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Assessing the readiness for 15-minute cities: a literature review on performance metrics and implementation challenges worldwide

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ABSTRACT

The 15-minute city (FMC) has recently emerged as a popular planning paradigm. While the concept builds upon wellstablished urban planning principles, such as density, mixed use, and proximity, its operationalisation in research and practice faces methodological and contextual challenges. This study conducts a systematic review of FMC performance metrics, analysing thirty-nine peer-reviewed articles analysing how assessment metrics have been defined and used to evaluate the alignment of a region with FMC principles across different geographical contexts. We categorise performance metrics into six broad groups: amenity-based, population-based, distancebased, gravity-based, behaviour-based, and weighted scores. The findings reveal significant methodological diversity, particularly in time thresholds, transport mode choices, and the selection of amenities. European and Asian studies tend to focus on the spatial distribution of amenities, while North American research emphasises behavioural analysis, highlighting the challenges posed by car dependency and urban sprawl. This review identifies key research gaps, including the limited attention given to digitalisation and equity concerns. Additionally, we highlight the need for standardised performance metrics to allow for comparability across studies. Given regional variations in urban form and behaviour, we argue that FMC policies should not adopt a one-size-fits-all approach but rather be tailored to local contexts. The findings from this research can be of interest to policymakers interested in understanding the regional challenges and methodological variations of FMC performance metrics.

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Highlights

- There is a growing number of studies examining their 15-minute city (FMC) performance.
- Variability exists in time thresholds, modes, speeds, amenities, and performance metrics.
- Findings across different regions reinforce the need to not approach FMCs as a onesize-fits-all solution.
- Policies should be developed based on local travel behaviour and preferences while considering access inequalities and regional characteristics.

Introduction

The 15-minute city (FMC) framework has emerged as a prominent planning paradigm during the COVID-19 pandemic, gaining traction in both research and practice for its focus on promoting sustainable transportation and increased proximity to destinations. At its core, the FMC envisions polycentric cities where people have access to essential services and amenities, such as employment, education, and healthcare, within a 15-minute walk or bike ride (Moreno et al., 2021). This conceptual framework builds upon well-stablished planning principles, namely density, proximity, and diversity whilst embracing digitalisation as a way to increase "proximity" and reduce the need to travel.

While the core planning principles of FMCs are widely recognised, the application of the concept in practice faces many challenges. In many cases, cities adopt FMC policies as a branding device, incorporating them into planning documents with low statutory weight and limited power to enact substantial change (Gower & Grodach, 2022; Pozoukidou & Chatziyiannaki, 2021). Moreover, the FMC framework was originally developed with the Parisian context in mind. Consequently, the replicability of its guidelines, particularly the 15-minute threshold, across different urban settings can be challenging. For instance, North American cities, which largely developed under car-centric policies, present distinct historical, structural, and political contexts requiring unique sets of planning interventions, metrics, and targets (Birkenfeld et al., 2023) that may diverge from the Parisian model.

Such contextual variations are reflected in the growing body of research assessing how different cities align with the FMC's core guidelines (e.g. Logan, Hobbs, Conrow, Young, et al., 2022a; Olivari et al., 2023; Rhoads et al., 2023; Ulloa-Leon et al., 2023; Weng et al., 2019; Willberg et al., 2023; Yu & Higgins, 2024). These studies exhibit significant methodological diversity in the development of performance metrics, which arise from the assessment metrics chosen, the FMC dimensions assessed, selected amenities, modes of transport included, modelled travel speeds, and desired time thresholds, as well as research objectives, data sources, data collection methods, and analytical approaches. Methodological choices are also influenced by the research context, particularly in the choice of time thresholds. For instance, while studies involving Asian and European cities often focus on shorter travel ranges (5–15 min), North American and Oceanian cities tend to focus on longer travel times. Given this heterogeneity and a rapidly evolving research landscape, a comprehensive review of the literature is necessary to better understand how performance metrics are developed and applied within the FMC framework. Such a review can capture the diversity of methodological choices, identify geographical patterns in the findings, and highlight avenues for future research.

To bridge this gap, this study conducts a systematic review of studies that apply or develop a 15-minute city performance metric aiming to capture a worldwide perspective on FMC evaluation practices. First, we identify the main components shaping the design of performance metrics across the literature and discuss the prevalent practices while highlighting geographical differences. Second, we examine patterns in performance of different regions across the analysed studies considering their readiness to be defined as a 15-minute city and potential challenges on the implementation of FMC practices. Finally, we identify research gaps and methodological concerns. More specifically, the main research questions this study aims to address are as follows:

- What are the key components and practices to assess 15-minute city performance metrics across the literature? How do these practices vary across geographical contexts?
- What patterns emerge regarding the readiness of different regions to be considered 15-minute cities, and what challenges do they face in achieving this goal?
- What are the main methodological challenges and future research directions in evaluating 15-minute city performance?

This paper aims to contribute to the literature by understanding how FMC principles are measured and assessed across different contexts aiding to the effective evaluation and implementation of the concept in practice and research. By systematically reviewing the literature on existing performance metrics, this study identifies methodological gaps, highlights regional variability and challenges, and provides insights that can guide both future research and practice.

From Garden Cities to 15-minute cities: a planning history perspective

Although often framed as a "new urban approach" (Moreno, 2024), the 15-minute city concept represents a culmination of long-standing planning theories and practices that prioritise proximity, accessibility, and mixed-used development. The main ideas of the FMC paradigm predate modern urban theory itself, as compact, walkable cities were the default settlement pattern for thousands of years. In settings where transport is based on human or animal power (i.e. most cities prior to the late nineteenth Century), the majority of destinations could be reached within 30 min by active modes (Manaugh, 2021). This section situates the FMC concept within urban planning history, emphasising both its similarities with past approaches and its novel contributions.

Clarence Perry's Neighborhood Unit (1929) is often cited as a direct inspiration to the FMC concept (Birkenfeld et al., 2023; Ferrer-Ortiz et al., 2022; Olivari et al., 2023). Designed to balance the rising expectations for quality of life with the rapid urban growth and motorisation of cities, Perry's model, drawing inspiration from Ebenezer Howard's Garden Cities (1902), proposed self-contained residential areas organised around a community centre, typically located within a quarter of a mile (about 15 min) of resident's

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homes. While Perry's ideas laid fundamental groundwork for the FMC, they were primarily focused on residential life and educational facilities with a strong emphasis on limiting car traffic to improve children's safety. In contrast, Moreno's vision expands the scope by paying less attention to specific groups and including access to employment, healthcare, and a broader range of services within its guidelines.

Emerging as a response to the mid-twentieth century modernist planning principles, which promoted a rigid separation of land uses and automobile mobility, a countermovement including the ideas of Jane Jacobs, Leon Krier, and Christopher Alexander have also informed the FMC framework. Jacobs' seminal work, *The death and life of Great American cities* (1961), critiqued top-down, car-centric urbanism while encouraging dense mixeduse neighbourhoods with diverse activities and "eyes on the street" to promote safety and social interaction. Moreno et al. (2021) explicitly acknowledges Jacobs as an influence, particularly her emphasis on promoting human-scale environments. Christoper Alexander's *A Pattern Language* (1977) encouraged polycentric city development surrounded by human-scale neighbourhoods with their own activity nodes, with services located within a 10-minute walk, a framework that, although more prescriptive, closely aligns with the FMC principles. In *City within the City* (1977), Krier proposed covering essential needs within a 15-minute walk, advocating for the development of compact, mixed-used communities.

