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ORIGINAL ARTICLE

A novel framework for the formation and expansion of *Active Ageing Cities*

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Summary

In the coming decades many prosperous cities around the world will be faced with two inevitable realities: rapidly growing ageing urban populations and intensified urban densification. Considering the well-documented health benefits of physical activity and the projected trends towards geriatric cities and compact cities, this multi-faceted conceptual framework proposes a novel approach to active ageing health promotion by underlining the provision of age-suitable built environments and urban features as a critical precondition for lifelong participation in physical activity, exercise and sports among middle-aged and old residents living in densely populated urban settings. The framework consists of two segments: formation and expansion. The first segment formulates six determinants outlining the key physical attributes in the light of demographic changes. The second part of the framework suggests the inclusion of inspirational World Cities with soft power qualities. These influential *Active Ageing World Cities* could ultimately serve as benchmark and catalyst cities, shaping the global expansion of active ageing health guidelines for large high-density cities. Overall, the city-wide integration of active ageing lifestyle elements into high-density urban settings with rapidly growing ageing societies could enhance city liveability and lessen the active health marginalization of older residents in the increasingly densely populated urban agglomerations throughout Asia and some parts of Europe. This framework also aims at broadening the active ageing conception beyond the group of individuals residing in aged care facilities and nursing homes.

1. Ageing Cities

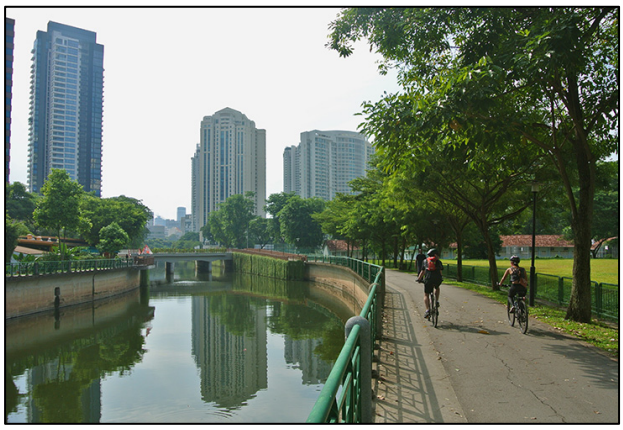
The ageing of urban populations in predominantly developed countries will emerge as one of the key issues facing the public health and urban planning in the coming decades. While in some Japanese and German urban centres the percentage of residents aged 60 years and above is currently at around 30 per cent, this proportion will over the years skyrocket and expand to other regions. By 2050 numerous large-sized cities located mostly in the Asia-Pacific region are projected to become geriatric societies, with Tokyo, Singapore, Hong Kong and Seoul presumably exceeding the 40 per cent levels[1,2,3,4].

Apart from this inevitable trend towards ageing societies, the projected urban population growth in various large metropolitan areas will result in con-

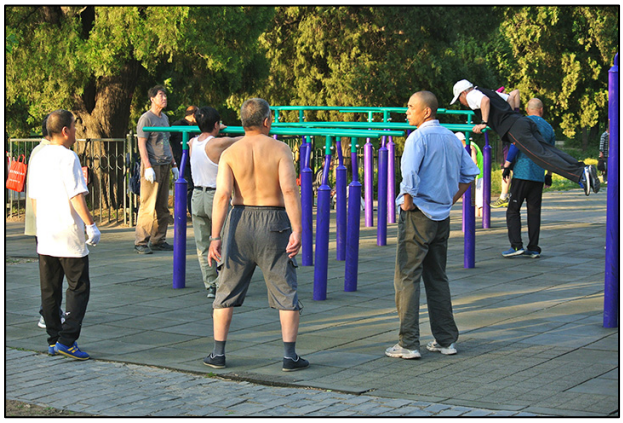
tinuous urban densification[5,6] – that is, various cities will become more densely populated. As high-density living has already become the norm in most residential districts of Asian and European cities[7], further increase in population could reduce the quality of life among elderly residents due to urban space limitation. As the availability of health-enhancing facilities and green space for physical activity, in particular, is critical for older people residing in high-density cities, the projected trends could compromise the future supply of suitable built environments for lifelong active ageing in those cities.

There is accumulating evidence demonstrating that physical activity and exercise in older people is closely associated with enhanced overall quality of life by decelerating or preventing chronic medical conditions, improving age-related neurocognitive disorders and preserving functional independence[8,9,10]. Most notably, moderate-to-strenuous physical activities and exercise modes that improve muscle strength, endurance, motor skills, mobility and balance are linked to improved cardiovascular health, musculoskeletal strength and neuro-motor control functionality among elderly people, resulting in the preservation of functional physical fitness and mobility, lower risk of the occurrence and/or progression of chronic conditions and the maintenance of physical independency[11,12,13,14].

