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The Potential of Low-Rise Dense Typologies for Post-COVID-19 Urban Housing Spatial Planning: A Case Study of Nablus, Palestine

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Abstract

Based on the global concern regarding human health in residential areas since 2020, this study delves into the potential of traditional low-rise dense typologies as a viable solution for post-COVID-19 housing spatial planning in Middle Eastern Mediterranean countries. Such typologies are found in the traditional architecture of Nablus City, Palestine. They are characterized by their horizontal stratification and distribution of courtyards through them, which offers a promising avenue for fair distribution of populations and avoiding crowded points in urban housing. The study seeks to elucidate the advantages, challenges, and applicability of low-rise dense typologies for future housing design in Palestine. It also aims to confirm their primary characteristics that can assist in limiting the spread of epidemics. Accordingly, the study analyses these typologies in Nablus City. It uses architectural analysis to verify its ability to enhance self-sufficiency, manage densities, facilitate isolation and quarantine, and encourage stay-at-home in residential areas. The survey results show that such typologies are characterized by mixed-use, activity-based densities and avoid crowding, support passive environmental systems, and facilitate flexible layouts for future design. The study also surveys expert opinions to confirm the research results and allocate factors such as spatial organization and community integration through empirical data collected in Nablus City. Accordingly, the study's main finding is that low-rise dense typologies are a high-potential approach for future housing if designed in a contemporary way that preserves traditional values. Proposed guidelines for a modern architectural model are presented, which can be used in many similar urban environments.

Keywords

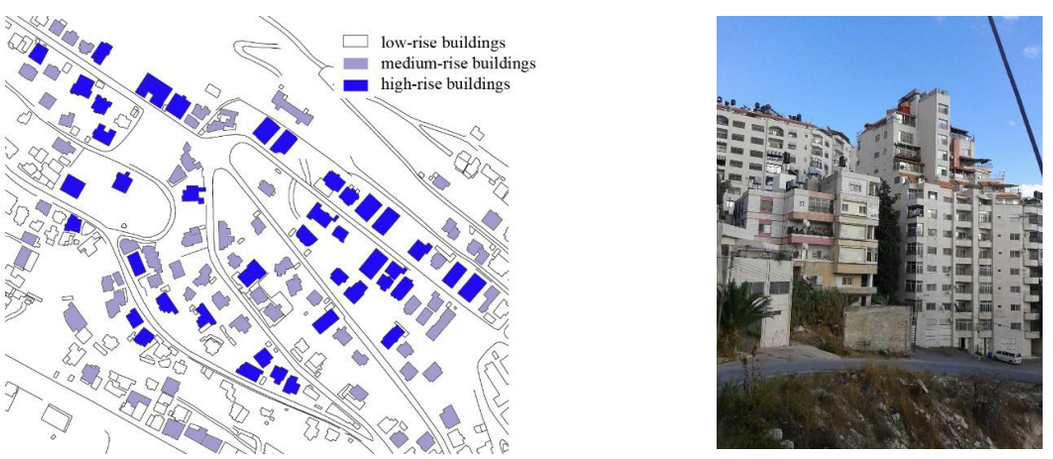
Low-rise dense typologies; Post-COVID-19; Crowded areas; Urban safety; Healthy environment

1. Introduction

The twenty-first century has witnessed the outbreak of a number of infectious diseases, including severe acute respiratory syndrome (SARS), Middle East respiratory syndrome, Ebola, bird flu, swine flu, and finally, the new COVID-19 epidemic (Gurushankara, 2021). In explaining underlying factors contributing to the fierce attack of the coronavirus, it is argued that our development and urban behaviour in recent decades have

degraded the environment and enhanced opportunity for outbreaks (Carabantes, 2022; Trpeski et al., 2021). Hence, we are in the modern era of epidemics and rapidly spreading diseases, which indicates the need to consider design of our residential areas that can enhance protection from epidemics and rapidly spreading diseases. It has been argued that in this century, the importance of clean and healthy areas for living is increasing (D'alessandro et al., 2020).

The COVID-19 epidemic revealed the fragility of the housing we produce or places to shelter people. Millions worldwide were forced to respond to strict calls to stay at home. Many houses were not designed to accommodate such closed family gatherings or have spaces full of meaning, value, and warmth; instead, they primarily focus on provision of simple human shelter (Hunter, 2021). Such shelters can be found in many countries of the Middle East and Palestine. It becomes clear that most people's lives after the pandemic changed based on staying at home for weeks instead of going out each morning and practising life in the street, at work, or in a café. The house's meaning becomes more than a shelter as part of the preparation for a person to integrate back into public society following the pandemic (Itma & Hussein, 2023). COVID-19 also revealed the failure of high-rise apartment building design where people stayed for weeks with limited opportunity for daily outdoor activities (Itma & Monna, 2022a). Figure 1 shows an example of high-rise apartment buildings in Palestine, the dominant type of urban housing in Nablus City. However, Nablus has a rich culture in its historic city centre, which includes traditional housing, while still conserving its original character to a high degree. Conventional, traditional, housing inside the city is still liveable and has been considered a successful interaction between social, environmental, and economic factors throughout history (Itma & Monna, 2024).



A. map for the distribution of high-rise apartment buildings b. Examples of medium-rise and high-rise buildings

Figure 1. High-rise dense typologies in Nablus City and their context.

Based on the ongoing discussion, housing planning and architectural design approaches should be reshaped because of changes attached to the post-COVID period. This study argues that traditional housing design could be a potential reference for the required reshaping. Accordingly, the main question of the study is: what are the potential design guidelines for post-COVID-19 urban housing adapted from low-rise dense typologies in Palestine? Therefore, the purpose of this study is to elucidate the advantages, challenges, and applicability of traditional low-rise dense typologies in Nablus to generate these guidelines. The study will confirm the primary characteristics of low-rise dense typologies that could help to limit the spread of epidemics,

and propose design guidelines for future housing in Palestine that provide solutions in architecture and urbanism to face COVID-19 and other infectious diseases. The design approach should limit the spread of epidemics and lead to a positive change in architectural thought of housing design. The study also aims to verify how urban spaces and facilities become suitable for confronting infection in residential areas. To begin, the following provides a review of the literature that explores the requirements of post-COVID-19 urban housing spatial planning.