The late twentieth century witnessed a renewed emphasis on walkability, mixed-use development, and sustainable progress with the emergence of the New Urbanist movement in the 1990s. The Charter of the New Urbanism (CNU, 1996) movement outlines a series of principles aimed at promoting walkable neighbourhoods that support multimodal transport, foster social interactions across urban spaces, and encourage urban revitalisation, compactification, and mixed land use. Mainly, this movement seeks to recreate the social cohesion of pre-modern neighbourhoods while addressing the environmental and social costs of car-centric planning. However, critics argue that poorly implemented New Urbanist projects can lead to exclusionary settlements, reinforcing social segregation and sprawl (Trudeau & Malloy, 2013), a challenge that FMC policies will have to navigate.

Real-world applications of proximity planning existed before the rise of the FMC. One notable example is Portland, Oregon's 20-minute neighbourhoods initiative (City of Portland, 2012), introduced as part of its 2030 plan to "guide the growth of the city". This initiative focused on fostering neighbourhood centres that promote access to essential services within a 20-minute trip. By 2016, 65% of Portlanders lived within these neighbourhoods, with a goal of reaching 80% by 2035 (City of Portland, 2017). Portland's approach inspired similar policies worldwide, including Melbourne's "20-minute neighborhoods" (Victoria, 2023) and China's "15-minute living circles" (Zhang et al., 2022), highlighting that the interest in proximity planning was emerging before the rise in popularity of FMC policies during the COVID-19 pandemic.

The 15-minute city builds on these and other established planning frameworks (e.g. transit-oriented development, compact cities, and the slow city movement) while rooting itself in longstanding urban principles like mixed-use development, densification, proximity, and polycentricity. While the FMC draws inspiration from these frameworks, it introduces new elements, such as digitalisation and a broader inclusion of services. It also highlights the need to plan for short trips coupling time and walking as a planning principle. The FMC's clear and brandable objectives make it appealing to cities and

policymakers, but challenges such as digital access, particularly in the Global South, can hinder its implementation (Guzman et al., 2021). Moreover, although the concept promotes self-sufficient neighbourhoods, critics argue that expecting every neighbourhood to provide specialised services or workplaces may be unrealistic (Mouratidis, 2024).

The evolving landscape of FMC research, marked by geographical and methodological diversity, underscores the need for a comprehensive examination of how performance metrics are developed across different contexts. This study employs a systematic review to address this gap, focusing on studies that evaluate 15-minute city performance. By doing so, we aim to identify common practices, geographic patterns, and critical gaps in this rapidly evolving research field, offering a clearer picture of how FMC principles are operationalised in diverse urban settings.

Methods

A systematic review approach was chosen to provide a comprehensive overview of existing research on 15-minute city performance metrics. Specifically, we adopt the systematic quantitative review method developed by Pickering and Byrne (2014), which offers a clear, comprehensive, and reproducible way to map the literature. This review includes studies that meet the following criteria: (i) studies that develop or apply performance metrics related to the FMC framework; (ii) studies assessing multiple amenity types (e.g. healthcare, education, and leisure) to reflect FMC principles; (iii) research published in peer-reviewed journals in English; (iv) studies that evaluate FMC principles using quantitative or mixed-method approaches.

Selected papers either evaluated how a city currently aligns with 15-minute city principles (e.g. percent of residents able to access a range of amenities within 15-minutes) or explore its future potential. Chinese studies on the 15-minute walkable neighbourhood were retained, as this policy closely aligns with the FMC concept. Excluding these studies would have resulted in limited representation of Asian cities in the review. While no date restrictions were applied, most of the research was published after 2020. We exclude papers that focused solely on one amenity type, as these do not reflect the FMC framework's emphasis on providing access to multiple destinations within a specific time frame. Additionally, studies examining the impacts of FMC policies on health or other outcomes, such as physical activity (Lamb et al., 2023) or heat adaptation (Wang et al., 2022), were excluded, as they were purely theoretical or conceptual papers and grey literature.

In December 2024, a keyword search was conducted across Web of Science, Scopus, and TRB's Transportation Research Information Services (TRID) databases to ensure a comprehensive coverage of the relevant literature. The applied query was ("minute city" OR "-minute city") AND ("walkability" OR "walk" OR "walking" OR "cycling" OR "proximity") yielding 147 documents (Figure 1). Terms related to proximity and active mobility were prioritised, as they are fundamental to the FMC concept (Moreno et al., 2021). To ensure a comprehensive coverage of relevant literature, backward snowballing was employed (Wohlin, 2014). In total, thirty-four papers met the criteria and were included in the review. Five additional papers were published during the review process and later included in the analysis, totalling thirty-nine papers. In Table 1, studies are organised first alphabetically by geographical information and then in chronological order.

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Figure 1. Flow chart of the process of selecting the studies.

From each paper, several pieces of information were systematically recorded in a database. First, general details were extracted to contextualise the research and its spread, including paper title, publication year, publisher, and geographical information (e.g. city, country, continent). Next, we document the methodological characteristics of each study, including research objectives, data sources, FMC dimensions assessed and performance metrics. Specific details on how FMCs were operationalised were also collected, including time thresholds, transport modes (i.e. walking, cycling, transit), mode speeds, and the range of amenities considered. This allowed us to capture both methodological consistencies and variations across the literature. Furthermore, we noted whether studies explicitly addressed equity concerns, such as differential access across socio-economic groups. Finally, we record findings related to the overall performance of the regions analysed in each study. In the following sections, when presenting the results, we emphasise geographic patterns, highlighting both similarities and variations across the studies.

Key components and practices in FMC performance metrics

Research spread

Most of the research on 15-minute city performance metrics has focused on cities and countries in Europe (22), reflecting the origins of the concept in Paris. Within Europe,