Given that the provision of built environments for physical activity, exercise and sports is believed to be supportive in reducing the risk of various preventable chronic medical conditions[15,16] and boosting physical activity participation rates[17,18,19], the increasingly geriatric and densely populated cities in some parts of the developed world will have to put more concerted effort into advancing this health-enhancing aspect of urban living.
In many cities located in the developed world embedding generic public facilities and green space for physical activity and exercise into urban settings has for decades been one of the key elements of local governments' urban health policies: urban parks, indoor and outdoor sports and fitness facilities, and trails along waterways can be identified as the key urban features for active and sporting lifestyle in metropolitan areas around the globe. Yet the quantifiable trends in rapidly ageing urban populations and the intensified urban densification projected for numerous large-sized cities will demand an innovative approach to this timely urban health topic[3]. Hence, providing age-suitable public facilities and sufficient open green space for physical activity and exercise should be incorporated into any future urban planning and public health strategy for increasingly geriatric high-density cities, thereby enabling middle-aged and old urban residents to pursue health-enhancing lifelong participation in physical activity and sports in close proximity to the residence and to maintain quality of life through physical independence. Particularly, the projected demographic alterations will require improved age-related adaptations to the existing built environments and urban features for health benefits reasons[3].



Despite its ongoing urban densification Singapore has constructed an extensive network of paved trails along its water canals and rivers[7,20].



Older city folks get physically fit at the Temple of Heaven Park in Beijing. Large outdoor fitness zones consisting of a wide range of gym facilities are regularly embedded into city parks in this large-sized, high-density city.

Thus the primary objective of this article is to propose a framework that would link the ageing urban population trends and the intensified urban densifi-

cation of larger cities with the provision of age-suitable and diverse built environments for physical activity and exercise. To enhance the physical health and the quality of life of a growing number of present and future elderly city residents living in large, high-density cities, this article therefore argues for a refocus on the structural component of active ageing health promotion. Above all, this framework should be considered as a starting point for a broader, long-term examination of the spatial integration of age-suitable urban features for sporting lifestyle into high-density urban settings.

2. Framework – Active Ageing Cities

In the developed world participating in lifelong physical activity will increasingly become a fundamental aspect of healthy city living. Given the projected population growths and ageing society trends in many large-sized, high-density Asian and European cities, in particular, providing the present and future generation of middle-aged and old city residents with adequate built environments for sports, exercise and physical activity could possibly emerge as a key precondition for the active ageing lifestyle evolution and city liveability.

The proposed conceptual framework approaches this public health subject from a synergistic, cross-disciplinary perspective[21,22], thereby capitalizing on the overall knowledge accumulation and intensification through the interrelatedness and cross-pollination of various themes – ranging from urban planning, exercise and fitness, public health promotion and gerontology to environmental and atmospheric sciences, cultural studies, behavioural neuroscience and socio-economics. The first segment of the framework proposes six determinants outlining fundamental physical attributes that are critical to designing age-suitable urban space and infrastructure for physical activity and sports. These factors are interlinked and could potentially serve as the formation basis for various geriatric cities across the developed world during their proactive process of establishing *Active Ageing Cities*. The physical attributes also lay the groundwork for future active health promotion research assessing the suitability of urban features for sports, exercise and physical activity in high-density cities with rapidly ageing populations. (It should be pointed out that physical activities such as walking and biking conducted in road traffic and in formal clothing are not taken into account in this concept!). The second segment of the framework proposes a long-term strategy for a global expansion of *Active Ageing Cities* across the increasingly geriatric developed world through the inclusion of an adjusted world cities conception.

Overall, this conceptual framework aims at facilitating future geriatric cities to create cohesive, long-term strategies for urban active health and sporting lifestyle. It also highlights the critical public health aspects of providing adequate and sufficient active ageing urban features, delivering an essential public good and popularising an active ageing lifestyle in urban centres. Due to the ageing population trends in mostly prospering cities and the global revival of the compact city concept, this proposed framework is particularly suitable for larger high-density cities located predominantly in Asia and Europe.

2.1. Formation

The proposed formation process of providing age-suitable built environments and urban features for physical activity and sports consists of six determinants – affordability, diversification, functionality, accessibility, environment and locality. These key physical attributes could potentially serve as reference points for the provision of adequate active and sporting lifestyle infrastructure and urban space for prospective *Active Ageing Cities* worldwide.

Affordability

The active lifestyle affordability among elderly city residents is partially limited due to absent income flow, restricting retirees from using chargeable facilities for physical activity and sports. Besides, the scale and accessibility of secured retirement payments of older city residents vary significantly between cities due to differing national labour and public policies. Securing the affordability of active and sporting lifestyle amenities will therefore be a defining element of any prospective *Active Ageing City*.

