6%)
Electricity	30 (5%)	570 (90%)
Waste management		
Safe Trash elimination	74 (12.3%)	526 (87.7%)
Containers and waste bins for waste management	50 (8.33%)	550 (91.67%)
Plastic bags for waste	80 (13.34%)	520 (86.66%)
Personal items(towel….)	23 (3.8%)	577 (96.2%)
Private eating items	24 (3.8%)	576 (96.2%)
Bedding (mattress, blankets, pillow…)	18 (3%)	582 (97%)
Sufficient food	22 (3.7%)	578 (96.3%)
Hygiene facilities		
Cleaning supplies and detergents	130 (21.7%)	470 (78.3%)
Hand washing material (soaps)	15 (2.5%)	485 (97.5%)
Health equipment's		
Thermometer (personal or digital)	60 (10%)	540(90%)
Ox meter	480 (80%)	120 (20%)
Gloves and masks	38 (6.3%)	562 (93.7%)
Disinfectants	41 (6.8%)	559 (93.2%)

5.4 Isolation room settings

Figure 1 illustrates the isolation room settings. More than 80% of isolation rooms featured an individual toilet (80.17%), an individual window (82.8%), and an individual bed (90.5%). Additionally, around two-thirds of isolation rooms had the availability of individual balconies (72%), amenities (61.17%), and entertainment tools (78.5%).