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Context	Paper (Year)	Publisher	Time Threshold	Travel Mode	Amenity Choice*	Outcome	Performance Metric
Hong Kong, China, Asia	Liu et al. (2024)	Elsevier	15 min.	Walking	hc, edu, ent, serv, Tran	15-min neighb. Index	25FCA (Gravity-based Accessibility)
Nanjing, China, Asia	Zhang et al. (2022)	Sage	15 min.	Walking	WK, HC, EDU, ENT, SERV, TRAN	Assessment Measure	Network grid (Optimal vs actual network)
	Chen et al. (2025)	Elsevier	5–45 min. (5 min increments)	Walking	HC, EDU, ENT, SERV	Assessment Measure	Mobility-based weighted accessibility
Shanghai, China, Asia	Weng et al. (2019)	Elsevier	5, 10, 15 min.	Walking	HC, EDU, SERV	Assessment Measure	Distance and travel time (decay function)
Suzhou, China, Asia	Jiang et al. (2025)	Elsevier	5, 10, 15 min.	Walking	HC, ENT, SERV, TRAN	Walkability index	Weighted walkability score
Various, China, Asia	Wang et al. (2024a)	Elsevier	15 min.	Walking	HC, ENT, SERV, TRAN	Assessment Measure	<pre># of amenities within 15 min vs. 15- min. city potential</pre>
	Chen et al. (2025)	Elsevier	15 min.	Walking	HC, EDU, ENT	Assessment Measure	% of population within 15 min
Barcelona, Spain, Europe	Graells-Garrido et al. (2021)	Public Library of Science	15 min.	Walking	HC, EDU, ENT, SERV, REL, TRAN	Current Behaviour	<pre># of amenities within 15 min by population</pre>
	Ferrer-Ortiz et al. (2022)	MDPI	5, 10, 15 min.	Walking	HC, EDU, ENT, SERV, TRAN	FMC Index	% of amenities within x min
	Rhoads et al. (2023)	Elsevier	15 min.	Walking	HC, EDU, ENT, SERV, TRAN	Assessment Measure	# of population within 15 min
	Núñez et al. (2024)	Elsevier	15 min.	Walking	HC, EDU, ENT, SERV	Current Behaviour	Minimum walking distance
	Maciejewska et al. (2025)	Elsevier	15, 30 min.	Walking, Cycling, and Transit	HC, EDU, ENT, SERV, TRAN	Current Behaviour	Minimum walking distance
Bologna, Italy, Europe	Gorrini et al. (2023)	Elsevier	5, 6-10, 15 min.	Walking	HC, EDU, ENT, SERV	Children-focused Index	Time-based weighted score
*WK = Work, $HC = H$	lealthcare, EDU = Educa	tion, ENT = Entertain	ment, SERV = Service	s, REL = Religious loca	tions, TRAN = Transit.		

Table 1. Relevant information related to the paper selection.

Table 1. Continued.							
Context	Paper (Year)	Publisher	Time Threshold	Travel Mode	Amenity Choice*	Outcome	Performance Metric
Coimbra, Portugal, Europe	Monteiro et al. (2023)	MDPI	15 min.	Walking, Cvcling	WK, HC, EDU, ENT, SFRV, RFI	Assessment Measure	Average distance weighted score
Gothenburg, Sweden,	Elldér (2024a)	Elsevier	15 min.	Walking	HC, EDU, ENT SERV	Assessment	Change in the total number of amenities over
Krakow, Poland, Europe	Noworól et al.	MDPI	5, 10, 15 min	Walking	HC, EDU, ENT, SFERV TRAN	Assessment	% of population within 15 min
Naples, Italy & London, IIK Furone	Gaglione et al.	European Transnort	15 min.	Walking	HC, EDU, FNT SFRV	Assessment	Comparison of supply and demand
Ancona, Italy, Europe	Ninivaggi and	Springer	15 min.	Walking	HC, EDU, ENT, SFERV_TRAN	Assessment	Density of amenities
Parma, Italy, Europe	Caselli et al. (2021)	European	5, 10, 15 min	Walking	EDU, SERV	Assessment	% of the population within x min
Oslo, Norway, Europe	Akrami et al. (2024)	Elsevier	15 min.	Walking	HC, EDU, FNT SERV	Assessment	# of amenities within 15 min for each cell on a
Seville, Spain, Europe	Radics et al. (2024)	Elsevier	5, 10, 15	Walking,	HC, EDU, ENT,	Assessment	grid # of amenities within 15 min for each cell on a
Thessaloniki, Greece,	Shoina et al. (2024)	Sage	5, 10, 15	Walking,	AC, EDU, ENT TDAN	Assessment	grid weighted by the population # of amenities within a given buffer
Utrecht, The Notherlands Europe	Knap et al. (2023)	Elsevier	10, 15 min.	Cycling	WK, HC, EDU, ENT,	Cycling Index	2SFCA (Gravity-based Accessibility)
Valencia, Spain, Europe	Carot and Villalba	SDEWES	15 min.	Walking	HC, EDU, FNT SFRV	Assessment	Weighted accessibility index
Various, Italy, Europe	Olivari et al. (2023)	Elsevier	15 min.	Walking	HC, EDU, ENT, SERV	Assessment Measure	% of population within 15 min
*WK = Work, HC = Healthc	care, EDU = Education,	ENT = Entertainme	ent, SERV = Serv	ices, REL = Relig	ious locations, TRAN =	Transit.	

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Table 1. Continued.							
Context	Paper (Year)	Publisher	Time Threshold	Travel Mode	Amenity Choice*	Outcome	Performance Metric
Various, Various, Europe	Schneider et al. (2022)	Taylor and Francis Ltd.	15 min.	Cycling	WK, EDU, ENT, SERV	Current Behaviour	Cumulative distribution of cycling distances
Various, Various, Europe	Bartzokas-Tsiompras and Bakogiannis (2023)	Taylor and Francis Ltd.	15 min.	Walking	HC, EDU, ENT, SERV	FMC Index	Ratio (# of dest. within 15 min/# of dest. within 1 km)
Various, Sweden, Europe	Elldér (2024b)	Elsevier	15 min.	Walking	HC, EDU, ENT, SERV	Assessment Measure	% of population meeting amenity category thresholds
	Elldér (2025)	Elsevier	15 min.	Walking	HC, EDU, ENT, SERV	Assessment Measure	% of population meeting amenity category thresholds by avg. income
Montreal, Canada, North America	Birkenfeld et al. (2023)	Elsevier	15, 30 min.	Walking, Cycling, and Transit	OD data	Current Behaviour	Gaussian fit decay function (Gravity- based Accessibility)
	Birkenfeld et al. (2024)	Elsevier	15, 30 min.	Walking, Cycling, and Transit	0D data	Current Behaviour	% and # of XMC destinations
	Negm et al. (2023)	Findings	15, 30 min.	Walking, Cycling, and Transit	WK, HC, EDU, ENT, SERV	Current and Potential Behaviour	# of actual and potential XMC trips
Various, United States, North America	Abbiasov et al. (2024)	Nature	15 min.	Walking	HC, EDU, ENT, SERV, REL	Current Behaviour	% of trips within 15 min
	Jin et al. (2024)	Elsevier	15 min.	Walking, Cycling, Transit, Car	HC, EDU, ENT, SERV, REL	Current and Potential Behaviour	% of trips within 15 min

*WK = Work, HC = Healthcare, EDU = Education, ENT = Entertainment, SERV = Services, REL = Religious locations, TRAN = Transit.

Table 1. Continued.