Urban waterfront trails for walking, running and cycling – the most popular urban features for aerobic exercises – can typically be used for free across metropolitan areas. Ideally, the entry to city parks should not be charged, while the utilization of the key government-subsidized sporting and recrea-

tional services should be either free-of-charge or fairly reasonably priced – based on the purchasing power of local retirees. A city-wide integration of publicly accessible small outdoor sporting grounds and fitness facilities into residential areas should also be considered. In this way, basic options for enhancing physical health could be freely and equally offered to local elderly people. On the whole, the pricing rates for publicly accessible active lifestyle facilities should not become a physical activity participation impediment among older city residents. Although privately operated indoor fitness clubs, tennis courts or golf courses, among others, have grown in popularity across metropolitan areas, they mostly offer pricier active ageing lifestyle options compared to public facilities. Furthermore, the utilisation of private amenities has regularly been limited exclusively to residents living in spatially segregated private condominiums – a socio-economic trend that has been noticed in Asian cities, in particular.

This steadily growing private/public accessibility imbalance could perhaps be regarded as a reflexion of the broader socio-economic circumstances observed in many affluent cities. After all, a progressively growing gulf in prosperity within societies has been emerging in numerous developed countries since the late 1980s and 1990s[23,24]. It remains unclear, however, whether in future this quantifiable inequality in income and wealth distribution could become a physical activity participation impediment. Given that in most Asian cities – not necessarily in European cities, however – larger numbers of the present middle-aged residents attain greater middle-class purchasing power compared to previous generations (i.e., the current retirees) due to higher incomes and higher labour force participation rates[25], this prospective retirement age group will most likely be financially better off, thereby enabling them to spend more on active ageing lifestyle options. Nevertheless, the pricing of public facilities for physical activity, exercise and sports would still have to be kept at affordably low rates in order to ensure high active ageing participation levels through equal accessibility. Since four of the rapidly ageing Asian cities – i.e., Singapore, Hong Kong, Tokyo and Seoul – are positioned at the very top of the global city ranking in terms of high costs

In Tokyo access to numerous city parks is not free and the prohibition of strenuous physical activities and exercises is also fairly common[28].

Seoul offers an extensive network of publicly accessible trails for walking, running and cycling along the Han River and its adjunct streams. In addition, medium-sized outdoor fitness areas are located along the trails[27].

of living[26], the affordability factor will be a critical aspect of any prospective Active Ageing City strategy for large high-density cities in the developed world.

Diversification

Older urban inhabitants typically confine their active ageing participation to a limited number of convenient physical activities – most notably, walking. Walking is a free-of-charge innate physical activity that does not necessitate any newly acquired motor skills and is suitable for middle-aged and old people aiming to preserve or enhance their cardiovascular fitness. Yet the predominance of this mono-functional, aerobic-centric activity may suggest that greater diversification of active ageing lifestyle options is required. A possible age-suitable urban feature for such diversification policy could be the provision of outdoor gym areas containing a large variety of easy-to-use fitness stations. Such outdoor fitness zones – which are systematically integrated into many high-rise residential areas across Singapore, Seoul, Beijing and Shanghai, for instance (see 'Functionality') – could also be installed along trails, enabling older people to enhance their overall physical health by adding fitness tasks to their recreational walking or recreational cycling. In this way, aerobic activities could be merged with various health-enhancing types of workout, thus improving strength, flexibility and balancing capabilities.

Public city parks in Beijing are good examples of diversification and compactness, regularly providing physically active visitors with walking trails, outdoor gym areas and small-sized grounds.

City parks are fairly popular with physically active elderly residents. In order to increase their utilization rates, some of the medium- and large-sized city parks could undergo structural alterations by com-

plementing them with a variety of active ageing-suitable amenities. In general, it has been demonstrated that greater diversity of facilities within parkland areas is associated with greater utilization levels among physically active urban residents[17]. By applying the aspects of diversification, centralisation and compactness, designated park segments that are easily accessible – e.g., adjacent to commercial areas and close to public transport system – could be transformed into *Active Ageing Parks*. These segments could, for instance, consist of outdoor fitness areas, small outdoor (or indoor) game grounds, table-tennis facilities and medium-sized outdoor (or indoor) swimming pools. In doing so, the present mono-structural city parks would obtain a diverse character, thereby realizing the full potential of this health-enhancing urban feature and altering the dominance of mono-functional walking.

Functionality

Prospective *Active Ageing Cities* will have to provide their older physically-active residents with a substantial number of age-supportive amenities and infrastructure that comply with the functionality aspect of healthy ageing – particularly, the inclusion of orthopaedic, biomechanical and cardio-respiratory research knowledge should be considered when crafting suitable strategies and policies. More emphasis could also be put on amplifying the multi-functionality and age-suitability of existing and planned outdoor gym areas observed in various large-sized, high-density Asian cities. In this way, older users of these free-of-charge fitness stations would be given the opportunity to optimize their physical health benefits by selecting strength, flexibility, balance and endurance tasks according to their individual demands. The inclusion of this age-related functionality aspect would ensure high-quality returns and greater efficiency – i.e., the optimization of overall physical fitness and health benefits relative to the individual's invested time.
Due to its age-suitable functionality the supply of gravel trails, for instance, in prime city parks and along waterways could also be expanded. Such softer, unpaved trail surface is suitable for middle-aged and older recreational runners, resulting in re-

In Singapore outdoor fitness zones consisting of a wide range of gym facilities are integrated into its urban planning concept[7,30].