2. Literature Review

We need a comprehensive conceptual framework for designing post-COVID-19 housing areas that integrate architectural typology and physical characteristics at both architecture and planning levels. Although much research deals with policies (Lai, Leone, & Zoppi, 2020), urban planning and urban design (Salama, 2023), more focus is required on physical characteristics of housing typologies. For instance, while research has focused on healthy outdoor spaces as a requirement to manage COVID spread (World Health Organization, 2021), there is insufficient focus on how traditional architectural typologies can influence physical design solutions.

One study, for example, proposed a resilient city for the sustainable development of cities, reflected in urban development and disaster prevention (Song et al., 2021). Another study focused on the impacts of COVID-19 on the environmental quality, socio-economic factors, governance, and transportation in cities and provided some planning recommendations to decrease such impacts (Sharifi & Khavarian-Garmsir, 2020). However, both studies focused on urban systems rather than specific architectural typologies. Similarly, while the role of pedestrian streets in promoting healthy living has been discussed (Jevtic et al., 2022), there remains a gap in linking these concepts to specific physical characteristics such as density, housing form, and spatial configuration.

Accordingly, this paper addresses these gaps in the literature by proposing an architectural typology that combines traditional architecture, urban design, and planning solutions for future housing design. Architecture and urban design are among the most essential and effective means of controlling the spread of epidemics (Tokazhanov et al., 2020). Crowded cities are more vulnerable to epidemics, with the difficulty of controlling them due to lack of adequate typology (Martínez & Short, 2021).

2.1 Physical Characteristics of Housing Typology

1. The ability of housing type for mixed uses: scholars have presented mixed environments as an approach for future design. This approach is made by taking into account the provision of all facilities and services when planning so that each city can meet its industrial, agricultural, and other needs with minimum need to obtain those goods from other cities that may be laden with viruses (Buheji et al., 2020). The best contemporary example of these integrated cities is the principle of a twenty-minute town in Melbourne, Australia. It was built as an experiment and the model is based on ensuring that everything a citizen needs, from shopping to health care centres and exercise spaces, is only 20 minutes away from their residence (Chau et al., 2022) (Allam et al., 2022). Other scholars have suggested managing the impact of COVID-19 in cities by providing green spaces. Many models of cities have been designed to maintain their residents' physical and mental health (Zhipeng & Wei, 2020). Therapeutic gardens, for example, were established in Singapore in 2016 to improve the mental health of citizens, while citizens in Tokyo cooperate with architectural designers to create green

spaces in their neighbourhoods to improve health (Vogt et al., 2017). Other scholars argue that cities should facilitate places designated for crises and emergencies. It is essential to establish health centres and temporary housing quickly and to allocate spaces in the towns for this purpose, as these spaces allow for the construction of buildings that are easy to implement (Majewska et al., 2022).

2. Activity-based densities and avoid overcrowding: Density is a critical factor in housing typology and urban planning. Johan Woltjer argues that cities should have the necessary means of protection, which makes them more capable of taking urgent measures to confront crises (Woltjer, 2014). Some scholars proposed small towns instead of big cities; thinking about a new method of city planning has become inevitable. The post-COVID-19 epidemic era should be a catalyst for changing the idea of huge metropolitan cities. It seems necessary to move to an era of planning a small, cohesive local community and not compete to transform the world's cities into overgrown cities with no comfortable and safe place except for those with superior financial capabilities. High-density urban environments often face challenges related to congestion and disease spread. Scholars argue that shifting toward lower-density, cohesive communities may improve health outcomes and resilience (Soylu, 2022). Urban expansion, especially in large cities, has significant disadvantages, such as congestion in transportation networks, increased pollution, waste accumulation, and a culture of consumption. Residents of many major cities rushed toward the countryside and small villages to escape the impacts and health risks of the COVID-19 pandemic (Golubchikov, 2021). Future housing typologies should incorporate density management, balancing population concentration with sufficient open spaces for health and safety.

Density is related to rising vertically. High-rise buildings present unique challenges during pandemics. For example, the reliance on shared facilities such as elevators and corridors increases the risk of infection transmission (Amran et al.,2022). Scholars recommend modifications such as additional staircases and enhanced ventilation systems to mitigate these risks. In contrast, low-rise buildings, with their potential for independent access and increased outdoor connectivity, are better suited for health-oriented housing solutions. Future typologies should carefully consider the trade-offs between these approaches, prioritizing safety, functionality, and adaptability.

3. Adequate outdoor spaces and support passive environmental systems: the integration of outdoor spaces is a central consideration in post-pandemic housing. Green spaces, therapeutic gardens, and accessible outdoor areas have been shown to improve physical and mental health (Vogt et al., 2017). For example, Tokyo's community-designed green spaces highlight the benefits of resident collaboration in urban design. Outdoor spaces also should limit large gatherings and promote safe distancing through thoughtful design (Jasiński, 2020). Future housing typologies must ensure the availability of functional, adaptable outdoor spaces that support both health and social needs. Finally, all parts of future design should facilitate relevant social distancing between individuals, including outdoors and interiors of public spaces like mosques and exteriors like pedestrian paths in which public seats should be separated (Sun & Zhai, 2020). Environmental adequacy of housing type also is important. Some scholars argue that if we spend more time in homes, good ventilation and lighting should be considered when designing homes (Shahbazian, 2021). It is advised to avoid design flaws that lead to disease, such as the lack of ventilation outlets in buildings, which leads to the recycling of pathogens in the air via air conditioning systems (Lipinski et al., 2020). However, some previous research emphasized the efficiency of traditional concepts in responsiveness and adaptability to pandemics. The conventional, traditional approach for the enclosed plan is better for adapting new emergent functions than the contemporary open plan. Those functions still affect the houses' spatial configuration and impact the experience ofworking and learning from home (Itma & Monna, 2022a).