Context	Paper (Year)	Publisher	Time Threshold	Travel Mode	Amenity Choice*	Outcome	Performance Metric
Various, US, New Zealand, North America, Oceania	Logan et al. (2022b)	Elsevier	10, 15, 20 min.	Walking	edu, ent, serv	X-min City Index	 (i) % of population within x-min, (ii) maximum travel time, (iii) population weighted mean and median, (iv) proximity to the 90th percentile (v) equally distributed equivalents
Hamilton, New Zealand, Oceania	Wang et al.	Elsevier	10, 15, 20 min	Walking	HC, EDU, SERV, TRAN	Assessment	% of the neighbourhood area within a 15-min icochrone
Bogota, Colombia, South America	Guzman et al. (2021)	Elsevier	15 min.	Walking	HC, EDU, SERV	Pandemic Effects	# of destinations within x min
	Guzman et al. (2024)	Elsevier	15 min.	Walking	HC, EDU, ENT, SERV, TRAN	FMC Index	Walkability-based weighted score
Santiago, Chile, South America	Ulloa-Leon et al.	MDPI	15 min.	Walking, Transit	HC, ENT, SERV, TRAN	Assessment Measure	# of destinations within 15 min (older adult focused)
	10-0-1						

*WK = Work, HC = Healthcare, EDU = Education, ENT = Entertainment, SERV = Services, REL = Religious locations, TRAN = Transit.

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studies predominantly analyse Barcelona, in Spain, as well as locations in Sweden (e.g. Gothenburg and nationwide studies) and Italy (e.g. Ancona, Naples, Parma, Ferrara, Bologna). Outside of Europe, seven papers examine Asian cities, particularly Hong Kong and cities in mainland China. Five studies focus on the North American context, including two nationwide analysis of the United States and three case studies in Montreal, Canada. South American cities, specifically Santiago and Bogota, are analysed in three studies, while only one study explores FMC metrics in Oceania, focusing on Hamilton, New Zealand. Additionally, one comparative study assesses urban areas across North America and Oceania, analysing 500 cities in the United States and 43 in New Zealand. This distribution highlights the geographical concentration of the literature on the European context and underscores the need for broader representation across diverse urban settings worldwide.

The development of performance indicators

Table 2 provides an overview of performance indicator development worldwide, detailing their primary research objectives, the FMC dimensions assessed, and the core focus of each metric.

Primary research objective

Studies fall mainly into three categories: (i) assessing the performance of a city or region (21), (ii) developing performance indexes (8), or (iii) examining current and/or potential travel behaviour in response to changes in travel patterns and land use (9). An exception is Guzman et al. (2021), which evaluated Bogota's suitability as a 15-minute city, while primarily investigating the impacts of the COVID-19 pandemic on travel across income groups. Geographical differences in research focus reflect diverging research interests. Studies conducted in Asia (7) and Europe (18) predominantly emphasise assessment metrics and performance indexes, with a strong focus on the spatial distribution and

Variables	Asia	Europe	North America	South America	Oceania
N ¹	7	22	6	3	2
Research objective					
Assessment metric	5 (71%)	14 (64%)	-	1 (33%)	1 (50%)
Index	2 (29%)	4 (18%)	1 (17%)	1 (33%)	1 (50%)
Current behaviour	_	4 (18%)	5 (83%)	-	_
Other	_	-	-	1 (33%)	_
Performance metrics					
FMC dimensions included					
Density	5 (71%)	16 (73%)	2 (33%)	1 (33%)	1 (50%)
Diversity	4 (57%)	7 (32%)	2 (33%)	1 (33%)	1 (50%)
Proximity	7 (100%)	22 (100%)	6 (100%)	3 (100%)	2 (100%)
Digitalisation	-	-	-	1 (33%)	-
Main focus of the metric					
Amenity-Based	1 (14%)	8 (36%)	-	2 (67%)	-
Population-Based	1 (14%)	7 (32%)	1 (17%)	-	1 (50%)
Distance-Based	1 (14%)	3 (14%)	1 (17%)	-	1 (50%)
Gravity-based	2 (29%)	1 (5%)	-	-	-
Behaviour-based	1 (14%)	-	4 (67%)	-	-
Weighted scores	1 (20%)	3 (14%)	-	1 (33%)	-

 Table 2. The development of performance indicators across the globe.

¹Logan, Hobbs, Conrow, Young, et al. (2022a) analysed cities across both North America and Oceania.

availability of amenities. In contrast, North American research tends to explore the alignment of current travel behaviour with 15-minute city goals (5), relying on origin-destination and private mobile phone data to analyse travel flows. This divergence suggests that while European and Asian studies prioritise evaluating spatial accessibility, North American researchers are more concerned with understanding behavioural patterns and mobility dynamics that may challenge achieving FMC objectives.

Core 15-minute city dimensions assessed

Not all studies assessed all core FMC dimensions: proximity, density, diversity, and digitalisation. Proximity, the concept's defining principle, is the most widely examined, as it relates to providing access to basic urban services in a reduced timespan. Moreno et al. (2021) argue that quality of life is inversely proportional to the time and money spent on transport, a concept rooted in chrono-urbanism (Ascher, 1997). Given its central role to the FMC framework, it is unsurprising that all examined studies included proximity in their assessments. However, the way proximity is measured varied significantly, particularly in terms of time thresholds, transport modes, modelled speeds, and the selection of amenities. These methodological differences are further explored in the following sections.

Density is introduced by Moreno et al. (2021) as a "crucial" element of city design due to its strong correlation with mode choice and mixed land use. The relationship between density, transport, and urban form has long been recognised in urban planning literature (Cervero & Kockelman, 1997; Levinson & Wynn, 1963) with contemporary planning theory advocating for compactification policies to counteract the negative effects of urban sprawl. Across the studies analysed, 23 studies incorporated density-related variables, using population size (8), population density (11) or both (4) to evaluate FMC performance. Notably, studies in Asia and Europe are more likely to include density metrics than studies in other parts of the world. These measures are often used to determine the proportion of the population residing within x-minutes of key amenities. In some cases, researchers specifically examined the distribution of vulnerable populations, such as children, the elderly, and minorities, when evaluating FMC accessibility (Gorrini et al., 2023; Ninivaggi & Cutrini, 2025; Weng et al., 2019). However, research on how specific demographic groups may be impacted by FMC policies remains limited.

Diversity in the 15-minute city concept is reflected in mixed-use neighbourhoods that integrate residential, commercial, and entertainment spaces, as well as in the presence of diverse cultural and social groups (Moreno et al., 2021). Like density, mixed land use is often prescribed as a strategy to revitalise communities (Rabianski & Clements, 2007), reduce car dependency (Levine, 2010), promote active transport (Fonseca et al., 2021; Pucher & Buehler, 2008), and foster social diversity (Moos et al., 2018; Raman & Roy, 2019). Despite its importance, diversity is assessed even less frequently than density in the studies analysed. Only fifteen studies investigated land-use diversity, primarily through land use mix (5) and built environment characteristics (4).

Digitalisation received even less attention. Among the studies reviewed, Guzman et al. (2021) is the only one to explore access to digital services, using an online survey in Bogota, Colombia, to reveal inequalities of access. This highlights a significant gap in FMC research, as digitalisation plays an important role in increasing proximity to services.

Notably, digitalisation is the only FMC dimension that has been changed since the concept's inception. Initially, the framework included ubiquity, which emphasised the widespread availability of FMC neighbourhoods across the city to ensure affordable and equitable access for all, reinforcing the concept's polycentric aspirations. However, during the COVID-19 pandemic, the dimension was replaced by digitalisation in recognition of the growing importance of online services in urban accessibility.

