TB, slum health, and exclusion



The Global Challenge of TB

Urbanization processes in the global south have speed up in recent decades, presenting different challenges which remind the issues faced by early industrialized countries in the global north. The unmet need for shelter of people seeking for a better future in the cities can often provoke the sprout of slums. Poor living conditions in these areas can create suitable environments to develop airborne infectious diseases like TB, adding extra weights to the burden of social exclusion. The role of the dwelling environment in the epidemiology of TB has been historically recognized, though recent studies give little or limited attention to this linkage in slums, despite the advocacy for more holistic approaches made by the WHO in its End TB Strategy.

Slum Health and exclusionary planning

Migrants come to the cities pursuing the benefits of the so-called 'urban advantage'; however, they find further obstacles when realizing that the authorities are often incapable to respond to their needs, ignore and sometimes act against them prioritizing actions which could lead to further exclusion. In exclusionary cities, low-income migrants are disadvantaged and forced to live in spatial and social marginality, which may condemn them to remain in poverty.

Slums have been profiled to lack one or more of the following conditions: access to safe water, access to sanitation, sufficient living space, housing durability, and secure tenure. Deprivations in the built environment could undermine the health of slum dwellers, to the point of worsening their already disadvantaged situation. Social and environmental factors combined in determinants can seriously undermine health. For instance, overcrowding in housing can result in both mental and physical illness with a wide range of problems including family violence and

infectious diseases transmission. The double burden of communicable and noncommunicable diseases among the urban poor is a challenge to be tackled by both government authorities and researchers.

Interventions mostly in the global south which followed hygienist visions, modernist ideas, urban aesthetics, or privileged certain social groups, have used slum clearance, forced evictions and relocations in marginal areas, ending in deterioration, demolition and the perpetuation of social disparities. The latter can negatively affect mental health and social networks, and enhance the prevalence of infectious diseases when bypassing the provision of natural attributes.

Transmission factors and the Peruvian strategy



Study Cases

The costs of TB in Peru

TB can hinder the affected from a normal social and working life, which can consequently contribute to diminish household income and wellbeing. At the national level, the direct and indirect cost of the struggle against TB was around 80.000 million USD in 2010 distributed among the stakeholders involved. Control campaigns are still focused on biomedical solutions and few actions seek to address the multidimensional determinants of TB. Also, control measures in the built environment are limited to awarenessrising of preventive actions in housing, workplaces and public transport. However, the incidence is yet to be reduced at the pace needed to reach the goal set by the WHO.

WHO: Advocating for integrative approaches

Since TB was declared a global public health emergency by the WHO in 1993, several efforts, campaigns, and plans have helped to accelerate the expansion of treatment and control globally. In 2015, under the SDG 3 "Ensure healthy lives and promote well-being for all at all ages", the WHO launched the 'End TB Strategy' with the vision having "a world free of tuberculosis by 2030". Recent global reports on the epidemic state that while TB is decreasing globally, the rates are not high enough to reach the goal by 2030. Therefore, the 'End TB Strategy' pursues more integrative and multi-sectoral approaches through expanding care, strengthening prevention and intensifying research, meaning that the role of the social determinants of TB is receiving further attention than before.

Transmission factors

The likelihood of TB infection can be increased by several factors, including environmental and exposure conditions. The latter are present in different settings which are prone for transmission; prisons, churches, bars, mines, classrooms, health centers, households, workplaces, public transport and slums. TB transmission is mainly an indoor event, for conditions in interior spaces could foster the concentration of the pathogen. High risk transmission environments are generally relatively small and enclosed spaces with lack of ventilation and lack of exposure to direct sunlight. The latter are useful to detect when an environment could be hazardous and to develop profiles of the physical characteristics in places yet not fully studied (i.e. slums). Exposed subjects will have higher risk of TB contagion if they are close to the infection source (proximity), have contact with the affected more frequently (frequency) and through longer periods of time (duration). The latter factors can overlap in certain situations, for instance in overcrowded housing. However, the proximity factor by itself can be enough to originate MTB transmission.

