Advancing urban green and blue space contributions to public health

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Urban green and blue spaces (UGBS) have the potential to improve public health and wellbeing, address health inequities, and provide co-benefits for the environment, economy, and society. To achieve these ambitions, researchers should engage with communities, practitioners, and policy makers in a virtuous circle of research, policy, implementation, and active citizenship using the principles of co-design, co-implementation, co-evaluation, and co-translation. This Viewpoint provides an integrated perspective on the challenges that hinder the delivery of health-enhancing UGBS and recommendations to address them. Our recommendations include: strengthening the evidence beyond cross-sectional research designs, strengthening the evidence base on UGBS intervention approaches, evaluating the effects on diverse population groups and communities, addressing inequities in the distribution and quality of UGBS, accelerating research on blue space, providing evidence for environmental effects, incorporating co-design approaches, developing innovative modelling methods, fostering whole-system evidence, harnessing political drivers, creating collaborations for sustainable UGBS action, and advancing evidence in low-income and middle-income countries. The full potential of UGBS as public health, social, economic, and environmental assets is yet to be realised. Acting on the research and translation recommendations will aid in addressing these challenges in collaboration with research, policy, practice, and communities.

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Introduction

The increasing importance of green and blue spaces in urban areas

The majority of the global population now live in cities. By 2050, almost 7 billion people are expected to live in urban areas worldwide.[1] Transforming urban infrastructure to support a higher quality of life and better health for the growing urban population is of great importance. Particular emphasis should be placed on strategies consistent with protecting planetary health in the challenging context of climate change. Urban green (ie, covered by vegetation) and blue (ie, bodies of water) spaces have an increasingly important role in improving public health.[2] In this Viewpoint, we focus on publicly accessible urban green and blue spaces (UGBS), such as parks, greened vacant lots, vegetated streetscapes and school yards, urban greenways and forests, trails, beaches, oceans, lakes, rivers, and canals.[3] We use the term UGBS as public spaces often integrate green and blue elements. Such spaces are not equally distributed across the world, with cities in west Africa, the Middle East, and central Asia having the least amount of green space.[4] In Latin American cities, greening is more likely to take place in peripheral sub-cities in which socioeconomic status tends to be lower.[5] Urbanisation will increase the demand and need for universal access to UGBS. During the COVID-19 pandemic, the closure of leisure facilities, restaurants, and shops, and the need to self-isolate at home and socially distance, provided a stark reminder of the importance of UGBS for population health and wellbeing, particularly in urban areas.[6,7]

Roles of UGBS in human health and health inequities

Having access to UGBS can improve health and mitigate inequities;[8–12] contribute to physical, psychological, social, economic, and environmental wellbeing;[13–19] and provide opportunities for social inclusion and active citizenship. Evidence for the relationship between the quality aspects of UGBS (eg, biodiversity, aesthetics, safety, and amenities) and health outcomes and wellbeing all support the same idea: the better the quality of the space, the better the outcomes.[20] However, the benefits of UGBS might not be spatially or socially distributed equitably,[21] and some population groups are disadvantaged in terms of access to UGBS, particularly for people who already face health-related challenges.[22] Although some of this evidence is contested, UGBS have been associated with widening health and social inequities due to poor quality and unequal distribution. Research also shows that the benefits of UGBS are not experienced equally across seasons.[23] For example, in China, green space promotes physical activity in summer, but not in winter.

UGBS contributions to global policy goals

Research has shown that UGBS can provide opportunities for physical activity and social interaction,[24] and can offer regulatory ecosystem services to mitigate the effects from urbanisation-induced challenges (eg, vegetation can improve air quality by removing pollutants, and can reduce greenhouse gas emissions).[25–27] Research has also highlighted the role of urban green space interventions, such as increasing tree coverage, in reducing urban heat island effects and mortality.[28] However, the evidence base for the effects of UGBS on sustainable development in low-income and middle-income countries (LMICs) is poor, which is particularly concerning for countries undergoing rapid urbanisation with little resources.[29] UGBS can contribute to the achievement of multiple sustainable development goals and their related targets.[29,30] UGBS are important elements to strengthen

action against the climate and biodiversity crises,[31,32] and have key roles in contributing to nature-based solutions, which are defined as "actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human wellbeing and biodiversity benefits".[33]