Performance metrics

Across the literature, there is no standardised approach in the definition of FMC performance metrics, resulting in considerable variation across studies. This section categorises the performance metrics used in the reviewed studies into six broad groups: (i) *amenity-based metrics* (11), which quantify the availability of essential services within a given travel time; (ii) *population-based metrics* (9), which measure the proportion of the population with access to key amenities; (iii) *distance-based metrics* (5), which examine travel distances within a given travel time; (iv) *gravity-based metrics* (4), which include travel-time and distance decay models to analyse accessibility; (v) *behaviour-based metrics* (4), which examine actual or potential travel patterns using origin-destination data; and (iv) weighted scores (5), which use composite indicators, often involving accessibility and walkability metrics.

Amenity-based, population-based, and distance-based metrics rely mostly on cumulative measures of accessibility and catchment areas to evaluate FMC performance. While these metrics are relatively easy to calculate using various network analyses, they have limitations. One key issue is their rigid threshold, which arbitrarily excludes residents living just beyond the selected threshold, leading to edge effects (Fortney et al., 2000). As a result, these metrics fail to account for gradual declines in accessibility and may overlook the experiences of those living slightly beyond the threshold (Logan, Hobbs, Conrow, Reid, et al., 2022b). Compared to other regions, these methods are particularly prevalent in European studies.

A recent development in destination- and population-based metrics is the use of longitudinal designs to analyse how neighbourhood accessibility evolves over time in relation to the FMC concept. For instance, Elldér (2024a) examines changes in the number of amenities over six years to explore the relationship between gentrification and improved local accessibility. Expanding on this foundation, Elldér (2024b) assesses how changes in the built environment influence local accessibility, while Elldér (2025) investigates spatial inequalities in access to amenities. These studies used data from 200 Swedish cities spanning 25 years, demonstrating how longitudinal analyses can provide insights into the causal effects of policy changes on urban environments, including their unintended externalities. Despite the limited availability of longitudinal data, such approaches hold potential for evaluating the long-term impact of FMC policies.

To address the limitations of cumulative accessibility metrics, some researchers have adopted gravity-based accessibility measures (4). For instance, Liu et al. (2024) and Knap et al. (2023) apply the two-step floating catchment area (2SFCA) method, which considers the availability of amenities in relation to population demand. However, both studies differ in how they weight their data: Liu et al. (2024) adjusts for the ratio of population distribution to amenity attractiveness, whereas Knap et al. (2023) examines accessibility across five age groups. Similarly, Birkenfeld et al. (2023) employs a Gaussian-fit decay function weighted by local commuting flows, while Weng et al. (2019) develops a modified WalkScore metric, integrating a tolerance time decay function based on the maximum acceptable travel distance for reaching specific amenities.

Despite their methodological advantages, these more complex measures present interpretative challenges. Unlike percentage-based metrics, which offer clear and intuitive results, gravity-based approaches can be difficult for policymakers and the general public to understand, potentially limiting their practical application. Furthermore, Kapatsila et al. (2023) found that gravity-based models perform similarly to cumulative measures in estimating accessibility to low- and non-low wage work locations, suggesting that the additional complexity may not always yield significantly different insights. This may explain why most researchers adopted cumulative-based metrics among the assessed studies.

North American research has shown a strong focus on behaviour-based metrics to analyse local travel patterns within the FMC framework. Birkenfeld et al. (2023) argues that achieving 100% local living in North America is unrealistic, emphasising the need for flexible targets based on local travel behaviours and preferences. Similarly, Abbiasov et al. (2024) finds that the median US city resident makes only 12% of their daily trips within a 15-minute radius. Expanding on this, Birkenfeld et al. (2024) examines the percentage and total number of trips reaching destinations within 15- and 30-minute active and public transit trips, suggesting that North American cities may require more flexible interpretations of the FMC concept.

A few studies have employed weighted scores, using average or percentile-based measurements. Monteiro et al. (2023) calculates the average distance to destinations, weighted by destination attractiveness, while Guzman et al. (2024) develop a walkability-like score, where the 5th and 95th percentiles define the minimum and maximum accessibility levels. Each approach presents trade-offs. Average-based metrics reflect the mean experience within a region, making them less effective at capturing inequalities in access (Logan, Hobbs, Conrow, Reid, et al., 2022b). In contrast, percentile-based metrics are better suited for identifying disparities, yet they can be highly sensitive to the choice of geographical boundaries, as demonstrated by Logan, Hobbs, Conrow, Reid, et al. (2022b).

Variability in the operationalisation of 15-minute city performance metrics

The operationalisation of FMC performance varies based on the choice of time threshold, transport modes, travel speeds, and the selection of amenities considered essential for local living (Table 3). These decisions significantly shape research findings, influencing assessments of a region's readiness to achieve FMC objectives and determining the scope of land use and transport policies required to implement the concept effectively.

Time thresholds

Most studies (35) cite Carlos Moreno's 15-minute concept (Moreno et al., 2021) as part of their theoretical framework. However, fourteen studies also explore additional time thresholds, recognising that different urban contexts may require more flexibility in the interpretation of FMC policies. In the North American context, Birkenfeld et al. (2023), Birkenfeld et al. (2024) and Negm et al. (2023) compare 15 - and 30-minute thresholds to

Operationalisation	Asia	Europe	North America	South America	Oceania
N ¹	7	22	6	3	2
Time threshold					
< 15 min	3 (43%)	6 (27%)	1 (17%)	-	1 (50%)
15 min	7 (100%)	22 (100%)	6 (100%)	3 (100%)	2 (100%)
> 15 min	1 (14%)	1 (5%)	4 (67%)	-	1 (50%)
Travel modes					
Walking	7 (100%)	20 (91%)	5 (83%)	3 (100%)	2 (100%)
Cycling	-	6 (27%)	3 (50%)	-	_
Transit	-	1 (5%)	4 (67%)	1 (33%)	_
Amenity selection:					
Data sources					
Local or federal data	3 (43%)	13 (59%)	3 (50%)	1 (33%)	2 (100%)
Open data	6 (86%)	13 (59%)	4 (67%)	2 (67%)	-
Private data	1 (14%)	-	2 (33%)	1 (33%)	-
Undefined	-	2 (9%)	-	-	-
Included					
Work	1 (14%)	3 (14%)	1 (17%)	-	-
Healthcare	7 (100%)	20 (91%)	3 (50%)	3 (100%)	1 (50%)
Education	5 (71%)	22 (100%)	4 (67%)	2 (67%)	2 (100%)
Entertainment	6 (86%)	21 (95%)	4 (67%)	2 (67%)	1 (50%)
Services	7 (100%)	21 (95%)	4 (67%)	3 (100%)	2 (100%)
Religious	-	2 (9%)	2 (33%)	-	_
Transit	4 (57%)	8 (36%)	-	2 (67%)	1 (50%)

Table 3. Variability in the operationalisation of 15-minute city performance metrics.