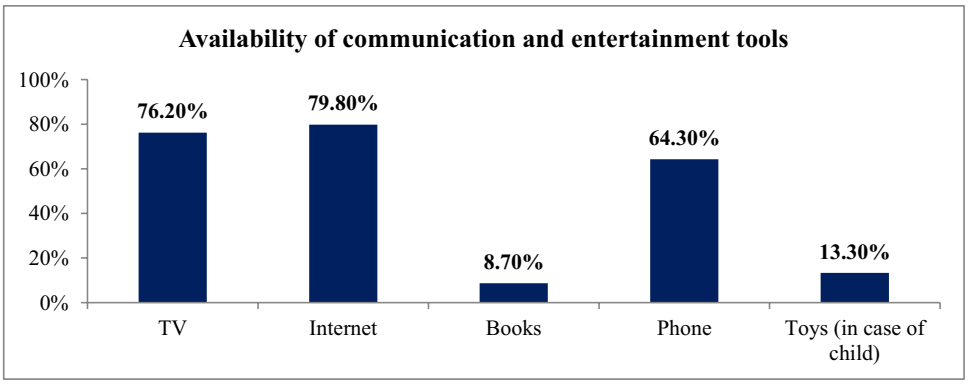


Fig. 2 Availability of communication and entertainment tools

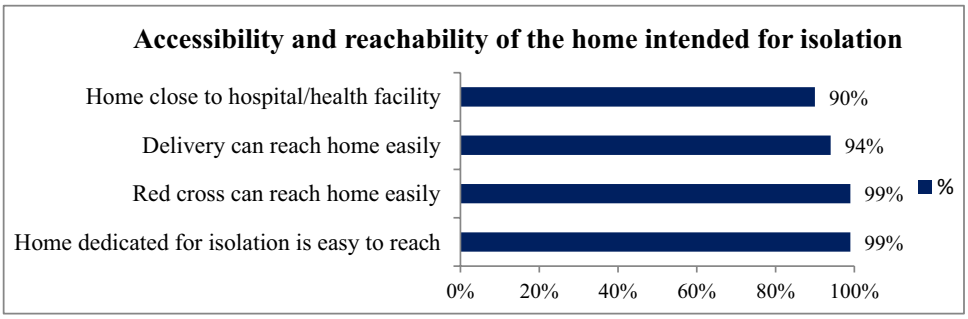


Fig. 3 Accessibility and reachability of the home intended for isolation

5.5 Availability of basic services

Table 4 presented the availability of basic services at home intended for isolation. The top majority of patients declared that they have available drinking and tank water. Besides, more than 90% have access to electricity and heating facilities. Concerning waste management, most of them acknowledged the presence of safe trash elimination (87.7%), waste bins (91.67%), and plastic bags for waste (86.66%). The availability of personal items (96.2%), private eating utensils (96.2%), bedding (97%), and sufficient food (96.3%) was declared. In respect of hygiene facilities, hand washing materials (soaps) (97.5%) and cleaning supplies and detergents (78.3%) were available in the majority of homes of isolation. For health equipment, more than 90% of patients declared the availability of a thermometer, masks, and oximeters, but only 20% have access to an ox-meter.

5.6 Availability of communication and entertainment tools

Figure 2 displayed the availability of entertainment tools in the homes intended for isolation. The primary entertainment tools listed by patients were television (76.2%), internet (79.8%), and phone line (64.3%).

5.7 Geographical accessibility and reachability

As depicted in Fig. 3, the majority of isolation homes were easily accessible (90%), reachable by the Red Cross (99%), and had food delivery services available (94%). Furthermore, 90% of these residential settings were in close proximity to hospitals.

5.8 Individual skills of home isolated cases

Out of all, 94.5% of the assessed patients were aware of preventive measures including physical distancing, wearing masks, cleaning and disinfecting, and were able to serve themselves. Almost all of them declared their ability

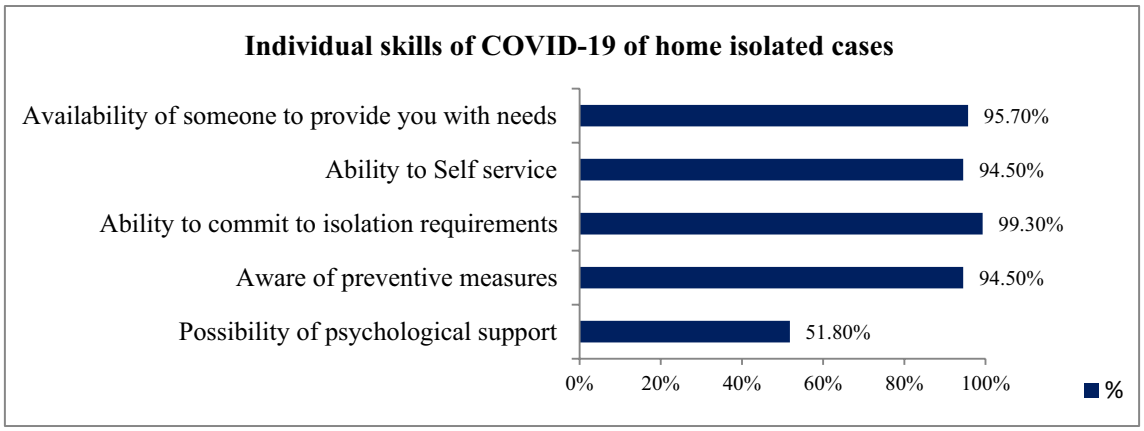


Fig. 4 Individual skills of COVID-19 in-home isolated cases

Fig. 5 Suitability of residential settings for home isolation of COVID-19 cases

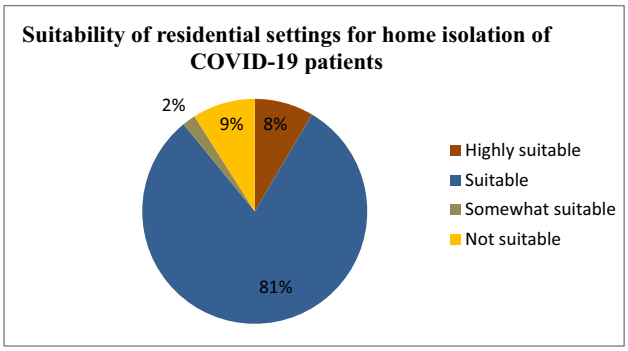
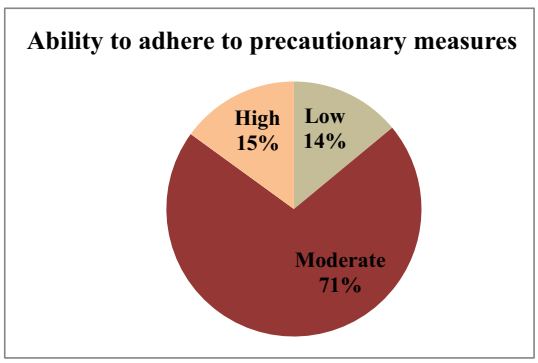