Little progress in policy and practice

Large parts of the global population do not have sufficient access to green space, especially people living in cities. This restricted access is associated with a mortality burden that could be prevented.[22] Improving public health, health equity, and social justice requires policies and practices that involve co-design, co-implementation, co-evaluation, and co-translation of solutions to create (or recreate) green and blue space, and the need to address an important policy-implementation gap.[18,34] Creative urban and landscape design can enable and encourage populations and individuals to adopt and maintain health-promoting behaviours. However, efforts to improve UGBS require integrated approaches involving research, advocacy, policy, and practice to make a notable contribution to population health, environmental quality, climate change resilience, biodiversity improvements, and reducing inequalities.[4]

Challenges regarding UGBS contributions to public health

Research

Research design

To date, much of the current evidence on UGBS is from cross-sectional studies and, to a lesser extent, longitudinal observational studies, with sparse evidence from intervention or natural experiment approaches.[13,35] Most research—and oftentimes policy—assumes that proximity and access to UGBS are surrogates for use, and that having more UGBS nearby is assumed to be good for all. But policy-relevant information about, for example, the distance, size, and quality aspects of UGBS that might be needed to confer health benefits is scarce.[36,37]

New indicators have been proposed, such as the 3–30–300 green space guidance, which stipulates that every citizen should be able to see at least 3 trees from their home, should have 30% tree canopy cover in their neighbourhood, and should not live more than 300 m away from the nearest park or green space.[38] However, these recommended conditions have rarely been evaluated[38] and might differ across different contexts with varying levels of population density and socioeconomic status.

We need to better understand how ecological aspects of UGBS (eg, biodiversity) can benefit human health,[18,39] and how densification of cities is increasing heat island effects. Evidence has suggested that simply viewing green space (rather than using it) might provide health benefits.[18,40]

It is important to comprehensively evaluate UGBS interventions given the complexity of known co-benefits, confounders, and effect modifiers; the difficulty in establishing the time period in which to measure change and determine attribution;[13,18,35] and the multifunctional and multilayered nature of UGBS.[18,35] The research–policy–practice cycle around UGBS is often misaligned in its timeframes, actors, scale, and priorities.[41] Therefore, the evidence base is underdeveloped and is not focused on what works, for whom, or where the issues lie.[2]

Diverse populations and equity

Substantial segments of the population (including many people from deprived and marginalised groups) have less access and thus fewer visits to UGBS than individuals from high-income backgrounds, which has consequences for their health and wellbeing.[34,42–44] The quality of UGBS has distinct social patterning that is only partly rooted in unequal access. Although disadvantaged areas are not necessarily deprived in the quantity of green spaces compared with advantaged areas, green spaces in disadvantaged areas tend to have poor-quality facilities and amenities, and safety concerns.[45] People with noncommunicable diseases, those with socioeconomic disadvantage, and those who feel excluded from local spaces are much less likely to visit UGBS at all than those from more advantaged areas. However, such groups are likely to benefit the most from UGBS. Little is known about non-use, but the scarce evidence suggests that culture (including personal values, capability (eg, not wanting to or not feeling able to visit due to time poverty), and quality of UGBS are greater determinants of non-use than an absence of nearby UGBS.[46]

Measurement and data

Research is often criticised for being slow and of little relevance to policy and practice.[41] Making better use of well curated administrative data, including through innovative ways to co-develop approaches and methods involving citizens (alongside practitioners and policy makers) that explore real-time and community-rich data sources, can accelerate the process.[41,47] For example, using Google-based real-time mobility patterns during the first wave of COVID-19 showed that visits to parks, beaches, and other places of leisure declined by roughly 25% in Africa, 50% globally, and 60% in Latin America and the Caribbean.[48] Access to such spaces was inversely associated with COVID-19 spread, globally. Such results highlight the potential of mobilising novel sources of big data and the importance of access to public UGBS data.

Data about the location and nature of UGBS, its quality and biodiversity, levels of use, how it changes, and experiences and perceptions of its users are sparse, lack coherence, and are typically not driven by the community. Data, methods, and tools often function with different governance structures, are difficult to access, and exist in academic silos.