¹ Logan, Hobbs, Conrow, Young, et al. (2022a) analysed cities across both North America and Oceania.

evaluate the replicability of FMC policies. Similarly, Logan, Hobbs, Conrow, Reid, et al. (2022b) analyse 10-, 15-, and 20-minute thresholds to assess how different time cut-offs influence FMC performance metrics in the U.S. and New Zealand. In the European context, Knap et al. (2023) examines 10- and 15-minute thresholds to develop a cycling index for Utrecht, Netherlands. Six other European studies apply a combination of 5-, 10-, and 15-minute thresholds, with four focusing exclusively on pedestrian access and two incorporating both walking and cycling. Similarly, one study applies these same thresholds to assess pedestrian access in Hamilton, New Zealand.

Beyond the FMC framework, four studies focus on China's 15-minute walkable neighbourhood policy, evaluating its implementation in Nanjing, Shanghai, Suzhou, and a group of 23 Chinese cities. Unlike the broader FMC concept, which includes multiple modes of transport, this policy specifically emphasises pedestrian accessibility within urban neighbourhoods. These studies were included in the analysis since these studies follow a national Chinese policy, which is closely aligned with the FMC concept.

Overall, European and Asian cities tend to focus on shorter travel thresholds (5–15 min), reflecting their higher-density urban environments and stronger multimodal networks. In contrast, North American and Oceanian studies frequently incorporate longer thresholds (15–30 min), likely due to a greater prevalence of lower-density development and greater reliance on motorised transport. This is likely a reflection of differences in land use patterns in North American and Oceanian cities. Studies examining South American cities consistently apply a 15-minute threshold, aligning with the original FMC framework.

Mode choice

Most studies (28 out of 39) focus exclusively on walking, primarily due to research interest in walkability and its role in achieving FMC goals (Gorrini et al., 2023; Rhoads et al., 2023;

Weng et al., 2019). These studies are concentrated in Asian, European, and South American cities. Another justification for assessing only walking is that local living is largely constrained by what can be reached on foot, particularly in regions without strong cycling infrastructure.

Two studies focus solely on cycling, both conducted in bicycle-friendly European regions (the Netherlands, Copenhagen in Denmark, and the Freiburg region in Germany). In contrast, only three studies fully align with Moreno's concept, assessing both walking and cycling trips. Monteiro et al. (2023) models the impact of compact urban design on accessibility in Coimbra, Portugal, while Radics et al. (2024) and Shoina et al. (2024) evaluate the number of amenities accessible within 5, 10, and 15 min by both modes.

Although not a part of the FMC concept, few studies (6) incorporate public transit, mostly in North American and Oceanian cities, where sprawled developments require longer travelling distances. Only one study combines walking and transit in their assessments, with Ulloa-Leon et al. (2023) assessing accessibility to essential urban amenities for older adults in Santiago, Chile. Their study categorises facilities into primary needs (within walking distance) and secondary needs (accessible within a 15-minute transit trip), offering a nuanced approach to FMC accessibility.

Mode speed

Eighteen studies define assumed travel speeds for accessibility calculations. Research on vulnerable populations, such as children and older adults, applies lower walking speeds (2.4–3.6 km/h) (Caselli et al., 2021; Gorrini et al., 2023; Ulloa-Leon et al., 2023). However, most studies use higher speeds suited to the general population (4.5–6 km/h) (Birkenfeld et al., 2023; Birkenfeld et al., 2024; Both et al., 2022; Da Silva et al., 2020; Ferrer-Ortiz et al., 2022; Negm et al., 2023; Noworól et al., 2022; Núñez et al., 2024; Olivari et al., 2023; Rhoads et al., 2023; Zhang et al., 2022). This raises equity concerns, as policies based on these assumptions may overlook people with reduced mobility. Few studies account for safety perceptions and street-level conditions (Jiang et al., 2025), while others shift from time-based to distance-based analysis to better capture differences in mobility (Elldér, 2024a, 2024b, 2025; Shoina et al., 2024).

For cycling, speed assumptions (12–20 km/h) are often based on infrastructure quality. Schneider et al. (2022) and Knap et al. (2023) vary cycling speeds depending on the urbanisation level and presence of dedicated infrastructure. Knap et al. (2023) assesses cycling accessibility at multiple speeds, finding that a 15-minute threshold is feasible for commuting in the Freiburg region, the Copenhagen Metropolitan Area, and the Netherlands.

Studies incorporating public transit (Birkenfeld et al., 2023; Maciejewska et al., 2025) use Generalised Transit Feeds (GTFS) data to calculate peak and off-peak travel times, assuming 4.5–6 km/h walking speeds for access and egress. While GTFS data partially accounts for congestion, it does not account for its variability, which can impact FMC evaluations.

Choice of amenities

The selection of amenities depends largely on data availability, particularly in open-databased studies (Gorrini et al., 2023; Olivari et al., 2023). Some researchers align their choices with government-defined basic urban functions (Gorrini et al., 2023; Zhang et al., 2022), while others base themselves on the FMC framework (Bartzokas-Tsiompras & Bakogiannis, 2023) or by identifying daily needs through surveys (Da Silva et al., 2020; Guzman et al., 2024).

Most studies rely on secondary data sources to map the location and distribution of amenities. Researchers use local or federal databases (e.g. cadastral databases) (11), open data sources like Open Street Map (11), or a combination of both (11). Some studies incorporate survey data to weight amenities based on local preferences (Guzman et al., 2024), while four studies use mobile company data, which included amenity locations and classifications. However, Gaglione et al. (2021) and Monteiro et al. (2023) fail to specify their data sources, limiting reproducibility and reliability.

Among the selected studies, most analyse access to services (36 out of 39), education (34), healthcare (34), and entertainment (33), all which align with Moreno's core urban functions. Some researchers extend beyond these categories, evaluating access to transit (15) and religious centres (4). Due to data limitation, few papers examine job accessibility, relying on regional origin-destination data (5) or mobile phone data (2). A notable example is Da Silva et al. (2020), which excludes workplaces, considering them a regional issue rather than a local one, particularly in sprawled areas where commuting across different zones is highly likely. This aligns with Boussauw et al. (2012), who argue that urban restructuring may reduce some commutes, but only a small share of residents will benefit. Their findings emphasise the need for regional planning to complement FMC strategies, ensuring a more integrated approach to accessibility.

Regional patterns and readiness for 15-minute city implementation

The diverse metrics used to assess 15-minute city performance highlight the complexity of evaluating local accessibility. Variations in time thresholds, transport modes, and data sources underscore the role of regional characteristics in shaping FMC evaluations. These differences raise an important question: what do studies reveal regarding how well cities and regions align with the FMC framework in practice? The following section examines emerging patterns across geographical contexts, highlighting key challenges that cities face in achieving FMC principles.

Asian cities

In Asian cities, particularly in China, historic urban cores tend to align most closely with 15-minute city principles due to their high population and amenity densities. Studies consistently show that residents of these traditional neighbourhoods, such as those in Hong Kong, Shanghai, and Suzhou, benefit from increased walkability and access to essential services (Jiang et al., 2025; Liu et al., 2024; Weng et al., 2019). However, newer, and more peripheral developments often lack the same level of accessibility, leading to stark socio-spatial inequalities. As housing prices rise in central areas, lower-income residents are pushed toward suburban zones with limited service coverage, reducing their ability to meet daily needs locally and undermining proximity planning objectives (Weng et al., 2019).