Although the new residential estates in Seoul typically contain a number of outdoor gym facilities, this health-enhancing urban feature has not reached the scale of Singapore's outdoor fitness zones[27].

duced cumulative impact on their hip and knee joints[29]. Thus the construction of age-suitable trails could potentially enable more residents to pursue recreational urban running beyond their retirement age.

Taken together, various aspects of age-related functionality should be evaluated and eventually incorporated into future *Active Ageing Cities* strategies outlining age-suitable built environments and urban features for physical activity, exercise and sports.

Accessibility

For older and physically challenged city residents the proximity to active lifestyle amenities is a critical factor in integrating lifelong physical activity and sports participation into their daily routines. Hence, active ageing lifestyle-enabling features – such as sports facilities, small neighbourhood parks, trails, small game grounds or outdoor fitness areas – should preferably be located conveniently around local neighbourhoods. While smaller sporting facilities, outdoor game grounds and outdoor fitness zones could fairly easily be incorporated into numerous existing residential districts, this barely applies to the provision of potential medium- to large-sized city parks. Due to high density levels of built-up areas prevailing in most established cities, there is little prospect of transforming larger sections of utilised urban land into green parklands – except for Seoul, where the US Army Garrison located in the Yongsan district, the geographic centre of the city, will most likely be replaced by a large park and recreation area, almost reaching the scale of the Central Park in Manhattan, New York City[31]. In this context, it is inevitable that only a small proportion of older city residents will live within walking distance to medium- or large-sized parks. Given the projected urban population growths in various large-sized, high-density cities, the divergence trend between availability of extensive public green space and population size will most likely continue. This will result in more inconvenient accessibility of city parks for larger shares of ageing urban populations. Therefore, future research and potential urban health policies should primarily focus on improving and diversifying accessibility options to major parks rather than excessively assessing the proximity to small neighbourhood parks and the population-to-parkland size ratios.

Although driving to popular active and sporting lifestyle amenities certainly improves the levels of accessibility, the overall costs of owning a car in various large-sized cities, and particularly in Singapore[32], do not make it a financially viable transportation option for urban retirees. As the car

ownership rate is increased by virtue of higher income and/or greater wealth, this economic factor restricts retirees in their active lifestyle options due to their mostly reduced purchasing power during their retirement. Hence, enhanced car-independent access to age-suitable facilities and city parks will become a critical element of any potential *Active Ageing Cities* strategy.

Publicly subsidized sports complexes consisting of outdoor swimming pools, stadium and indoor sports hall are successfully embedded into Singapore's high-density, high-rise residential districts[7].

Most importantly, the key facilities and medium- to large-sized city parks that are suitable for physical activity and exercise should be accessible via a well-connected train and bus network. Most large Asian and European cities with rapidly ageing populations provide their residents with expansive, yet not always affordable public transport system networks. Eventually, keeping the public transportation prices low and improving the efficiency and the inter-connectivity of trains and buses will result in greater accessibility of medium- to large-sized city parks. An increasing number of prosperous and innovative cities have furthermore been investing heavily into the operation of driverless transportation systems. Thanks to its compact and integrated urban layout Singapore, for instance, could soon be able to incorporate overlapping transportation systems and fully autonomous multi-modal transportation networks into its city living environments, considerably improving the accessibility of active ageing facilities and public green space[3,33].

Environment

Older city residents typically prefer to pursue active lifestyle in outdoor environments (e.g., walking and cycling). Yet the availability of urban features for outdoor physical activities will not necessarily result in greater physical activity participation levels among elderly residents, if the environmental conditions are perceived to be unsuitable or hazardous to the individual's health. Since high levels of air pollution are associated with posing health risks to older people and people with medical preconditions[34,35], in particular, the local air quality levels in geriatric cities should be considered during the *Active Ageing Cities* formation process. To be clear, for any potential *Active Ageing City* the preservation or rather improvement of its urban air quality as well as the provision of sufficient indoor facilities will therefore emerge as critical aspects of active ageing lifestyle.

The growing number of motorized vehicles in the increasingly prosperous Beijing has contributed to the city's high air pollution levels.

The environmental movement had its origins in the developed countries during the 1960s period, inspiring cities around the world to adopt standard environmental regulations that were designed to reduce their man-made air pollution levels. Apart from having imposed national anti-pollution policies across industrial sectors, many large high-density cities, in particular, have implemented rigid car-restricting measures due to their urban space limitations, resulting in reduced levels of air pollutants thanks to lower car ownership numbers and greater usage of public transportation and bicycles – e.g., in Tokyo and Osaka[36].