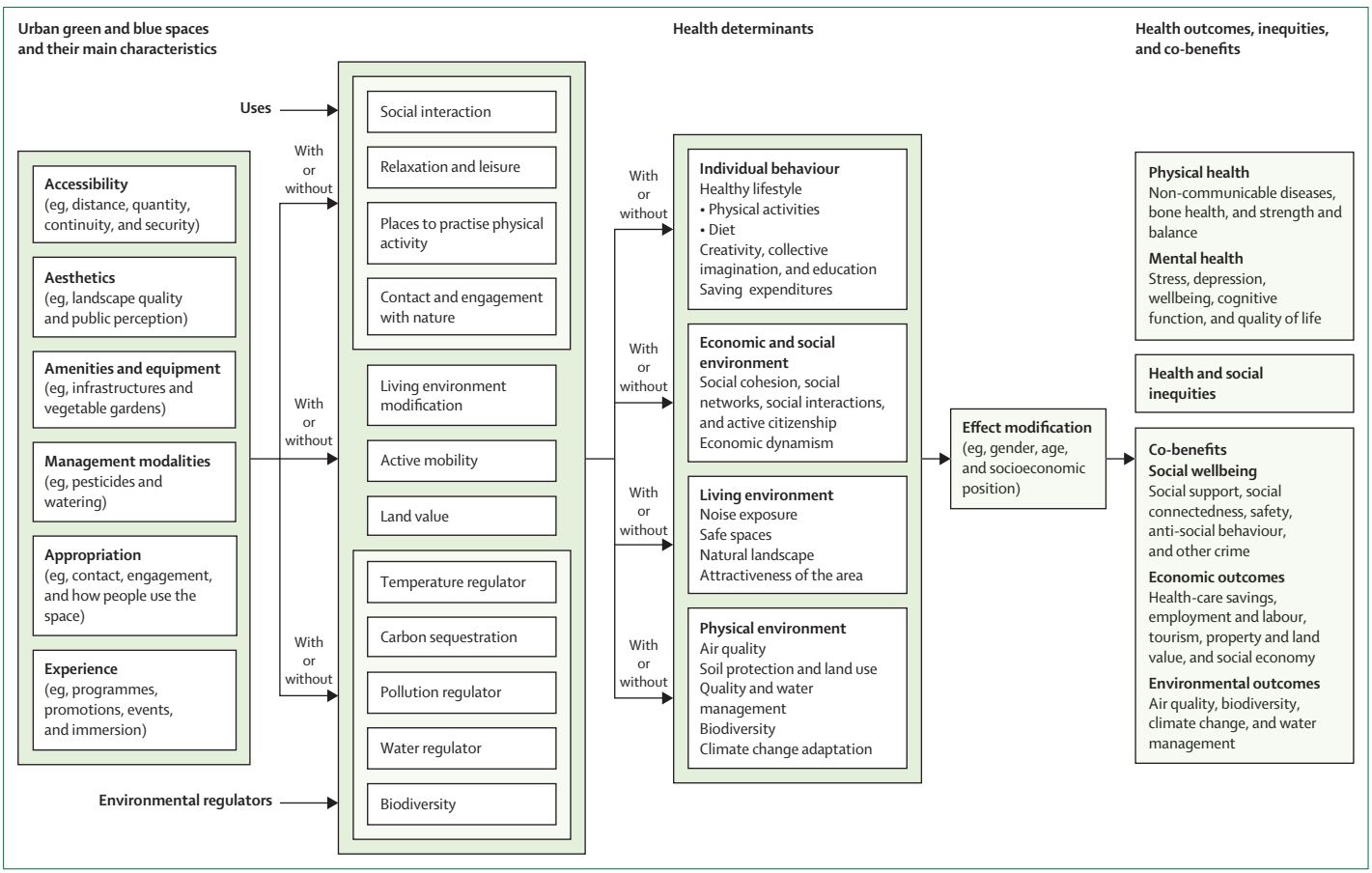

Figure: **Conceptual causal pathway model between urban green and blue spaces, public health, equity, and co-benefits**
Modified from Hunter and colleagues.[49]