Study Cases

were carried out. After the fieldwork, the data was coded per sample into layouts with plans, sections, pictures, and relevant data from the interviews, to be organized into three scales for analysis: neighborhood, collective housing building, and housing unit. Later, a set of indicators for analysis was built based on the literature review and data gathered during fieldwork. Additionally, topographic conditions of the neighborhoods were considered to explore its influence on the provision of sunlight and natural ventilation in buildings. The only requirement for sample selection, was that at least one TB, MDR-TB or XDR-TB affected household member should live there

The selection criteria was firstly the high level of incidence and endemicity of TB. Secondly, the neighborhoods would be situated in two different topographic conditions which are representative of the slums in Lima: sloped and flat lands, assuming an influence in their urban fabrics. Thirdly, the historic relevance in the urban development of Lima during the 20th century, to suggest a possible relation between gradual deterioration and TB endemicity.

which fostered the mobilization of migrants and organization into a resident association. Throughout time, the densification of the hill augmented following the demand for housing in the area, which may explain the reduced dimensions of the plots. Parallelly, shacks were developed into permanent houses encrusted into the hill following its topography, and later expanded vertically with further floors. By 2007, CSC had a density of 2054 p/ha and 20,000 inhabitants, one of the highest densities in Lima. Despite the improvements made during the last decades, CSC still have depravations among some households which classifies it as a slum: inadequate sanitation and access to water, reduced living space, and tenure insecurity. Also, several social issues and illnesses including tuberculosis, affect negatively the external image of CSC. The rates of TB in the area and its surroundings is five times higher than national ones, and the prevalence in time ensures its endemicity. The latter was addressed in the Metropolitan Urban Development Plan for 2035, which empirically recognized the determinants of Tuberculosis to be tackled through slum upgrading: the inclusion of an open space ring to reduce density, and the relocation of dwellers to a nearby area. Nevertheless, the PLAM 2035 was bypassed shortly after the change of administration.

area, which later in the colonial period framed residential and agricultural developments, resulting in an irregular and unproportioned urban tissue. The latter produced large blocks which were fully occupied responding to the current demands for housing, influencing the creation of collective housing typologies including 'callejones': rooms or small dwellings usually without toilets, organized along one or more hallways and patios. During the second half of the 20th century, BA underwent changes influenced by the migration process. Upper and middle-income groups moved to other parts of the city, which were gradually replaced by low-income groups in deteriorated properties with overused services. BA still preserves some of its former image: however. much of the historical buildings are in appalling conditions and sometimes are replaced with storages, although some are protected by law. Despite the building conditions, families occupy the spaces exposed to multiple health and safety hazards. The epidemic of tuberculosis has been reported since the beginning of early 20th century and almost one century later still remains a burden for low-income families. The latest renovation plan of the historic district, includes BA in the scope of the interventions; nevertheless, it gives little attention to health and ignores TB endemicity in the area, whereas it relies heavily on rescuing the former image for touristic purposes.

Case Study 1: San Cosme Hill



Neighborhood scale

The irregular urban form of CSC, shaped by the geomorphological conditions of the hill, can be clearly differentiated from its surroundings. The narrow streets, alleys, and stair alleys might be a consequence of the process of high contestation and demand over dwelling space in that location, which left tight spaces between buildings. It could be noted that green area is almost inexistent and instead few open space pockets were left scattered over the hill. Thus, the proportion of open space (in white), including circulation spaces, appears to be reduced against the built area over the hill (color black). Additionally, the sloped terrain creates differences between building heights despite floor numbers, which may benefit the upper levels in higher elevations of the hill with natural ventilation and sunlight. Also, a possible Venturi effect in the higher part of the hill might increase wind pressure and ventilation rates for the buildings in that area.

Collective housing scale

Dwellings surveyed were often part of collective housing buildings with roofed spaces (RSS) shared with other residents. The most common type were corridors and toilets which often had only one direct opening to the outside besides entrance doors, and were commonly dark and narrow. Similarly, spaces between the buildings visited had tight proportions of building heights and distances between them in five out of the eleven cases.

Housing unit scale

Most of dwelling spaces were built 'carved' on the hill in reduced and irregular plots, sometimes with subdivisions which produced enclosed spaces often without exposure to the outdoors. Likewise, housing demand may have influenced the proliferation of spaces for rental: bedrooms and two-room studios, which are meant to host singles or couples. However, the latter were found to be occupied by four to ten member households with 5 to 2 sqm per person. From the eleven cases, five dwellings are critically crowded with more than three inhabitants per habitable room. On the other side, most of the cases presented at least one window per room; however, they would only ensure 'single-sided' ventilation and limited possibilities for 'double-sided' one, meaning that they would rely on having entrance doors continuously open. Contrarily, three apartments presented less windows per habitable spaces despite having more rooms.

Case Study 2: Barrios Altos



Irregular urban tissue with streets sufficiently wide and large blocks. Source: the author.



Inner spaces in large blocks were occupied through 'callejones' (orange) Source: the author

Traditional 'callejones'

Informally-built

'callejones'











Spatial constrains in housing units: mezzanines can limit the performance of the few openings available.