4. Responsiveness, adaptability, and facilitate flexible layouts: Traditional architectural concepts have demonstrated resilience and adaptability in responding to crises. For instance, enclosed plans in traditional architecture are more effective than contemporary open plans in accommodating new functions, such as working and learning from home (Itma & Monna, 2022a). The adaptability of traditional housing layouts provides valuable lessons for contemporary design, emphasizing flexibility and multi-functionality. This research posits that referencing traditional typologies is essential for creating adaptable, sustainable housing environments in post-pandemic contexts.

2.2 Integrated Framework for Post-COVID-19 Housing Design

From the above review, most recommendations take human and sustainable design as future considerations for facing health challenges during a pandemic. Self-sufficiency for cities would be determined by sustaining mixed uses. Managing densities –which means controlling the number of people on a certain area of land- is required for health separation to be achieved by focusing on activity-based densities, avoiding overcrowding, isolation, and quarantine using passive environmental systems. Furthermore, encouraging sheltering in place (work and study at home) can be enhanced by flexible layouts for houses.

The best reference for such considerations is the traditional city design and architecture (Amad, 2003; Itma M. , 2016; Itma & Monna, 2022a). Thus, this research considers that referring to traditional concepts is a potential approach for future settlement design that potentially decreases the effects of contemporary diseases. The subsequent text examines how conventional typologies have great potential for future housing design.

This research emphasizes the physical characteristics of housing typologies—density, building form, outdoor spaces, and traditional adaptability—to propose a framework for designing future housing areas. By integrating these elements, post-pandemic housing can better respond to the needs of residents while promoting resilience and sustainability. The subsequent analysis will explore these concepts further, linking them to the four typological values identified in Section 2.1, above.

3. Methodology

The methodology is based on using two basic approaches to achieving the study's goal of showing how low-rise dense typologies can be a strong potential choice for housing spatial planning in the post-COVID-19 pandemic era. The two approaches analyze a case study of traditional low-rise dense typologies, representing condensation and compact fabric throughout history, such as in the old city of Nablus. As part of the analysis, a comparison between traditional and contemporary housing design typology is undertaken to highlight the potential of conventional/traditional typologies. This comparison uses the literature review results, which indicate four values are required for future housing design: mixed-use, activity-based densities, passive environmental systems, and flexible layouts.

The second approach explores the opinions of professionals from various governmental and private sectors in Palestine regarding housing design to infer the effectiveness of the proposed design model. As for the case study, the study relied on architectural and morphological analysis of the compact urban fabric, field survey, study of plans, and taking photographs to support the validity of the hypothesis for this research. The field survey included observation and field visits to neighbourhoods and main streets as well as unstructured meetings with residents and visitors within old residential neighbourhoods in Nablus. Many drawings were conducted onsite to better understand the housing types. Figure 2 clarifies the sequence of the methods used

and summarizes the findings of the literature review about post-COVID-19 urban housing design, which can be a theoretical guideline for future design. These steps were essential to developing urban characteristics in the traditional compact fabric that would enhance the future design requirements for the post-COVID-19 period: mixed uses, activity-based densities, avoiding overcrowding, isolation, quarantine, and flexible layouts, as shown in Figure 2.

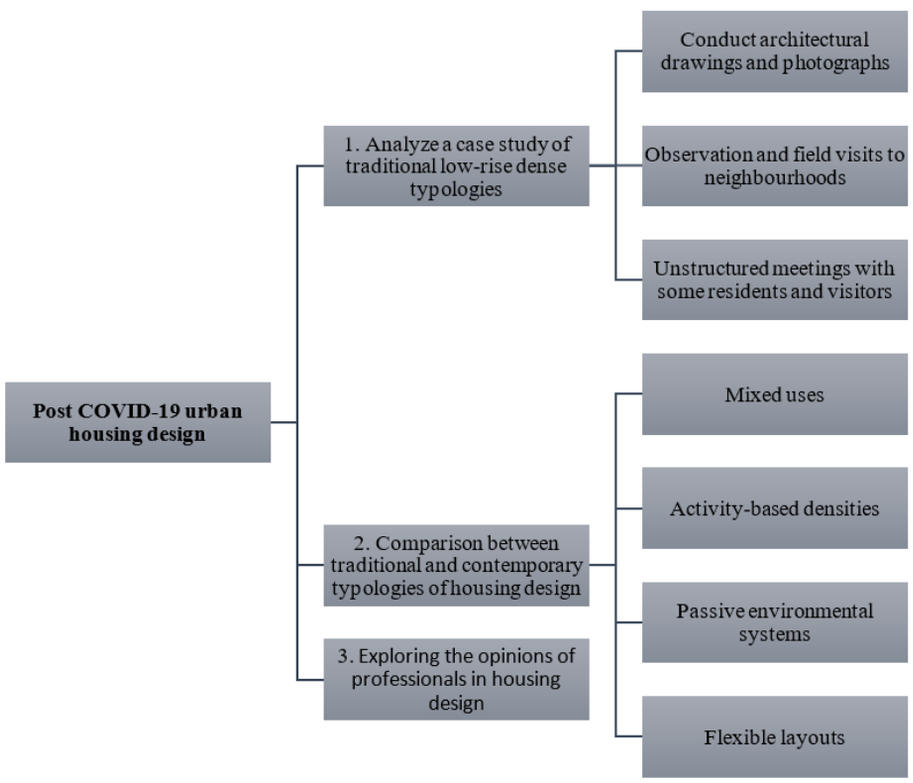
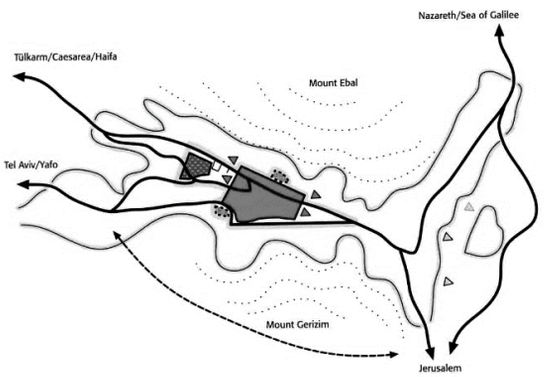


Figure 2. Study methodology and workflow.