Understanding mechanisms

Although compelling evidence exists for the various positive effects of UGBS on health and wellbeing, the mechanisms are not yet fully understood and might differ considerably across population groups. We propose a conceptual framework that encompasses the health and co-benefits of UGBS (figure). The aim of the framework is to provide a foundation for addressing the large gaps in evidence on the types, determinants, and magnitude of UGBS contributions. For example, we need to understand the mechanisms through which UGBS benefits health, including via physical activity, social interaction, visual exposure, and physical environment (eg, through reduced pollution and heat mitigation); which mechanisms are more important; and how contributions differ across population groups. Physical activity has been identified as a potentially important pathway in the relationship between green space and health.[10,13,50] However, due to the diverse influencing factors and pathways, mechanistic research typically takes place in separate silos, often without much exchange and by using non-compatible measurement approaches and tools.

Blue space

Blue space is positively associated with health at a population level, including with obesity, all-cause mortality, general health, and mental health.[51] However, much of the research to date has focused on green space. Blue space research indicates that public health is only considered indirectly in urban blue space regeneration, and the potential to use urban blue space regeneration as a community-based health intervention has yet to be realised.[51] By its nature, blue space is inequitably distributed. Although increasing the quantity of green space in urban areas is possible, blue spaces are largely fixed (albeit access can be enhanced, for example, through paths and the provision of artificial ponds), which presents unique challenges.

Economic assessment

Few UGBS improvement approaches have been assessed for their value for money, and most existing evaluations fail to capture the health and social effects comprehensively.[35,49] Some studies have shown that UGBS can contribute to better mental health and reduced stress, particularly in more deprived communities, which

can result in substantial health-care savings.[10] One study showed that every 10% increase in exposure to UGBS translated to a decrease in the number of physical and mental health symptoms, which equated to a reduction of 5 years in age.[52] Similarly, part of the yearly costs of air pollution in the UK could be averted by having more and better UGBS.[53]

However, the evidence base for the economic benefits of UGBS remains scarce and unconvincing to some policy makers, particularly when balanced against competing, market-related demands in high-income countries, or population densification in LMICs. Few studies have attempted to consider a comprehensive range of monetary benefits of UGBS interventions. In one review,[54] a growing body of research on the benefits of UGBS, including land and property values, tourism, recreation and leisure, health and wellbeing, employment and productivity, climate change adaptation and mitigation, and biodiversity was collated, but strong health and economic evidence was scarce. More wide-ranging and stronger economic evidence is key, as it could alter prioritisation of decisions that would otherwise be based on understated returns on investment.[55] To better capture the full (or true) value of UGBS, economists with broad perspectives on health, the environment, and society could help develop a societal, whole-system case for UGBS interventions to address health, inequities, and other co-benefits.

UGBS in LMIC settings: an evolving construct

Research on UGBS in LMICs is scant.[11,56,57] However, rapid urbanisation will have important implications for the health and wellbeing of urban populations in LMICs. For example, the most rapid urbanisation is taking place in sub-Saharan Africa, with more than 50% of the population projected to be living in cities by 2030. This rapid shift often means urbanising into poverty, with many new city-dwellers living in urban slums, informally employed and confronted with high rates of crime.[58] This new pattern is an essential area for further research, as many cities in LMICs are facing systemic burden from communicable and non-communicable diseases, and extreme events related to climate change.

Hypothetically, there is reason to assume that UGBS in LMICs would confer the same health benefits and co-benefits as in high-income countries. However, context matters, and the dearth of research in LMICs presents obstacles to the adoption of favourable UGBS policies by policy makers in LMICs. The findings from high-income countries might not be generalisable to LMICs due to the high risk and burden of communicable diseases, high levels of poverty, and poor infrastructure, alongside differences in cultural norms.[11]

Moreover, where such evidence exists, there are indications that the development of and access to UGBS is not equitably distributed.[43,56] Two reviews[11,57] on UGBS in LMICs included the following recommendations: (1) modifications of data collection tools to facilitate low-cost research in LMICs; (2) understanding of unintended consequences and potential negative effects of UGBS, such as increased prevalence of asthma[59] and pollen allergy,[13] vector-borne diseases (eg, breeding of dengue-bearing mosquitoes), and social nuisances;[60] (3) better understanding of moderating factors, such as crime, inequalities, and environmental pollution and litter or the accumulation of human waste; and (4) understanding the relationship between UGBS and health, particularly mental health, for informal settlements and slums. We also believe these two additional recommendations hold true for all contexts: (1) more longitudinal and natural experiment studies to advance methodological quality are needed, and (2) research should be expanded beyond major cities to include a focus on smaller towns and cities.