Fig. 6 Ability to adhere to precautionary measures among COVID-19 cases



to commit to isolation requirements and the availability of somebody to provide them with their needs (95.7%). However, only 51.8% had access to psychological support (Fig. 4).

6 Suitability score

Based on the findings of this assessment, around 89% of patients had suitable residential settings and were eligible for home isolation (Fig. 5).

6.1 Ability to adhere to precautionary measures

The breakdown of ability scores for adherence to precautionary measures during the self-isolation period revealed that 14% of individuals had low adherence, 71% demonstrated moderate adherence, and 15% exhibited high adherence (Fig. 6).

6.2 Eligibility for discharge

The results of the assessment revealed that a substantial proportion of cases, specifically over 90%, were deemed eligible for home isolation based on established criteria.

6.3 Discussion

The COVID-19 pandemic has placed immense pressure on healthcare systems worldwide, necessitating innovative approaches to managing cases while conserving hospital resources. Home care isolation has emerged as a crucial strategy, providing mild to moderate COVID-19 cases with a comfortable and familiar environment for recovery. As Lebanon experiences an upsurge in the number of persons with COVID 19 infection, it is becoming less rational to isolate all patients in hospital-based care treatment facilities. Hence, home isolation could be a reasonable choice for decongestion of health facilities. This study aimed to assess the suitability of residential settings for home care and the patients' capacity to adhere to precautionary measures during home care in Lebanon.

Based on the findings of this assessment, it was determined that over 90% of cases were eligible for home isolation, and approximately 89% of patients had residential settings suitable for home isolation. These results indicate that a majority of the patients in this study met the criteria for home-based care, taking into account factors such as their living conditions, access to resources, and their ability to adhere to isolation measures. It's important to note that these findings assess the suitability of the intended isolation locations based on the current health status of the cases. However, the effectiveness of home isolation also depends on preventing the spread of infection among household members. This can only be achieved with a sense of responsibility among the cases themselves. Furthermore, health authorities and municipalities must closely monitor the compliance of cases with the recommended infection prevention and control measures. For those patients who were unable to isolate themselves within their own homes, as determined by the assessment, they would be isolated at community isolation centers that meet the specifications and requirements established by the Order of Nurses and the Lebanese Army [20].

6.4 Patient characteristics

The baseline characteristics of the home-isolated COVID-19 cases in Lebanon reveal important insights. Over half of the assessed cases were male, and the majority were Lebanese. While data showed that men and women had approximately the same susceptibility, men were more prone to dying. A study conducted in China showed that men were 2.4 times more than women in the deceased patients [27]. This underlines the importance of regular health monitoring. It is noteworthy that a significant portion of the cases were aged over 50 years, emphasizing the importance of managing COVID-19 in older populations. This finding aligns with global trends where older individuals are at higher risk of severe outcomes. This underscores the importance of monitoring older cases. A study about the impact of home care on older adults during the COVID-19 pandemic showed that home-based isolation among older adults must be tailored to meet individual needs and must meet evidence-based specifications [28]. Additionally, a notable portion of cases had lower educational levels, which may have implications for their understanding of isolation protocols. Moreover, approximately 18% of the cases were in the age group of 18 years or younger, with only 2.3% of them being younger than 5 years old. Ensuring the continuous care of children throughout the entire isolation period and maintaining children under 18 years old with their families during isolation is crucial, except in cases of critical health conditions, with a specific emphasis on safeguarding children's well-being.