These patterns are frequently identified using metrics that emphasise spatial proximity. However, these methods often overlook the behavioural dimension of accessibility, whether residents actually use nearby services or can access them affordably. In cities like Nanjing, where dense neighbourhoods are burdened with serving both locals and residents from underserved areas, a misalignment between supply and actual community needs occurs leading to a surplus of upscale retail and a lack of basic amenities (Weng et al., 2019; Zhang et al., 2022; Zhang et al., 2025). Compact cities overall tend to perform better: Chen et al. (2025) find that more sprawling urban forms correlate with lower shares of residents having 15-minute access to key destinations. Similarly, studies on older adults in Suzhou highlight that local living is far more viable in dense, walkable areas than in newer developments (Jiang et al., 2025).

While challenges remain, research points to the potential for strategic planning interventions to reduce accessibility gaps. For example, Wang et al. (2024a) shows that even peripheral neighbourhoods could meet FMC criteria if amenities are redistributed thoughtfully. However, most studies in the region emphasise modelled spatial access rather than observed behaviour, limiting insights into whether proximity actually translates into local living practices. As such, future research should examine how demographic factors and mobility behaviours shape the lived experience of FMC accessibility in Asian contexts.

South American cities

In South American cities, persistent inequalities in spatial access and socioeconomic conditions present key challenges to 15-minute city implementation. In Bogotá, Guzman et al. (2024) show that while proximity to non-work amenities is relatively high, low-income groups are often unable to benefit due to limited local service quality, digital divides, and dependence on travel for work. During the COVID-19 lockdown, poorer residents were more likely to continue commuting, while wealthier groups adapted through telework and online access, revealing structural constraints on local living (Guzman et al., 2021). Similar patterns emerge in Santiago, where displacement of older adults to less connected zones further undermine local accessibility (Ulloa-Leon et al., 2023). These findings highlight that spatial proximity alone is insufficient without addressing the deeper inequalities shaping urban accessibility.

European cities

Even in European cities, often seen as more adapted to local living, walkable accessibility is shaped by persistent socioeconomic inequalities. Large-scale analyses based on amenity-based metrics show that wealthier neighbourhoods consistently offer better walking access to amenities, regardless of urban density (Bartzokas-Tsiompras & Bakogiannis, 2023). This pattern is evident in cities across the UK, Ireland, Portugal, and Mediterranean regions of France and Italy, where accessibility gaps remain significant. In Nordic contexts like Sweden, Elldér (2024a, 2025) finds that amenity improvements often coincide with gentrification, particularly in large urban centres. Historic cores with older building stock offer better alignment with 15-minute city principles, but in small and mid-sized cities, affluent households increasingly relocate to semi-urban areas, limiting the practical scope of FMC adoption (Elldér, 2024b).

The spatial arrangement of European cities does support proximity in many urban cores. Studies in Ancona, Krakow, Oslo, Barcelona, and Seville identify a dense mix of

land uses, urban functions, and population that fosters local living (Ferrer-Ortiz et al., 2022; Ninivaggi & Cutrini, 2025; Noworól et al., 2022), what Alexander et al. (1977) frame as the "magic of the city". However, access remains unequal. In Barcelona, residents in lower-rent areas often lack basic services and must travel beyond their neighbourhoods (Graells-Garrido et al., 2021). In Oslo, disparities between inner and outer districts have led some to question the FMC's primary position as a development model, advocating for a complementary rather than central role in planning (Akrami et al., 2024). Bologna displays similar patterns, with wealthier areas enjoying better walkability, lower traffic volumes, and access to amenities (Gorrini et al., 2023).

Beyond spatial metrics, several studies emphasise the role of social and demographic factors. Maciejewska et al. (2025) find that proximity alone is a weak predictor of local living, with women, older adults, and lower-educated individuals more likely to adopt FMC lifestyles. Similarly, Shoina et al. (2024) argue that while FMC strategies show promise in Greece, not all needs can be met within a 15-minute radius.

Cyclist studies in Europe primarily focus on cycling-friendly regions, yielding highly positive results that may not be generalised. In Utrecht, 100% of residents can access at least one facility across nine amenity types by bike, though this drops to 94% within a 10-minute threshold (Knap et al., 2023). However, lower-income and immigrant populations are still more likely to live in peripheral areas with fewer amenities compared to central areas. Schneider et al. (2022) find that cycling distances vary by trip purpose (i.e. shorter for services, groceries, and healthcare, but longer for work and education) highlighting that acceptable travel times differ based on demographics and trip purposes.

Despite these insights, FMC evaluations often overlook infrastructure quality. In Barcelona, accessibility drops significantly when accounting for sidewalk conditions, particularly for vulnerable populations (e.g. children, elderly, those with limited mobility) (Rhoads et al., 2023). Seasonal variations, such as winter conditions, also impact accessibility (Willberg et al., 2023). Additionally, many studies fail to assess whether local studies meet population demand in terms of capacity, quality, and affordability, limiting the practical application of their assessments.

North American and oceanian cities

In Montreal, Canada, Birkenfeld et al. (2023) found that only 2% of households can meet all their travel needs within 15 min using active transportation or transit. This figure rises to 6% with a 30-minute threshold, but those meeting these criteria are often unemployed, suggesting that local living may be driven by travel constraints rather than personal choice. Work remains the primary barrier to achieve full local living, even in highly walkable areas, with larger households less likely to achieve FMC conditions. To address this, Birkenfeld et al. (2024) propose setting contextually appropriate targets, such as defining that a certain percentage of trips, rather than all trips, to be made locally by sustainable modes.

In the United States, Abbiasov et al. (2024) analysed mobile phone data from 40 million residents across 418 cities, finding that a 1% increase in accessibility correlated with a 0.8% rise in the share of trips within 15 min. Their study underscores the impact of zoning laws in shaping accessibility, with mixed-use neighbourhoods encouraging shorter trips. However, they caution that such policies could inadvertently increase

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social isolation among marginalised communities, which currently benefit from interneighbourhood travel. Jin et al. (2024) confirms these findings in a study of 12 selected cities using the same dataset.

Recognising the challenges of integrating work into FMC policies, some North American cities have already opted to exclude work trips from their frameworks. For example, Detroit's 20-minute neighbourhoods policy prioritises access to services, transit, and parks but omits work-related trips (Logan, Hobbs, Conrow, Reid, et al., 2022b). However, this policy predates the rise of Moreno's 15-minute city concept, which includes work as a local urban function. Addressing employment accessibility in North America remains complex due to factors such as urban sprawl, housing-job imbalances, rental markets, and employer location choices. Similar challenges exist in Australia. Both et al. (2022) found that even if all workers switched to active modes, only 29.5% would be able to reach their workplaces within 30 min.

Methodological challenges and future research directions

Research on 15-minute city performance is heavily concentrated in Europe with fewer studies in North America, Asia, South America, and Oceania, highlighting the need for a broader representation of varying urban contexts in the field. Studies primarily focus on the development of performance metrics and indexes as well as on identifying behavioural dynamics, with European and Asian studies emphasising the spatial distribution of amenities, while North American studies focus on behavioural patterns. In assessing FMC dimensions, proximity is the mostly commonly studied, as it relates to reducing travel time for essential services. Density and diversity are less frequently analysed, and digitalisation remains overlooked, despite its increasing relevance postpandemic.