Although there is no globally standardized air pollution index that is suitable for inter-city comparisons, the concentration levels of one key air pollutant – i.e., the PM2.5, which is known to have adverse cardio-respiratory effects on individuals due to its ability to deeply penetrate lungs – could

offer a valid measure of urban air quality. The air pollution in large, high-density cities with the potentially highest ageing population growths are mostly positioned in the lower to mid range levels, offering fairly acceptable conditions for active ageing lifestyle. With 15 µg/m^3 Tokyo demonstrates the lowest annual PM2.5 value of all large, high-density cities across Asia, highlighting the city's efforts in managing its domestic air pollution. The values in the large European urban centres typically range between 15 and 20 µg/m^3, while in the other ageing cities in Asia, such as in Hong Kong, Singapore and Seoul, the levels fluctuate between 20 and 30 µg/m^3 **(see Chart 1)**. By contrast, Shanghai and Beijing reveal rather inhospitable environmental conditions for active ageing – 52 and 85 µg/m^3, respectively (with 7 µg/m^3 Vancouver, Canada, exhibits the lowest air pollution, whereas Delhi, India, is the uncontested city with the highest air pollution levels, recording an annual average PM2.5 value of 122 µg/m^3)[37,38,39].

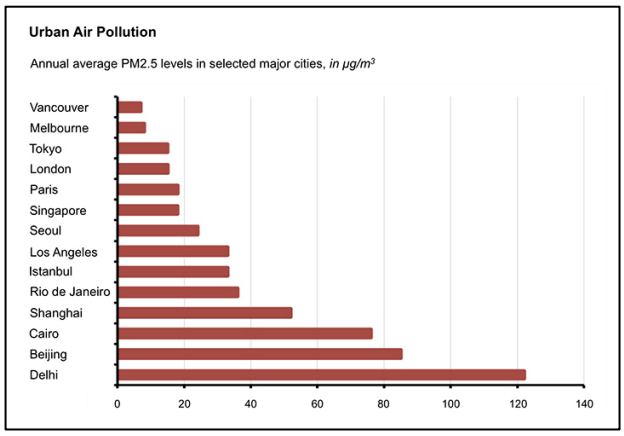


Chart 1. Urban air pollution. Average annual PM2.5 levels in selected large-sized cities[37,38,39]

To reduce the levels of exposure to hazardous exhaust fumes among older city residents, the location of urban trails, city parks and outdoor sports facilities should preferably be located at a safe distance from main roads. That said, in the long term the management of car traffic volumes around the prime outdoor active lifestyle amenities and the implementation of less polluting transportation technologies would be considered the more forward-looking and effective urban health policies.

In all, prospective *Active Ageing Cities* will have to offer satisfactory environmental conditions for outdoor physical activities and the required volume of indoor facilities. If the projected prime ageing cities, such as Singapore, Hong Kong, Tokyo and Seoul, were to maintain (or even reduce) their air pollution levels, their (older) residents would be able to utilize urban features for outdoor physical activities without being incessantly concerned about possible health implications. Thus the provision of active ageing-supportive outdoor urban features in large-sized, high-density cities will have to occur in conjunction with advanced urban anti-pollution regulations.

Locality

To enhance health benefits through greater physical activity participation among elderly city residents, active ageing-supportive urban features and infrastructure should reflect the local topographical and geographical circumstances of a city (in general, this important aspect has not been sufficiently factored in the largely generic active ageing policies). For instance, creating cycling trails for older residents is not a viable option in city districts with hilly urban terrain, such as in large parts of Hong Kong, in the central and northern districts of Seoul or the north-eastern and south-eastern parts of Guangzhou. Also, large-sized, high-density cities with limited numbers of natural waterways or with no access to coastal areas are constrained in supplying their older residents with sustainable and suitable trails for walking, running and cycling. Alternative physical activity options and city-specific active and sporting lifestyle strategies would have to be established in these topographically-disadvantaged cities.

As for the geographic location of cities, local climate patterns should also be reflected in the city-specific planning and formation process of *Active Ageing Cities*. Although the seasonality impact of winter weather is associated with lower physical activity participation, the research has largely been limited to world regions with four distinct seasons throughout the year[40,41]. Especially, residents living in cities with long and cold winters, such as Moscow or Toronto, are limited in their outdoor activity options, considerably reducing the time spent in outdoor environments **(see Chart 2)**.

Furthermore, numerous large-sized ageing cities are located in the subtropical and tropical rainforest climate zones, such as Hong Kong and Singapore, for instance[44]. This non-modifiable factor, i.e., high ambient temperatures and high humidity levels, creates challenging meteorological circumstances for physically active older city residents by increas-