Our results revealed that approximately half of the cases intending to discharge for home care were married. Although having a partner can offer essential psychological and physical support, a study conducted by Liu et al. revealed that spousal relationships increased the risk of COVID-19 transmission among positive individuals and their household members [29]. However, it's important to note that home care is associated with a reduced risk of COVID-19 stigmatization and an increased likelihood of recovery. As most of the cases were actively engaged in work before contracting the virus, the suspension of their work activities, which may not be compensated for by their workplace or covered by their home care expenses, could impose added financial burdens on both individuals with COVID-19 and their caregivers. Moreover, a notable portion of cases had lower educational levels (secondary level of education

or lower). Typically, a higher level of education is linked to better knowledge about the disease and its preventive measures, which, in turn, is associated with more responsible practices. Consequently, there is an imperative to enhance awareness among both cases and their close contacts regarding infection prevention measures in order to reduce the risk of intra-family transmission of COVID-19 [30].

The presence of household members during home isolation is a critical factor to consider. Most cases were not living alone, with the majority isolated with 2 to 5 family members. An examination of research on home-based care for COVID-19 has indicated a heightened risk of transmitting the virus within families when COVID-19-positive individuals are isolated at home. The household environment appears to be a primary setting that facilitates the transmission of COVID-19, thus presenting a potential challenge to the widespread adoption of home-based care (HBC). Moreover, households with a larger number of residents may be more susceptible to experiencing elevated rates of COVID-19 transmission compared to those with fewer occupants. Previous investigations have revealed that, on average, Chinese households accommodate about five individuals, a figure that aligns with the range of household members assessed in Lebanon [29, 31]. A significant proportion had children and elderly individuals at home, including children less than five years old. This presents a unique challenge in terms of preventing intra-household transmission. While it is crucial to maintain the presence of children within their families, recognizing their specific needs, especially in the absence of an alternate caregiver, it is equally important to implement preventive measures such as physical distancing and establishing secure means of communication.

Of noteworthy concern is that one-quarter of patients had a family member aged over 65 years old at home isolation, and about half of them had a household member with underlying medical conditions. The presence of household members with comorbidities further underscores the need for stringent adherence to isolation measures as any lapse in adherence to preventive measures could result in the transmission of the virus within households, posing a significant risk to the elderly population. Some individuals reported having family members with disabilities in their isolation homes. Given the critical role of disseminating information to enable individuals to make life-saving decisions, access to and comprehension of this information by people with disabilities may be limited. This underscores the importance of strict compliance with recommended preventive measures. However, it is crucial to emphasize that despite the potential for household transmission of the infection, home isolation for COVID-19 offers an opportunity for emotional care and support essential for the recovery of patients, particularly in communities with a high prevalence of the virus [32].

In terms of housing conditions and infrastructure, the majority of patients were in apartments within multi-unit buildings, highlighting the urban nature of isolation. Urban settings and multi-unit buildings often involve close living quarters, increasing the risk of transmission due to shared spaces and common areas. While most residences had one entrance, only about half had elevators. Of note, single entrances may contribute to a higher risk of intra-household transmission, as individuals sharing the same entrance are more likely to come into close contact. In addition, limited availability of elevators may pose challenges, especially for patients with mobility issues, potentially leading to increased interaction in common areas like stairwells, elevating the risk of transmission. Nearly all homes had individual rooms, but less than a third had individual balconies. Having individual rooms is a positive factor, reducing the risk of viral transmission within the household by providing separate spaces for individuals to isolate. However, the scarcity of individual balconies may impact patients' mental well-being, as these spaces contribute to overall comfort. While not directly linked to transmission, mental well-being is crucial for adherence to isolation protocols. Our findings also indicate that the majority of the evaluated residences meet the criteria for an isolation room that is well-equipped, adequately ventilated, and in close proximity to a dedicated patient toilet and balcony. In line with established guidelines, the majority of these isolation rooms were considered suitable for the purpose of isolation. The presence of these features is crucial for maintaining infection control and minimizing the risk of intra-household transmission. The overall alignment of the evaluated isolation rooms with established guidelines indicates a promising foundation for effective home isolation. However, it is essential to recognize that these findings may not be universally applicable, and variations in housing conditions may exist across different geographical and socioeconomic contexts. Further research and continuous monitoring are warranted to ensure the ongoing suitability of home isolation settings and to inform any necessary adjustments to guidelines or recommendations.