Methodologically, there is no standardised approach to measuring FMC performance, with most studies using amenity-based, population-based, or distance-based metrics, which often rely on rigid thresholds that can misrepresent the experiences of those just beyond the threshold. While gravity-based models offer a more nuanced perspective, their complexity limits their use in policymaking, and behaviour-based metrics, especially in North America, reveal that 100% local living is often unrealistic without flexible targets. Regional readiness varies, with historic, high-density, walkable areas in Asian and European cities aligning well with FMC principles while still struggling with displacement, gentrification, and economical inequalities. Conversely, North American and Oceanian cities face the greatest challenges to align with FMC principles due to urban sprawl, strict zoning laws, and car-dependency, particularly for work-related trips.

As the 15-minute city continues to evolve as a research field, numerous methodological concerns and future research opportunities remain. One pressing area for further exploration is the equity impacts of FMC policies. Many studies focus on general accessibility while overlooking the needs of people with reduced mobility. Building on the previous work on the impact of infrastructure quality (Rhoads et al., 2023) and seasonality (Willberg et al., 2023) on accessibility, future research can explore how built environments can be designed to be more inclusive under the FMC framework. Additionally, studies should examine which demographic groups benefit the most from FMC policies, how service availability fluctuates throughout the day, and whether local services are affordable to all residents. Another key concern is the role of FMC policies in gentrification processes, as increasing local accessibility may lead to displacement and rising living costs, an area of research that started gaining prominence in the second half of 2024. Future studies should investigate how to balance the benefits of FMC policies with housing affordability and social equity.

There is a need for improved methodological approaches to evaluating FMC policies. While there is growing interest in defining essential amenities, current studies often rely on data availability rather than exploring neighbourhood-specific needs. Future research should focus on establishing localised criteria for necessary amenities, ensuring that assessments reflect real community priorities rather than data limitations. Another critical research avenue involves understanding how different operationalisation metrics influence FMC assessments. Research is required to examine how different modelling assumptions, such as walking and cycling speeds, time versus distance thresholds, and various transport modes, influence FMC performance in urban areas. Moreover, performance metrics should include all four FMC core dimensions for a comprehensive evaluation.

Research should examine the influence of political economy and policymaking on service distribution and developing neighbourhood-/city-based metrics to better reflect local priorities. Future studies could also investigate the role of local, regional, and national policies in shaping FMC implementation while exploring public perception and opposition over time. The relationship between local and regional planning, especially the role of inter-neighbourhood connectivity within the FMC framework, could be examined further. Comparative studies across different urban contexts, such as Bartzokas-Tsiompras and Bakogiannis (2023) and Abbiasov et al. (2024), are encouraged as they would help to identify generalisable trends and allow for cross-regional assessments, leading to a more standardised FMC evaluation framework.

Advancements in data collection techniques could significantly improve FMC assessments. Studies should incorporate more travel behaviour data, integrating local preferences to understand current behaviour and derive context-based targets and metrics. Leveraging machine learning and big data analytics (e.g. GPS tracking, mobile phone data, and real-time transit data) could also provide more dynamic and accurate models of local travel behaviour. Additionally, origin-destination (OD) data can offer valuable insights into how people move through cities, helping policymakers design more effective FMC strategies that account for population heterogeneity. The influence of remote work on local living remains an underexplored area in FMC performance assessments, with potential implications for policy design.

Finally, longitudinal studies are essential to understanding the medium- and long-term effects of FMC policies. Future research should examine how built environment modifications under FMC policies influence mobility patterns, accessibility, and urban equity over time. As changes to the urban environment can take decades, making short-term success claims can be misleading without evidence of sustained behaviour change.

Conclusion

The emergence of the 15-minute city (FMC) concept has brought renewed interest in proximity-based planning, emphasising increased density and diversity at the neighbourhood level. This literature review examines how 15-minute city performance metrics have been defined in research and how they have been used to assess current regional alignment with its principles. Although significant progress has been achieved in the literature within a brief time period, numerous methodological gaps and research opportunities still exist. Moreover, although similarities occur across contexts, the dominance of European case studies underscore the need for broader representation of other regions, particularly North America, Oceania, and the Global South, where urban forms, socioeconomic conditions, and government structures may differ significantly.

A key finding is that proximity varies in its operationalisation, often relying on rigid thresholds that can misrepresent the experiences of those living just beyond the threshold. Findings are also affected by differences in time thresholds, transport mode combinations, modelled speeds, and the chosen amenities. Moreover, density and diversity, while central to urban planning, remain underexplored in performance assessments, and digitalisation has received little research attention. The removal of ubiquity from the concept's dimensions can pose a challenge to achieving equitable cities. For instance, if FMC neighbourhoods remain niche, these areas may be subject to gentrification processes which will reinforce inequities.

Central areas in European and Asian cities often follow FMC principles due to high-density, mixed-use developments. In contrast, North American and Oceanian cities face greater challenges, primarily due to sprawling urban developments, car dependence, and restrictive zoning policies. Similarly, South American cities grapple with inequalities of access to essential services, reinforcing the need for context sensitive policies. Consequently, the FMC framework should not be considered as a one-size-fits-all solution given the importance of understanding local built environments and travel patterns to develop policies that include regional idiosyncrasies while limiting negative outcomes, such as gentrification processes, decreasing housing affordability, and reinforcing socio-economic disparities. Failing to understand the local context is likely to lead to policies with limited relevance serving only as a branding device. Moreover, the lack of locally defined objectives and metrics can fuel groups who see FMC policies as an attack on freedom.

Specially in more sprawled contexts, such as North America and Oceania, a joint approach combining local and regional planning will be essential to foster proximity. Most cities will need zoning reforms to boost mixed land uses and densification around transit, leading to multiple urban centres rather than one core. This transition will likely encounter resistance in North America due to entrenched legislative and cultural separations of land uses. This process will also require more adaptable and realistic targets, with higher time thresholds for regional destinations (e.g. 30 min for work, universities, or hospitals) and lower thresholds for local amenities (e.g. 15 min for groceries, healthcare, and recreation).

Future research should focus on standardising FMC performance assessments metrics, examining the equity impacts of FMC policies, expanding research in underexplored regions, and applying longitudinal research designs to track policy impacts over time. Additionally, greater attention is needed on integrating behavioural data, evaluating digital accessibility, and defining flexible targets to ensure that research outputs have practical and equitable implications. For example, individuals with limited mobility may be more impacted by infrastructure quality and weather conditions, which can decrease their accessibility to desired destinations. Sociodemographic factors, such as gender and age, can also influence the amount of time people are willing to travel, which varies based on trip purpose.

Author contributions

The authors confirm contribution to the paper as follows: Study conception and design: Carvalho, Farber, Manaugh & El-Geneidy; Data collection: Carvalho & El-Geneidy; Analysis and interpretation of results: Carvalho, Farber, Manaugh & El-Geneidy; Draft manuscript preparation: Carvalho, Farber, Manaugh & El-Geneidy. All authors reviewed the results and approved the final version of the manuscript.

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