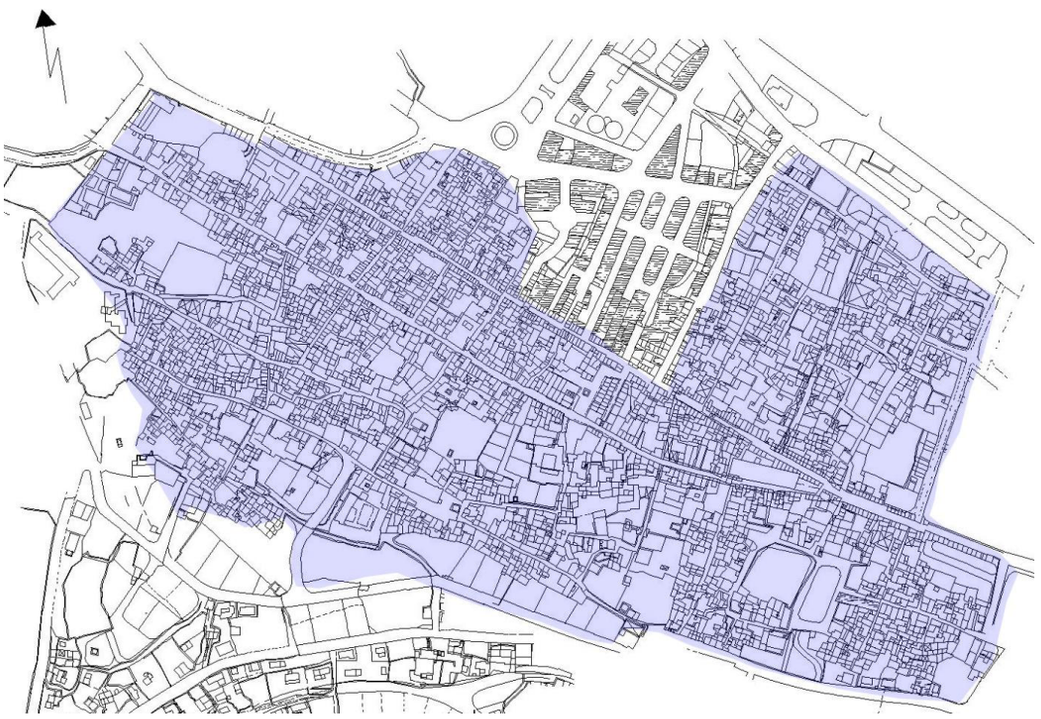
3.1 The Case Study

Nablus is considered one of the Palestinian cities with a vibrant historical centre similar to other Islamic cities (Abd-el-Aziz, 1979). The construction of the old town dates back to the Roman era and its fabric developed towards a compact, organic fabric during the Islamic eras that the city witnessed; it has preserved much of its original composition until now (Doumani, 1995, pp. 1-3). To understand the dense low-rise typologies in the city of Nablus, we choose the old town to study the urban fabric and parts of it to study deeper levels of interactions and relationships between buildings. The study analyzes the morphological and urban characteristics of the old town: number of floors in structures, land use, and type of streets and buildings. Figure 3a,b shows the location of Nablus City on the map and the location of the compact fabric (the old city) in the town. Figure 3c shows that the spontaneous spirit is dominant in this type of settlement because small cells were built by societies throughout history without a preconceived plan. Such cells form an organism that can multiply and increase according to need in an endless urban form.

a. The Location of Nablus City



b. Location of the old city in Nablus



c. Map of the old city of Nablus

Figure 3. Location of the selected case study.

3.2 Questionnaire Survey

The survey used an electronic-based questionnaire that was administered to specialists from various public and private sectors related to housing. The invitation to complete the questionnaire was sent to more than 60 persons, 32 of which were sent back to the authors completed, while other incomplete questionnaires were not considered in the analysis. The analyzed dataset included staff in profit and non-profit sectors such as engineering offices, municipalities, ministries, and contracting offices. However, most of the sample members who responded to the questionnaire were personnel in private institutions due to the large size of this sector compared to government institutions working in the field of housing. The diversity in job titles among the sample members was considered to ensure more accurate results and the recipients were asked about the four main pillars of designing residential areas after the pandemic, as shown in Figure 2. The question development was based on the study team's field investigations for the case study site in an effort to understand

the specialists' opinions as to whether they agree that dense residential low-rise typologies are suitable to address the desired design. The professionals' opinions were converted into quantitative values that could be calculated. The professionals were asked to select an appropriate numbered response, based on a Likert-type scale, to determine the extent of their agreement with the design observations in which1 represented the lowest degree of agreement and 5 was the highest degree, meaning complete agreement. These numbers were then converted into a percentage to draw results for all categories using the following equation:

$$\text{Percentage of agreement} = \frac{Summation\ of\ scores\ for\ each\ question}{Number\ of\ recipients * 5} * 100_{\%}$$

4. Results

This section discusses the results of the analysis, architectural survey, and observations of the architectural and urban situation of the case study. It links them to the study framework and workflow shown in Figure 2 to support the idea that traditional low-rise dense typologies effectively achieve the different aspects of the guideline, which are mixed uses, activity-based densities, avoiding crowds, facilitating isolation, quarantine, and flexible layouts. The study compares low-rise dense typologies with high-rise typologies to clarify their potential for post-COVID housing design, as shown in Figure 1.

4.1 Mixed Uses

There is a close relationship between the mixed uses of residential areas and compact urban design. These traditional cities were determined to promote the idea of self-reliance to face difficult political and economic situations throughout history (Michael & E., 2006). Self-reliance was helped by dense, compact, low-rise typologies extending horizontally, which increased the building area on the ground floors used for commercial purposes and thus reduced the distances necessary to reach the various and varied services.