In terms of basic infrastructure, such as access to water, electricity, heating, and waste management, the conditions were generally satisfactory. Additionally, essential hygiene facilities, including hand washing materials such as soaps, cleaning supplies, and detergents, were readily available. However, it's important to note that a shortage of these necessities could hinder the maintenance of hygienic conditions in homes where COVID-19 patients are being managed. A study conducted in Beijing, China, demonstrated that infection prevention and control (IPC) measures could effectively prevent household COVID-19 transmission, even in crowded or small households [33]. Nevertheless, it is advisable to provide ongoing support

for meeting the needs of patients and ensure continuous monitoring throughout the entire duration of home care management for COVID-19 cases.

In terms of availability of basic services, ensuring its availability is crucial for successful home isolation. Fortunately, most patients reported access to essential services such as water, electricity, heating, and waste disposal. However, there was a notable lack of oximeters, a valuable monitoring tool for COVID-19 patients. This could potentially hinder their ability to monitor their symptoms effectively, particularly given that COVID-19 infection has been associated with silent hypoxemia [34]. Therefore, it emphasizes the importance of local authorities, specifically municipalities, in providing such equipment when needed.

While the majority had access to communication and entertainment tools such as television, internet, and phone lines, addressing the needs of the minority who lacked these amenities is important. The availability of these tools contributed to a positive and engaging environment. Given that mental health considerations are pivotal in sustaining adherence to isolation protocols and promoting overall resilience during challenging periods [35], therefore, providing access to such resources may help alleviate the psychological burden of isolation.

In addition, geographical accessibility plays a role in the success of home isolation. Most homes intended for isolation were easily accessible, close to hospitals, and reachable by the Red Cross. Additionally, the availability of food delivery services can help meet patients' nutritional needs without requiring them to leave their homes.

Finally, patients' awareness of preventive measures is encouraging, with the vast majority expressing their commitment to adhere to isolation requirements. The presence of someone to provide for their needs is also reassuring. However, the reported limited access to psychological support for about half of the patients is a notable concern. Addressing the mental health aspect of individuals in isolation is essential, as it significantly contributes to their overall well-being. This emphasizes the importance of integrating mental health support services into the broader framework of home isolation strategies.

The score of patients' ability to adhere to precautionary measures revealed that the majority of cases falling into the moderate category. This suggests a reasonable level of compliance but indicates room for improvement. Of note, this nuanced categorization of adherence levels allows for targeted interventions and support strategies tailored to the specific needs of individuals. This approach can enhance overall adherence and mitigate the risk of COVID-19 transmission during the self-isolation period. Continuous monitoring and adaptation of support services based on these findings are essential to promoting a holistic and effective approach to home isolation for COVID-19 patients.