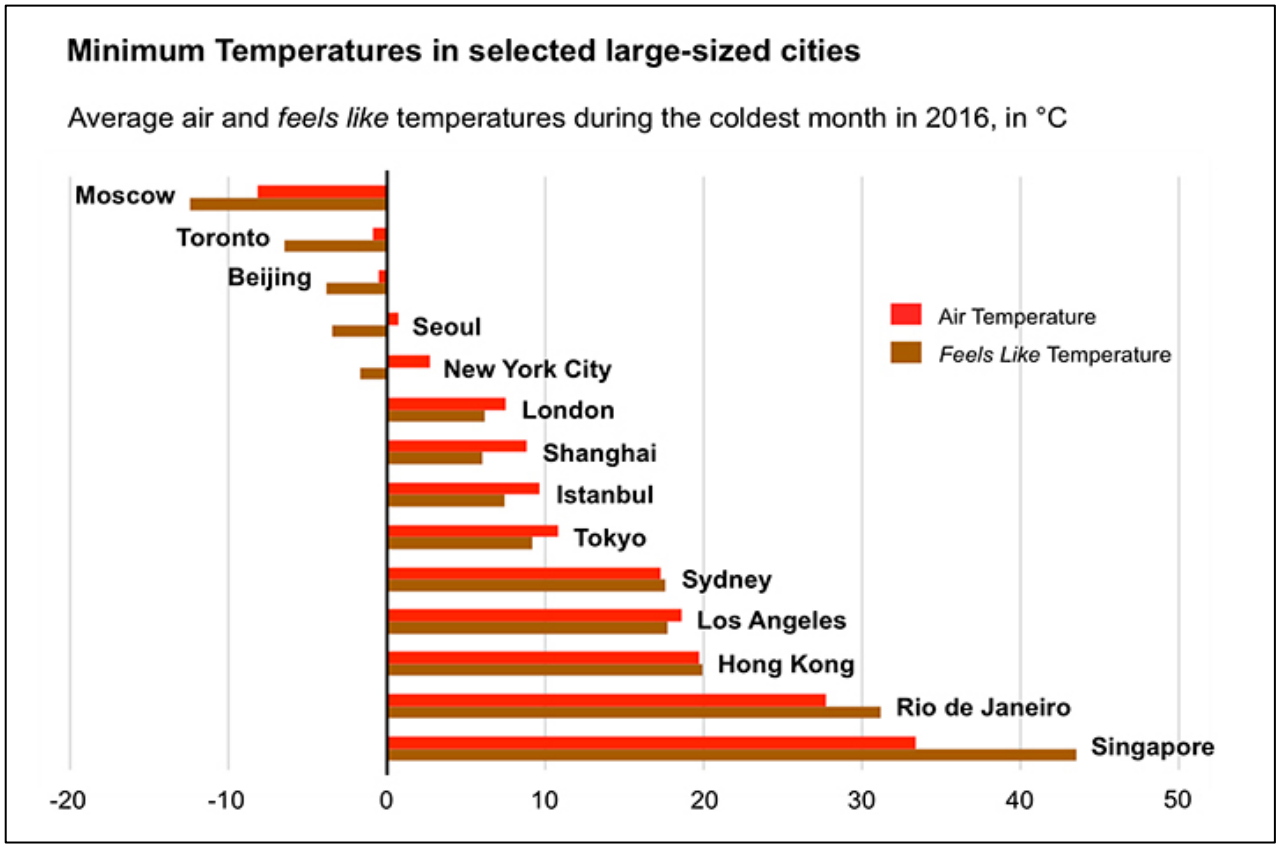


Chart 2. Air temperatures and *feels like* temperatures during the coldest period in selected large-sized cities. In some cities the *feels like* temperatures are colder (by up to 4°C) compared to the officially recorded air temperatures. Given the weighty impact of humidity level and wind speed on the perceived temperature, the *feels like* temperature is at times the more suitable assessment choice[42,43].

ing the risk of medical emergencies as a result of hyperthermia-caused impaired response of the cardio-respiratory system[45]. Although residents living in such (sub-) tropical cities are better acclimatized to hot and humid conditions compared to the so-called non-tropical natives[46], the scale of perceived heat levels still influences the daily rhythm of tropical natives and their physical activity choices. To avoid the rather inhospitable temperatures and humidity levels prevailing in the daytime, local residents typically tend to incorporate outdoor exercising into their daily rhythm during the slightly more pleasant early morning and evening hours. Hence, extensive lighting should be provided in city parks and along trails before dawn and after dusk, ultimately helping to popularise *Twilight Active Ageing* – a prospective element of *Active Ageing Cities* located in warm climate zones.

To reduce the risk of suffering hyperthermia-induced medical complications among elderly, small outdoor sports facilities and fitness areas could furthermore offer inexpensive, sun-protective shade sails and small solar-powered fans, thereby reducing the users' exposure to extreme UV-solar radiation and perceived heat levels. And evidently, large numbers of comfortable air-conditioned indoor facilities are also required.

In addition, city parks should be better adjusted to the local climate, that is, they should provide middle-aged and older residents with an experience that reflects the uniqueness of the city's geographic locality. Thus the incorporation of this behaviour-altering factor – i.e., climate – into urban planning concepts will be an essential aspect of consolidating a distinctive, liveable *Active Ageing City*. By integrating local, tropical elements into tropical-style park designs, such as outdoor table-tennis or beach badminton, for instance, city parks located in (sub-) tropical climate zones could offer older city residents suitable location-centric physical activity options.

In short, the climatic aspect would certainly have to be highlighted in any city-specific active ageing strategy and policy.