From studios to apartments

Inner extensions in historic buildings: from studios to apartments, blocking openings and preventing sufficient ventilation and sunlight

Dwelling-workshop



Informally built callejones: incremental housing with productive spaces which increases crowding

Neighborhood scale

Topography in BA was not determinant for its urban form because of few elevation differences. Although the urban tissue is composed by streets which are wide enough to allow vehicular transit (white), and few open spaces sometimes with restricted access inside blocks (dark grey), it seems that façades have no obstacles for wind flows and sunlight. However, high rates of occupation inside the blocks through collective housing typologies (i.e. 'callejones'), imply that the provision of such attributes would be determined by each building solution.

Collective housing scale

doors. Toilets are usually dark and poorly ventilated

Most of the houses visited were located in 'callejones', which presented at least one unroofed hallway that provides dwellings with sunlight and ventilation. Also, roofed corridors often had windows above doors; however, the 'callejones' and buildings alike, also presented roofed toilets which generally lacked of windows. On the other side, eight cases presented high structures and narrow hallways, sometimes partially roofed with balconies along in the upper levels. Old 'callejones' generally present balcony hallways and level heights around 3.5 meters which could be spatial constrains for ventilation and sunlight, whereas new constructions in plots from former 'callejones' had neighboring buildings as obstructions. Noteworthy, two callejones presented more than one TB affected household, and some interviewees mentioned having at least one neighbor affected in the past

Internal facades of callejones: spatial distribution along tight shared hallways, with one or none windows above

Housing unit scale

Almost all dwelling units could be classified as apartments, with a wide range of sizes and inhabitant numbers: from 21 to 76 sgm in one to three levels, occupied by two to ten member households. Half of the houses surveyed in old 'callejones' presented less than 10 sqm per person. Eight dwellings had more than three inhabitants per habitable room and half of them presented productive spaces including workshops and storages inside the dwelling. The most crowded buildings are old 'callejones', which were densified in time due to household size increase and consequent shelter demand through inner extensions including mezzanines, second floors, and sometimes new rooms in unroofed spaces and rooftops. Despite the extensions were made often blocking existing openings, undermining ventilation and sunlight gains, seven cases had at least one room without window. However, only two dwellings presented conditions for effective 'double-sided' ventilation, and the rest had limited or no possibilities, probably reducing ventilation rates. On the other side, seven interviewees claimed having at least one member which had TB in the past.





Conclusions

Discussion

Spatial constrains in both neighborhoods might produce shading effects that limit direct sunlight and ventilation for dwelling units, which may increase environmental suitability for MTB droplets and infection risk. In CSC, the latter could be due to tight proportions between multi-story buildings facing narrow alleys, whereas for BA, the constrains are narrow hallways of 'callejones' and building heights. Also, the geomorphology of CSC could play a role accentuating differences of exposure between higher and lower floor levels, which could consequently have an effect on indoor environments. Furthermore, shared spaces without sufficient openings could increase the risk of MTB infection among neighbors. Especial attention should be taken to these spaces due to the frequency of use by numerous people. Likewise, in dwelling units it is common to find rooms without windows and few possibilities for 'double-sided' ventilation, which could dramatically reduce ventilation rates. Therefore, dwellings are prevented from healthy attributes which makes them environments with high TB transmission risk. Nevertheless, airflows and sunlight could depend from other environmental factors and physical phenomena, which require specialized studies in slums. High-demand for shelter in both areas resulted in overcrowding conditions in half of the dwelling units surveyed; thus, increasing the probability of household contagion.

Recommendations

Including actions to tackle environmental and exposure factors of TB, might reinforce current control measures into more effective strategies, which are suitable to each context, seek for the greatest positive impact, and prevent negative side-effects. Firstly, health advocacy is needed among all sectors of society and levels of governance, which should reach academics and practitioners related with urban planning. The allocation of resources for health improvement through upgrading living conditions in slums, could be considered as an investment which could benefit national-level economy in the long-term, considering the outrageous amounts spent annually in the struggle against diseases. Interventions in the built environment should eliminate crowding and allow sunlight and natural ventilation in dwellings. To eliminate crowding, relocations may be carried on to re-densify and re-distribute population into healthier spaces; however, these should be sensible towards social assets of the households. Successful models including Participatory Slum Upgrading and co-housing, could be an alternative in this context.

Conclusions

Biomedical strategies and drug treatments could be accompanied by upgrades in the built environment and reinforced by the improvement of socioeconomic conditions, to assemble an effective plan on alleviating TB burden among slum dwellers in the study cases, and similar areas of Lima. The construction of healthier environments must be centered on enhancing the integral wellbeing of its slum dwellers if a sustainable habitat is desired. Projects of this type could set a precedent which follows the integral approach proposed by the 'End TB Strategy', adding substantial advances to reach the goal by 2030. Finally, considering the recent economic and social stability in Peru, it could be the appropriate moment to switch paradigms and advocate for good practices of slum upgrading as means to enhance public health and human capital, strengthen the urban economy, and achieve a more equitable city.