The fabric of the old city is highly compact and produces well-defined outdoor spaces. It consists of tied and attached low-rise and dense typologies; the dominancy in the fabric is not for the urban space as contemporary typologies but for the urban mass. The traditional compact fabric can provide vital requirements for sustainable housing design, which is the ability to have density without negatively impacting environmental aspects. Hence, dense typologies are articulated together to form an endless mat, as shown in Figure 4a. Accordingly, the outdoor spaces between houses are limited but fairly distributed. The urban mass controls the urban space and encloses it in inner spaces. Such inner spaces are used for the mixed-use of groups, families, and individuals because they facilitate planting simple home crops and fruit trees and raising poultry.

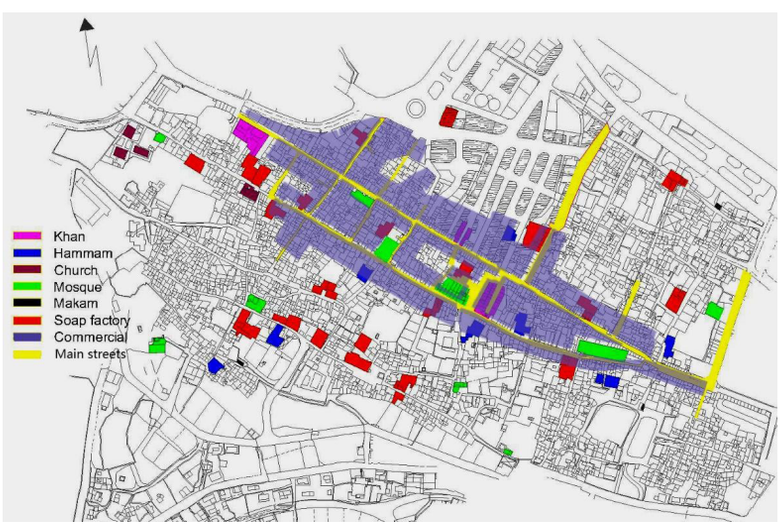
Thus, the compact fabric facilitates the design of a self-sufficient settlement and the self-sufficient parts of such settlement. These compact buildings reduce travel distances and enable walking to fulfil most daily needs in a relatively small circle. The dense typologies opening inward produce compact external spaces that significantly reduce land consumption. To understand the degree of compression in traditional residential styles, these can be compared with the extent of compression in modern styles according to the rule of showing the entire building. In this rule, the viewer needs to move away from the building at a horizontal distance equal to twice the height of the building. In this case, if the same public buildings are spaced apart in the compact fabric of traditional cities, the resulting fabric will consume as many as eight times the original size (Nour, 1979, p. 15)

The housing in Palestine's old cities is separate from other functions. It is based on integrating public and private functions in a homogenous fabric. Such homogeneity could provide an easy and accessible way to different daily services on foot. Low-rise dense typologies enhance the use mix by articulating commercial, light industrial, and cultural activities with the housing environment (Rapoport, 1969, pp. 70-72). Figure 4b shows that planning all city parts guarantees a fair distribution of different services to provide a sense that each part of the city is independent without being odd from the other parts.

Mixing of use becomes accessible from a design standpoint as a result of employing the same cluster organization for residential, commercial, health, and other buildings. Therefore, orienting the buildings inward around the courtyards is an appropriate organization for all functions. The same structural organization around the courtyard can have different uses without significantly changing the interior spatial design, for example, a clinic, school, commercial complex, or house complex.

By comparing the low-rise dense typologies of Figure 4 with the high-rise dense typologies in Figure 1, we can see the extent of the difference that traditional patterns make in terms of the level of independence and self-reliance of human settlements. Three characteristics of traditional typologies also exist in modern typologies: The first is that outdoor spaces are well-surrounded by buildings and suitable for household chores. The second is the ease of access to parts of the city and neighbourhood on foot, with reduced distances due to compactness. The third is facilitating a mix of use and multiple uses due to the presence of courtyards. Moreover, the horizontal extension provides optimal use of the ground floor, which offers large spaces for daily

a. Compact distribution of urban spaces within the urban mass of Nablus' old city.
urban space, urban mass



b. The ability of low-rise dense typologies for a mix of use in the old city of Nablus.

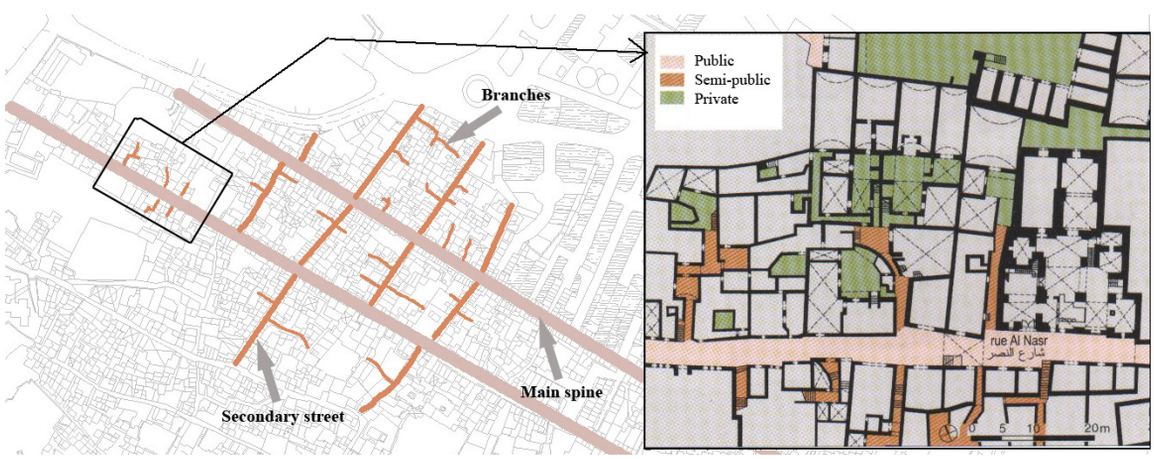
Figure 4. Nablus old city compactness and mix of uses (Nablus Municipality, 2002).