2.2. Expansion

A successful *Active Ageing City* formation in a number of large high-density cities with rapidly ageing populations could eventually inspire other geriatric cities across the developed world to emulate their active ageing-suitable built environments and urban features. After all, cities regularly monitor, analyse and adopt new ideas and urban developments of other cities. The probability of such emulation process appears to be greater, if the trends originate or get popularised in dominant and influential cities. Such key metropolises typically set new standards of city living while becoming the driving forces for other cities' evolution.

Various ideas, policies and trends that originated or were popularised in London – the influential urban centre of the former British Empire – have impacted the evolution of city living around the world.

The panoramic skyline of Manhattan, New York City, has triggered a global expansion of high-rise, high-density urban developments.

In modern history, for instance, the urban beautification development with tree-lined boulevards in Paris[47], the construction of London's Underground railway[48], or the expansion of New York City's illustrious skyscrapers[49,50] have unarguably had major impact on the urban development of other cities. Yet the influence of some pioneering urban population centres has not been confined to city planning and urban design, usually extending its reach into other areas of city living, such as culture, fashion and lifestyle – for instance, New York City's hip-hop and graffiti street culture in the early 1980, London's various music subcultures, the Parisian fashion culture, Tokyo's Manga culture or New York City's recreational marathon events since the 1970s, just to name a few.

Such major urban centres of supremacy and influence are labelled World Cities[51]. Over the past decades cities across the globe have been assessed in regard to the scale of urban dominance in various aspects of urban development and city living, resulting in the identification of the top-tier World Cities in the areas of political power[52,53], finance and business[53,54], technology[52], social progress and environmental quality[55], prestige[56], culture[57], prowess in global services[58,59], international connectivity[60] and transportation infrastructure[48]. Taken together, a number of top-tier World Cities play a key role in dictating and shaping the world's progress in the areas of economics, technology, infrastructure, culture and society. Despite the differences in methodology and selection of criteria, there appears to be an analytical consensus in the world cities' analyses as to which cities have acquired a top-tier World Cities status – London, New York City, Tokyo, Paris, Singapore, Hong Kong, Los Angeles, Chicago and Seoul are mostly positioned at the top of the World Cities hierarchy. Overall, prime World Cities are global role models for various aspects of modern city living. They possess a great capacity to shape the view of what urban living will look like in the 21st century; hence, they are the geographic points of reference for long-lasting trends. Based on this notion of World Cities' dominance and global influence it is reasonable to argue that the successful implementation of active ageing lifestyle strategies in some of the influential high-density urban centres could eventually inspire other ageing cities to put greater emphasis on providing age-suitable built environments and urban features for physical activity, exercise and sports across their geriatric urban districts. That is, an expansive dimension of active ageing strategies originated and consolidated in such urban centres could be established through imitation. Imitating social behaviour and cultural trends is an innate neuroplastic capacity that is associated with the emulating processes in human

brain function[61,62]. That is, due to the existing mirror neuron system human beings (i.e., societies) tend to replicate observed behaviours of others, frequently resulting in socio-cultural transmission. As all city living aspects are products of human behaviour, cities regularly imitate appealing urban developments and lifestyle trends of other cities.

For such active ageing city-to-active ageing city emulation pattern to occur, however, a number of densely populated prime World Cities with rapidly ageing populations would firstly have to acknowledge the relevance of creating long-term active ageing urban planning strategies for their own geriatric districts (relevance factor). Subsequently, they would have to demonstrate ambition for developing critical public health policies (aspiration factor) and identify the most suitable urban health elements for active ageing (identification factor). Once the three factors are established, these prime World Cities could potentially evolve into world's laboratories for active ageing lifestyle in high-density urban settings during their formative years (formation), maturing into *Active Ageing World Cities* and projecting its urban active health policies across the globe. Ideally, *Active Ageing World Cities* would create a nexus of active ageing elements, eventually inspiring other high-density cities with rapidly ageing populations to incorporate the most suitable and appealing urban strategies and features into the urban environments of their own cities. This expansion process would furthermore be amplified by the soft power capacity of World Cities – soft power is the ability to exercise influence over the behaviour of others and to get them to desire something[63].

In the long run the emulation process of the most suitable built environments and urban planning concepts for active ageing lifestyle could have a transformational impact on future-city-living and the state of urban health. To amplify the effectiveness of such global expansion, cities are advised to adopt strategies and ideas from cities with fairly identical city living elements – i.e., a cluster-like formation of cities with comparable aspects of urban planning, socio-culture and economics should be encouraged (affinity factor). In this way, cities would evolve more rapidly into *Active Ageing Cities* due to their geographic and cultural networks **(see Chart 3)**.