Although not limited to LMICs, arid climates create special challenges to increasing UGBS that will only worsen with rapid climate change. Creative, focused research will be needed to identify feasible solutions for these challenging contexts.

Policy and practice

Policy evaluations

Various political frameworks underscore the need for UGBS in cities. For example, the New Urban Agenda[1] states that "green space can reduce urban poverty, including tackling urban regeneration and creating safe and social spaces for integration and interaction, and access to quality services". However, some UGBS policies can also inadvertently expand the gap between the advantaged and disadvantaged as a result of gentrification or unequitable distribution of high-quality UGBS. Policies need to be evaluated to develop more effective, consultative, participatory, and equitable approaches. Policy evaluations are not easy to do, but we need to know which policies worked and which did not work.

Co-creation

Genuine co-creation approaches involving researchers, policy makers, and practitioners working in a virtuous cycle with community voices embedded are needed to provide and improve UGBS. Participatory processes can provide greater knowledge of an individual's connection with public space, and can aid in understanding the direct, active, and not always conflict-free interaction of the population with their environment.[61,62]

The Right to the City approach[55] frames and advocates for a new kind of urban policy that asserts that everyone, particularly the disenfranchised, not only have a right to be living in the city but, as inhabitants, have a right to shape it, co-design it, and operationalise an urban human rights agenda. This approach might be a useful framework for UGBS work. In addition, citizen-science approaches to environmental change could also be applied to UGBS, particularly in LMIC contexts.[63]

Panel: Recommended actions

We set out recommendations to address core challenges in research, policy, practice, and equity of implementation of health-promoting urban green and blue spaces (UGBS), particularly in underserved communities and in low-income and middle-income countries (LMICs). They represent the global context. Readers are encouraged to interpret these recommendations with their specific context in mind.

Research

- Strengthen the evidence base on UGBS, health, and co-benefits with longitudinal observational studies and natural experiment approaches, including examination of UGBS in an integrated manner.
- Strengthen the evidence base on UGBS interventions, including aspects such as the size, quality, biodiversity, and actual use and viewing of UGBS, focusing on what works, for whom, or where the real problems lie.
- Evaluate the effects of UGBS and UGBS interventions on diverse population groups and communities.
- Accelerate research addressing environmental and health inequities related to UGBS and transferability of approaches to different cultural, socioeconomic, and climatic environments, particularly related to LMICs and arid regions.
- Accelerate research on blue space, health, and co-benefits.
- Provide a robust evidence base for the environmental effects of UGBS actions to inform climate change and biodiversity policies.
- Research should incorporate co-design, co-implementation, co-evaluation, and co-translation approaches, methods, and tools.

Policy and practice

- Develop innovative modelling methods and technologies, such as agent-based modelling, to simulate and inform future UGBS actions to promote resilience, health, and economic and societal co-benefits.
- Foster a more robust, whole-system evidence base designed to be relevant for policy-making and co-implementation into practice, including practice-based evidence and recent learnings from the COVID-19 pandemic on future-proofing urban environments against future shocks.
- Harness political drivers, such as citizen advocacy, to support UGBS actions.
- Create new ways for policy makers, practitioners, researchers, and local citizens to collaborate across sectors and government agencies for sustainable UGBS action, including training, advocacy, and support.

LMICs

- Expand the evidence base on UGBS in LMICs, including low-cost research approaches, and consider the specific contexts in terms of population composition, socioeconomic realities, crime, climate, health care, and infrastructure systems, as well as other moderating factors.