4.2 Activity-based Densities and Avoiding Overcrowding

Reducing gatherings of people in the same space to the smallest possible number is one of the goals of future design to manage disease transmission in residential areas. An environment that limits overcrowding and gatherings will reduce the spread of infection. Since resorting to designing dense regions is a necessary tool for creating and planning cities, the redeployment of the population and their distribution in distant points that do not contain large gatherings can decrease the adverse effects of densification in future design.

It is argued that fair distribution of structures led to activity-based densities and avoiding overcrowding. Analyzing the homogeneity of the structures in the fabric led us to believe that this type of settlement is ideal for the fair distribution of the population and for avoiding crowding. Although no tangible physical boundaries exist for the residential neighbourhoods, their separation naturally exists due to the mixed uses discussed in Section 4.1. This way of separation is simple and does not affect the unity of the fabric. However, the neighbourhoods join and share a central public area devoted mainly to commercial activities. There also is an overlap between residential areas and the commercial centre, which provides a fair spread and regular distribution of population and activities throughout the city. Despite the difference in activities based on the residential or commercial area, we find that the regular distribution of buildings leads to a fair population distribution across all parts of the city. Removing the need to go for daily services in far parts of the living place is a simple way to prevent the gathering of large numbers in residential areas.

The method of mixing between the different elements in one whole appears by focusing on one part of the urban fabric, which reflects the fairness of distribution at the level of the residential group, as shown in Figure 5. Figure 5 clarifies the hierarchy of streets and spaces, encouraging the distribution of entrances and meeting points across the residential area. However, we need to notice that the sizes are equal, as the different functions and needs led to a large discrepancy in shape and size between the buildings. As a result, the image of part of the fabric can illustrate the same homogeneous structure repeated on a larger scale at the level of the urban fabric. In this miniature structure, the parts of the fabric continue to convey a sense of harmony, so there is no dominance of a particular space or element, which reinforces the idea of fair distribution and spread among the population in the spaces.



a. Hierarchy of street pattern b. Hierarchy of spaces

Figure 5. Encouraging fair population distribution using a hierarchy of spaces (Nablus Municipality, 2002).

By comparing the low-rise dense typologies of Figure 5 with the high-rise dense typologies in Figure 1, we can notice the unsuitability of the contemporary typologies. Collective spaces (semi-public) in traditional typologies function as distributors for 5-8 houses, with a range of 40 persons using this space. However, contemporary typologies contain two features opposite to the desired goals of future housing design, the first being the concentration of large numbers of the population in limited places. One residential building, for example, consists of 6 floors with an average of 20 apartments on approximately 1,500 m2. Thus, 100 families can occupy one building using limited-sized shared spaces: stairwell, elevator, and main entrance hall. Second, high-rise dense typologies produce relatively large outdoor public and communal spaces distributed unevenly and unfairly between residential homes, encouraging crowds to stay in them.

4.3 Passive Environmental Systems

As was shown in Section 4.2., traditional residential areas structurally encourage the presence of small collective spaces, which are characterized by a regular and fair distribution of communal spaces between homes. These external spaces result from the assembly of compact low-rise dense typologies and their opening inward which include a succession of often impermeable corridors and courtyards. This traditional space can be called a cul-de-sac (Hoosh in Arabic), considered one of the most important structural elements in forming residential areas, as a large percentage of residential homes surround it, as shown in Figure 6b. The fair distribution of outdoor spaces is followed by the fair distribution of gardens and outdoor spaces, where plants and water elements that soften the atmosphere abound in those outdoor spaces to create an environmental atmosphere suitable for various daily residential activities.

a. Narrow paths and encouraging rapid circulation

b. A map shows the articulation of houses around small urban spaces

c. Distancing between entrances in the cul-de-sac

Figure 6. Organization of houses around collective spaces (Cul-de-sacs) in the old city of Nablus.

Figure 6a,c shows that the fabric also provides aesthetic values on the street level, resulting from the unlimited visual richness that appears when compact blocks are formed in harmony. These values reflect positively on the common sense of residents and assist in comfortable and relaxation modes, which are beneficial in coping with the pandemic. Compared to high-rise dense typologies in Figure 1, traditional housing excels in the presence of such collective spaces, which significantly helps in the effectiveness of quarantine and in raising people's morale while they are ill or experiencing lockdown.

In that sense, a relationship exists between healthy outdoor spaces and the limitation of disease spread. The presence of external areas with easy access and good ventilation helps increase immunity and speed recovery. These areas are very suitable for reducing the spread of the disease and promoting the idea of quarantine. On the one hand, recovery may be slower and accompanied by many frustrating feelings without exposure to sunlight and natural ventilation. On the other hand, there also is a relationship between the population density in one building and the difficulty in safely accessing the outside atmosphere during quarantine. The larger the building is, the larger its population and the greater the possibility of mixing with neighbours. Therefore, quarantine in large buildings requires not going out to the outdoor spaces, which causes a lot of negative feelings and loneliness and increases the time needed for healing.

4.4 Flexible Layouts

The field survey revealed that traditional houses have two characteristics that facilitate staying at home, the first being that they open inwardly and provide natural lighting and ventilation through the courtyard. This idea was confirmed by many previous researchers (Hussein et al., 2010; Tawayha et al., 2019). Figure 7 shows a typical example of a house with a courtyard in Nablus's old city, which provides a healthy open courtyard that usually includes a variety of plants. It is specific to this house and has excellent benefits in entertaining the residents and enabling them to carry out their daily activities, such as eating food, playing with children, and doing homework outside. These characteristics are very important to facilitate the process of staying at home and reduce the feeling of boredom and loneliness that accompanies it. The second characteristic is promoting the use of a roof as a part of the outdoor spaces and continuity to the upper-level courtyard. This use increases the outdoor area for each house and makes it easy to enjoy a good relationship with the outdoors through the upper levels, as is the case with the ground floor. The repetition of these houses provides a wide range of rooftops around the settlement that encourages efficient and sustainable land use.