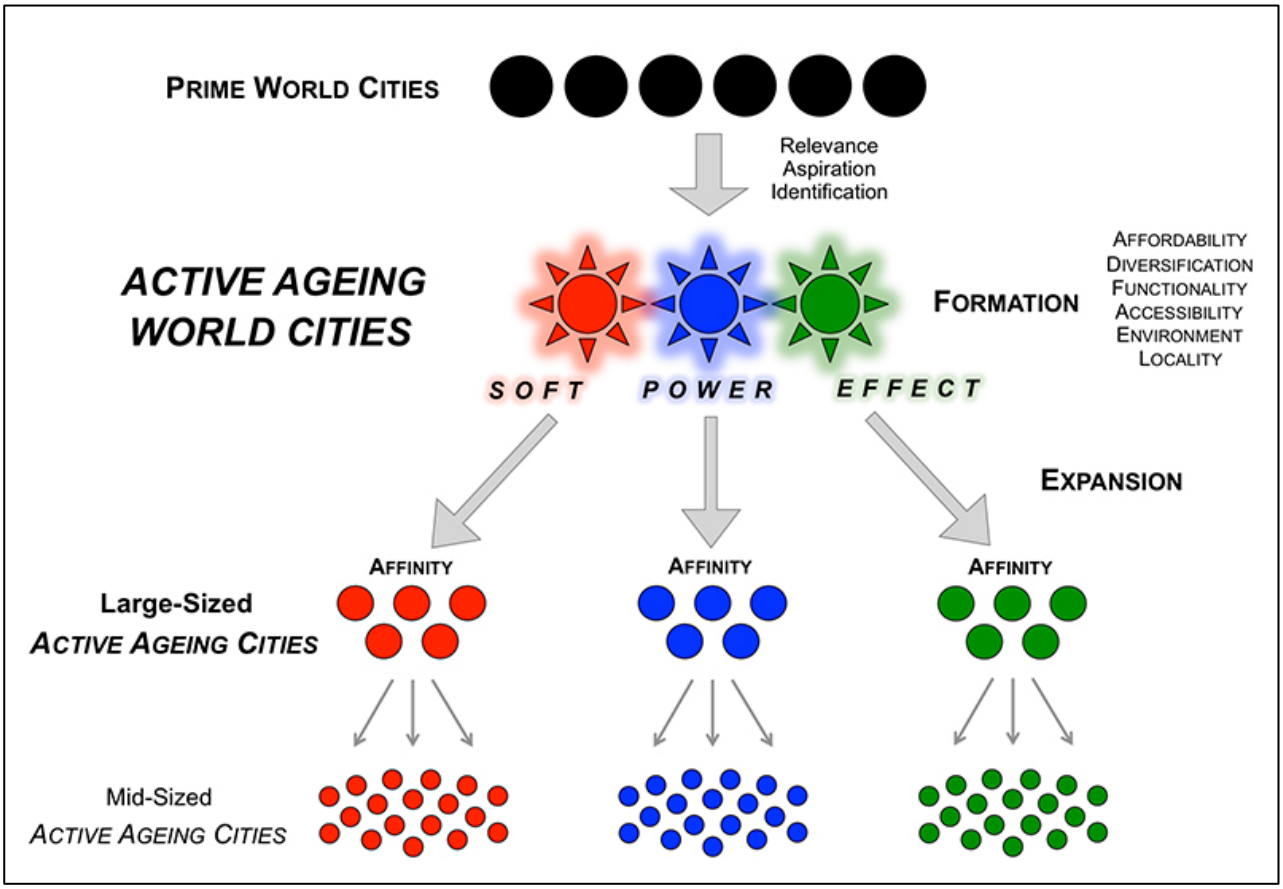


Chart 3. The *Active Ageing World Cities* framework

3. City Liveability

Considering the well-documented health benefits of lifelong physical activity in ageing populations, the projected trend towards geriatric cities and the revival of the compact city model, this conceptual framework proposes an original approach to active ageing promotion by underlining the provision of age-suitable built environments and urban features for physical activity, exercise and sports. It also implies that *Active Ageing World Cities* could ultimately serve as benchmark and catalyst cities, setting the tone for global expansion of novel urban active health guidelines that could help promote the integration of active ageing lifestyle elements into future city living.
By incorporating the outlined physical attributes into city profiles, prospective *Active Ageing Cities* could moreover create compelling and recognisable active ageing city brands. That said, the reluctance of cities to be identified and labelled with hyper-aged societies must be anticipated. In general, cities rather emphasise the youthification of their urban living while desiring to attract young, health-conscious knowledge workers. Thus the *Active Ageing World Cities*, in particular, could potentially become the driving forces underpinning societal changes in the ageing perception.

Overall, this novel framework could potentially make a transformative contribution to the global active ageing strategy and embolden both academics and government officials to broaden the definition of active ageing beyond the groups of individuals residing in aged care facilities and nursing homes.
Furthermore, this framework could encourage national and international organisations for active and sporting lifestyle to exert more influence over urban health policies in major cities with rapidly ageing populations. And incorporating the key components of the proposed framework into city liveability concepts[64,65] would eventually be a critical phase towards extending this topic's reach beyond the academic circles.

Given its rapidly growing ageing population, increasing urban densification and an emerging active and sporting lifestyle culture, Singapore could potentially transform itself into an *Active Ageing World City*[3].

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