Political drivers

It is important to uncover and harness political drivers to support UGBS actions, and through the creation of new ways for policy makers to collaborate with researchers, practitioners, and local citizens. These approaches need to be accompanied by comprehensive evaluations, including health impact assessments, to strengthen the evidence base.[13,42,49] Training and support will be needed to ensure effective communication, collaboration, and co-creation among researchers, policy makers, practitioners, and citizens. Platforms to advance this agenda have been created,[64] along with a WHO repository for local action for health, which includes resources and tools on UGBS, and the Urban Health Research Agenda.[2] We need to adapt public policies across sectors to achieve health benefits, systematically taking into account the health, social, and economic implications of decisions, to seek synergies and to help avoid harmful health and societal effects and unintended consequences, particularly in disadvantaged population subgroups.[2]

Leadership and prioritisation

Evidence about the value of UGBS is insufficiently acted upon, and the systems of relevant decision-making are disjointed. Leaders in most sectors recognise the potential of UGBS but remain unsure how best to act on them, support them, or defer the responsibility to a different administrative unit. Despite recognition of their value in many policy documents, UGBS are often underprioritised by policy makers facing competing pressures from housing, business, and transport sectors. UGBS is integral to the work of urban practitioners—including infrastructure engineers, urban designers and planners, park and recreation professionals, ecologists, and community managers—the design, delivery, and promotion of intentional UGBS and the installation of informal UGBS could be enhanced to maximise health benefits.

The timeframes and funding requirements of UGBS interventions mean that science is often focused on interventions that are underway, rarely contributing to their development. Attributing specific outcomes to UGBS is therefore difficult. Evidence synthesis and simulation within a common framework offers a means to address this challenge, particularly with researchers embedded in practice and communities.

For more on the **Urban Health Repository** see https://urbanhealth-repository.who.int/

UGBS integration

UGBS may be viewed by clinicians, public health practitioners, and urban planners as discrete physical assets, without adequate appreciation of how health and co-benefits in the social, environmental, and economic

Search strategy and selection criteria

The aim of this Viewpoint was to present the challenges regarding the contribution of urban green and blue spaces to public health, and to present recommendations to support future research and translation into action. We convened a workshop of public health and other stakeholders to identify the needs and challenges to tackling urban green and blue spaces and urban and public health, and to adopt a unified, action-oriented agenda to address this pressing global issue. The workshop was supplemented with a purposive literature search of PubMed with the terms "urban green space" OR "urban blue space" AND "health" for papers published from database inception until Jan 20, 2023. We included articles published in English. References were selected to provide interdisciplinary and global perspectives.

realms rely on their wider integration with the surrounding urban environment (ie, social, cultural, and physical connectivity).[35,66] The complex systems governing UGBS create a need for applying systems-thinking approaches, including the dynamic exchange of knowledge to identify upstream levers and drivers for systems-level interventions.[35,66] It is also important to know more about the transferability of such approaches to different cultural and socioeconomic environments. Solutions are needed for large-scale and cost-effective improvements in health and other co-benefits, and to reduce inequities. Strategies should aim to meet the needs of providers, practitioners, policy makers, and industry partners, who can all contribute—together with citizens—to the design and implementation of UGBS interventions. Jointly evaluating these collaborations will foster the translation of practice-based evidence into best practice.[67]

Community involvement

Citizen co-led approaches to the planning and creation of UGBS and their comprehensive evaluation are rare. There is almost always some kind of community consultation, but this is often performative and only draws opinions from a few active voices in the community. The consequences of this non-systematic approach might be inappropriate or contested UGBS that serve only some groups in the community. Genuine and inclusive approaches to co-design, co-implementation, co-evaluation, and co-translation are needed, involving diverse groups of citizens, communities, implementers, content experts, and policy makers (panel).

Conclusion

Evidence to date indicates that UGBS have benefits for physical and mental health, but the optimal amount, location, duration, type, and quality of these spaces is still unknown. Thus, the full potential of UGBS as public health, social, economic, and environmental assets has yet to be realised. We therefore extend consideration beyond the UGBS and health research agenda to policy and practice challenges, and have developed recommendations to begin addressing these challenges in collaboration with research, policy, practice, and communities in multiple sectors.

Contributors

RFH and SK conceptualised the manuscript. All authors were involved in writing the first draft and revising the manuscript for intellectual content. All authors approved the final version for submission.

Declaration of interests

We declare no competing interests.

Data sharing

This manuscript does not report any data.

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