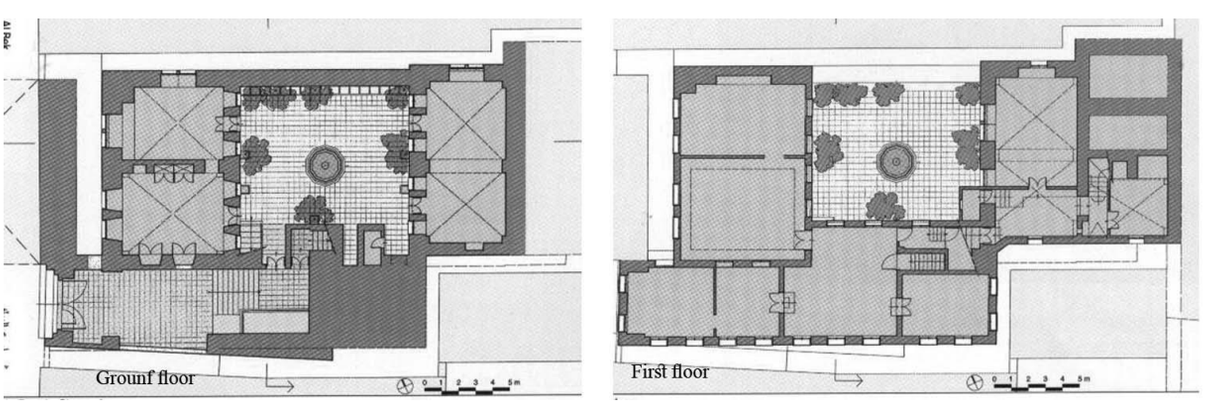


Figure 7. Qualities of houses in the old city of Nablus, including opening inwardly and upper-level courtyards (Revault, Santelli, & Rochant, 1998).

Our study argues that there is a close relationship between persuading people to stay at their homes for a long time -when needed- and the spatial quality of these homes and their close relationship with the external space. It may be self-evident to believe that a house whose design considers social, environmental, and functional needs can facilitate staying home more than commercial, residential apartments. Such apartments are likely to function as a shelter and sleeping area because the nature of the modern lifestyle has become dependent on staying outside the home most of the time. This kind of lifestyle has been reflected in the design of modern residential apartments, which are characterized by relatively small interior spaces and a weak relationship with the outside. However, our study aims to introduce traditional concepts of settlement design for contemporary housing, not recommending copying the traditional houses' spatial design. Traditional spatial designs were developed during peasant times and needed to be adequate for the existing social needs, which changed during the pandemic to include work and study from home. Therefore, the study recommends a contemporary design of low-rise dense typologies that preserve traditional values, yet are suitable for modern needs, as clarified in the second part of the Discussion 5.2.

5. Discussion

5.1 The Potential of Low-rise Dense Typologies

Our field survey confirms many of the results reported in the literature. The results show that the traditional design of residential areas is an appropriate solution to confront the spread of diseases in residential areas in the future. Compactness, courtyards, and mix-of-use standards have been considered necessary for sustainable housing as outlined in Section 2. They are essential for promoting mixed uses, quarantine, and staying home in contemporary settlements. As indicated by a number of studies (D'alessandro et al., 2020; Golubchikov, 2021; Tokazhanov et al., 2020), traditional designs align with integrated cities and the twenty-minute city principle (Chau et al., 2022). Traditional designs provide green spaces and psychological aspects to residents through a simple, connected, yet organic pattern (Vogt et al., 2017; Zhipeng & Wei, 2020).

The results of our traditional low-rise dense typologies survey were used in developing guidelines, derived from the reviewed literature, and translated into settlement characteristics, as shown in Table 1. Table 1 also shows the verification method of the guideline, which is the degree of the professionals' acceptance of the proposed guideline. This percentage represents the extent to which the surveyed professionals agreed on the importance of each item in future housing spatial planning to manage the spread of infectious diseases. Only the points approved at a rate higher than 50% were included in the table. The guidelines that received less than 50% were excluded, but for completeness are listed here: reducing setbacks between high-rise buildings, reducing heights in contemporary residential buildings to four floors, and mixing several residential units in the residential building. These three points were excluded due to the professionals' conviction that they are not directly related to the goal of developing the guideline or based on their ineffectiveness in exploiting expensive land compared to the compact traditional low-rise dense typologies known for efficiency in exploiting the land.

Table 1. Potential of Low-rise Dense Typologies and the Developed Guidelines for Post COVID-19 Urban Housing Design,

Items of post-COVID-19 housing requirements	Translating items into settlement characteristics	Acceptance degree of professionals	Low-rise dense typologies	High-rise dense typologies
Mixed uses	Compactness, accessibility, and lower travelling distances	56.8%	✓	✓
	Facilitating a mix of use	66.5%	✓	✓
Activity-based densities &avoiding overcrowding	Distribution of entrances, meeting points	72.9%	✓	
	Fair distribution of population and avoiding crowding	79.3%	✓	
Passive environmental systems	Encouraging small collective spaces	74.8%	✓	
	Fair distribution of gardens and outdoor spaces	74.8%	✓	
Flexible layouts	Open inward and provide natural lighting and ventilation	70.3%	✓	
	Providing a wide range of rooftops	57.4%	✓	✓

Table 1 also shows the superiority of the traditional low-rise dense typologies in fulfilling all the conditions in the proposed guideline compared to the modern high-rise dense typologies. High-rise, dense buildings show lower efficiency than low-rise, dense buildings in activity-based densities and avoiding overcrowding. This lower efficiency is due to these buildings' reliance on concentrating many people in a small area and producing large squares and spaces instead of the small, distributed spaces associated with traditional low-rise dense typologies. Concentrating increases the chances of overcrowding at specific points, especially entrances, exits, stairwells, and elevators. This fact also leads to the lack of effectiveness of modern models in passive environmental systems due to the concentration of densities at specific points and the lack of communication between the inside and the outside in the residential units, which often are on the upper floors, far from access to the external spaces.