7 Challenges of home isolation

Home isolation, while a viable option for managing COVID-19 in Lebanon, presents several challenges that need to be addressed comprehensively. As COVID-19 is primarily transmitted through droplets, home isolation in households with many members poses a risk of familial transmission, potentially placing caregivers and other family members at risk of infection. Moreover, a lack of knowledge and difficulties in adhering to isolation guidelines and infection prevention and control (IPC) recommendations can hinder the adoption of home-based management for COVID-19 patients. Financial implications are also a concern. Unlike isolation centers where the costs are covered by the government, the responsibility for home isolation largely falls on COVID-19-positive individuals and their families. This financial burden can be substantial and needs to be acknowledged and managed. Furthermore, home isolation may affect the mental health of patients. Being unable to maintain physical relationships within their own homes can lead to feelings of isolation and confinement, potentially impacting their psychological well-being. Despite these challenges, home isolation remains a reasonable approach for managing COVID-19 in Lebanon. It offers numerous opportunities for effective care. To enhance COVID-19 management in a home-based setting, it is essential to tailor care practices to individual needs, considering factors like housing arrangements, age, and other sociodemographic characteristics. Additionally, there is a need to foster greater awareness and knowledge regarding IPC practices, including hand hygiene, mask-wearing, social distancing, disinfection, and proper household ventilation. Achieving these goals requires multi-sectoral collaboration and close monitoring of cases to ensure compliance with recommended measures.

8 Clinical implications

This study has practical implications for the management of COVID-19 cases in Lebanon. It highlights the feasibility of home care isolation for a significant portion of mild to moderate cases, allowing healthcare facilities to focus their resources on severe cases. The findings emphasize the importance of tailored guidance for patients with diverse living conditions and support needs.

9 Limitations

Several limitations of this residential suitability assessment should be acknowledged. Firstly, it includes potential self-reporting bias as the assessment relies on self-reported information from patients or their caregivers, which might be subject to bias or inaccuracies. Patients may overstate the suitability of their home environment to avoid hospitalization. Secondly, the lack of objective measures, such as home inspections, which may not always be feasible, limits the accuracy of the assessment. Thirdly, the assessment might not account for the fluctuating availability of essential resources (e.g., water, electricity, or food) during the isolation period, which could impact the patient's ability to maintain isolation effectively. Finally, there are no specific thresholds available in clinical guidelines or best practices for suitability. It is noteworthy that guidelines and recommendations for COVID-19 care may evolve over time. Periodic review and updating of the scoring system and threshold in line with the latest evidence and guidelines are essential. It is also important to clearly document the rationale for the established threshold and any adjustments made over time.

10 Conclusion

Home care isolation is a viable strategy for managing mild to moderate COVID-19 cases in Lebanon, particularly in the context of the surge in cases. The findings revealed that a substantial majority of cases met the criteria for home isolation, considering factors such as living conditions, access to resources, and adherence to precautionary measures. The study underscores the need for comprehensive support, including medical equipment, and psychological assistance to ensure the success of home isolation programs. The study also highlighted the need for tailored guidance, multi-sectoral collaboration, and ongoing monitoring to ensure the effectiveness of home isolation strategies.

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Data availability Data are available from the corresponding authors upon reasonable request.

Declarations

Ethics approval and consent to participate This assessment is an integral component of the national preparedness plan and the country's response to COVID-19. It is a mandatory requirement for the discharge of COVID-19 cases to home isolation. Therefore, it was deemed exempt from ethical approval by the Ministry of Public Health, as it falls within the purview of the public health surveillance and emergency response system, as stipulated in the Communicable Disease Law of 1957 (18). All participants provided informed consent after receiving a comprehensive explanation of the study's procedures. Furthermore, participants were required to sign a written informed commitment in which they pledged to strictly adhere to the requirements of home isolation. All information was collected and handled with strict confidentiality, and participation in the study was entirely voluntary. Given that individual participants cannot be identified based on the information presented in this study, it posed no foreseeable harm or stigma to the participants. The study's design ensured the adequate protection of all participants and did not involve clinical patient data, nor did it constitute a clinical trial. All methods employed in this study adhered to relevant guidelines and regulations.

Consent for publication Not applicable.

Competing interests The authors declare no competing interests.

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