5.2 Applying the Proposed Guideline in a Contemporary Model

The contemporary model of low-rise dense typologies can be designed in a modern way that combines modern building materials with contemporary organized shapes that preserve the values of the traditional fabric. The model is based on the distribution of courtyards in an equally systematic manner that provides many centres for articulating structures of the residential area. These structures are characterized by various sizes and shapes that support many functions to facilitate mixed-use environments. The courtyard's proportions and places should consider the number of floors around each to distribute activities that lead to managing population densities. Furthermore, a passive environmental system is highly related to courtyard design. Natural lighting and ventilation can be achieved using relevant distances between houses -one-half the height of the building. For example, the minimum distance between the front houses should be 18 meters for a maximum height of four floors and nine meters for two floors.

The design also should consider the need for a private outdoor space for each housing unit to enhance health while staying home for a long time. Then, the private courtyards can be transferred into terraces. Each house should have a private terrace that also may be used to enhance the flexible layout of the house to

respond to families' current activities and future extensions. In addition, housing typologies can be determined by identifying patterns around courtyards. These should be separate from mass production, which aims at providing several similar models of houses and dwellings that formulate dense and unhealthy buildings. Instead, these patterns can be designed in many shapes and forms, increasing the house's flexibility to adapt to different demands and needs while preserving the distances between houses.

On the domestic level, the design of the housing unit should acknowledge the renewable needs of family members in the post-pandemic period. The need for increasing work from home and study from home capabilities can reflect the physical, technological, and psychological factors influencing the suitability of a home for remote work. Then, the spatial design of the unit should facilitate workspaces by allowing separate rooms or areas designated for work to be available. The designed spaces should be adequate to ensure comfort and privacy. The courtyards and terraces also should facilitate the psychological and social environment that promotes mental health, such as greenery or views of nature.

6. Conclusion

Any society should work hard to develop spatial planning methods for housing that are compatible with contemporary changing needs. This development towards sustainable design stems from each region's cultural and traditional ideas. Hence, traditional ideas still prove themselves today as a source of inspiration for designers trying to solve contemporary problems. Analysis of conventional residential areas indicates their advantages. They enjoy simplicity of design and easy access to essential services and activities due to the ancient reliance on walking and simple tools for transportation. This type is suitable for designing tiny, low-cost, and large, expensive homes, integrating these differences into a homogeneous architectural fabric. However, the survey revealed that many challenges could face this approach of design, which are the changing societal characteristics, types of building materials, and construction methods in modern times. However, this approach still is applicable because challenges can be solved by the cooperation between urban planners, urban designers, and architects to create contemporary housing forms that do not affect traditional values, as clarified in the proposed guideline in Section 5.2. Therefore, the low-risedense typologies are a high-potential approach for future housing spatial planning and design.

There is no doubt that the Coronavirus (COVID-19) has affected all aspects of our lives and led to the suspension of many activities. Thus, traditional low-rise dense typologies proved to offer sustainable solutions that can reduce the spread of the infectious diseases in the future. It becomes clear that returning to traditional ideas and trying to adapt them to modern conditions is one crucial way to confront contemporary problems. Low-rise dense typologies in Palestine can provide the city with many social and environmental values and economic benefits. Accordingly, our research attempted to link the design values inherent in traditional housing to the conditions that should be met for the post-COVID-19 period, which is mixed uses, activity-based densities, avoiding crowds and isolation, and quarantine that encourage staying home. These values can be reached naturally using low-rise dense typologies for a healthy and sustainable environment.

Low-rise dense typologies produce a compact fabric where all residents can meet their needs within a short walk or bike ride from their homes. The horizontal expansion of this fabric may seem unattainable for large modern urban areas due to high land prices. However, a wide rooftop area could be designed to benefit from this horizontal expansion. In light of spending long periods at home during the curfew periods imposed by COVID-19, the rooftops of houses can be used as a refuge to obtain an open place that reaches direct

sunlight, has sufficient ventilation and lighting, and also can be used for work. Finally, careful urban planning that inserts modern tools like wide streets, parking areas, and regular building forms can gradually make low-rise dense typologies possible.

The future residential areas should be livable and their streets should not be empty of residents once a new epidemic breaks out. The required housing planning should prioritize the physical aspects of the built environment, such as the design, construction, and functionality of buildings, while maintaining an awareness of community needs. Indeed, future design will require architects, urban designers, and planners to collaborate on effective designs that can deal with the challenges of building a comfortable environment for the residents. Then architects, urban designers, and planners should address the challenges of creating comfortable and resilient housing by focusing on material quality and spatial layouts tailored to residents' needs. Governments also have a crucial role in facing such challenges; the shift to horizontal urban development would only make affordable housing attainable for the general population if the governments controlled building regulations, land prices, and the housing production process. Moreover, enforcing construction regulations, ensuring cost-effective housing production, and promoting safe, adaptable building practices also are needed.

Finally, this study developed recommended guidelines for future housing designs. In future research, it also is necessary to ask householders about their needs during the pandemic. Hence, future studies are recommended to determine how communities can be involved and how their real needs can be met in shaping a place in the post-COVID-19 design. People's contribution will, without doubt, enhance the process of designing a housing environment suitable for staying home during the pandemic. Future studies also could explore how technical aspects of construction, such as ventilation, spatial flexibility, and durability, can improve housing design in response to post-COVID-19 challenges. Straightforward construction controls and codes will ensure that housing environments are well-suited for extended stays during pandemics, balancing safety, comfort, and accessibility.

Author Contributions

Conceptualization, methodology, software, resources, data curation, writing—original draft preparation, writing—review and editing, and supervision were all carried out by M.I. The author has read and approved the final version of the manuscript.

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