

Active Transport And Mobility On University Campuses: A Comprehensive Review Of Interventions And Travel Behaviors.

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Abstract

The article addresses active mobility on university campuses, analyzing the factors that determine student mobility patterns and strategies to encourage its adoption. In recent decades, cities have faced challenges stemming from motorized transportation, which has driven a transition towards active mobility. University campuses emerge as key settings for promoting this mobility due to their high concentration of young people. However, there are barriers such as the lack of adequate infrastructure and the prioritization of private cars. A review of empirical studies published between 2018 and 2025 reveals that mobility patterns are influenced by individual factors (attitudes, perceptions), infrastructural factors (access to bike lanes and sidewalks), and institutional factors (university policies). Moreover, successful interventions include improvements in infrastructure for pedestrians and cyclists, as well as economic incentives and technological programs to facilitate the adoption of active modes. The importance of a multidimensional approach that considers the specific characteristics of each campus is highlighted. Universities must adapt to local particularities and work together with governments to overcome structural barriers. In regions like Latin America, where research on this topic is limited, there is a need for efforts to implement active mobility models tailored to local realities. In conclusion, universities can be key agents in promoting more sustainable transportation, but this requires policies adapted to their specific contexts and increased investment in infrastructure.

Keywords – Active mobility, university campuses, sustainability, infrastructure, non-motorized transport.

1. INTRODUCTION

In recent decades, urban mobility dynamics have undergone significant transformations in response to environmental, social, and public health challenges arising from the dominant motorized transportation model [1]. In the face of increased pollutant emissions, traffic congestion, and sedentary lifestyles, various international organizations and local governments have promoted a transition to more sustainable transportation systems, within which active mobility – understood as non-motorized travel through walking, cycling, or other modes powered by human effort – has taken on a central role [2], [3].

In this context, university campuses represent strategic settings to promote sustainable mobility habits, both due to the high concentration of young populations and their potential as urban innovation laboratories [4]. Mesarec & Trček [5] mention that active mobility in these environments not only contributes to reducing the environmental footprint of educational institutions but also promotes healthy lifestyles, equitable access to transportation, and improvements in the quality of public space. However, its adoption remains unequal and conditioned by multiple structural and cultural factors that need to be understood comprehensively.

University environments face particular mobility challenges, arising from both the sustained growth of student enrollment and their integration into diverse urban fabrics, often poorly connected to sustainable transportation systems [6]. Although campuses typically have basic mobility infrastructure, barriers persist that hinder the adoption of active modes, such as the prioritization of private cars, the lack of pedestrian or cyclist connectivity, and limited integration with public transport. These conditions create negative externalities such as congestion, air pollution, and deterioration of the university public space [7], [8].

Furthermore, student mobility patterns are influenced not only by infrastructural conditions but also by sociodemographic, cultural, regulatory, and institutional factors. The modal choice of students is affected by aspects such as the campus location, availability of transportation alternatives, perceptions of safety, and attitudes towards sustainability [9], [10]. These complex dynamics require multidimensional analysis, as only through understanding them is it possible to design effective interventions tailored to the specific characteristics of each institution.

Despite the growing interest in sustainable mobility, until recent years, the scientific literature on active mobility in university campuses has been characterized by its thematic and methodological dispersion [11]. Studies such as those by Mueller et al. and Nash & Mitra have focused on local cases or sectorial analyses, without systematically integrating the various factors influencing the mobility behaviors of the student community. Additionally, few studies have linked mobility patterns with evaluations of specific interventions, limiting the ability to generalize findings and formulate policy recommendations based on evidence.

In this regard, there is a need for a structured review that synthesizes accumulated knowledge, identifies common trends, and highlights innovative approaches applied in different institutional and geographical contexts. By addressing this gap, the present study contributes to the consolidation of an interdisciplinary research field that links urban planning, sustainability studies, and educational policies, aiming to promote more resilient, equitable, and environmentally responsible university environments.

The period between 2018 and 2025 represents a key phase in the evolution of policies and practices related to active mobility in university contexts [12]. Since 2018, there has been a notable increase in scientific production related to sustainable mobility, driven by the consolidation of international agendas such as the Sustainable Development Goals (SDGs), as well as the adoption of sustainable urban mobility plans (SUMP) in various cities and regions around the world [13], [14]. This time frame allows capturing both the conceptual maturation of the field and the implementation of innovative institutional interventions.

Moreover, this period includes disruptive events such as the COVID-19 pandemic, which caused substantial changes in mobility patterns and the configuration of university spaces, with direct implications for the perception and use of active transportation modes [15]. The review of studies published between 2018 and 2025 not only reflects the recent transformations in student mobility behaviors but also enables the evaluation of the impact of emerging policies and the projection of trends for the coming years in higher education.

The main purpose of this study is to identify the factors that determine active mobility patterns on university campuses and systematize the intervention strategies that have been proposed or implemented to promote their adoption in diverse contexts. Through a structured review of scientific literature, the study aims to provide a comprehensive and comparative view that allows understanding the underlying dynamics of student mobility and offer evidence for the design of effective institutional policies.

The guiding question of this research is as follows: What factors determine active mobility patterns on university campuses, and what intervention strategies have been proposed to promote their adoption in diverse contexts? This formulation allows addressing the phenomenon from a multidimensional perspective, considering individual, infrastructural, social, and institutional variables, as well as contextually grounded intervention approaches. The proposed review is limited to empirical studies published between 2018 and 2025, focusing on active mobility in the university setting, with an emphasis on those providing results applicable to the planning and management of sustainable campuses.

This review not only responds to an academic need for systematizing knowledge on active mobility in university contexts but also holds clear practical relevance for the design and implementation of sustainable transportation policies. By identifying recurring patterns and effective strategies across different regions of the world, valuable insights are generated for decision-makers, urban planners, and university authorities who face similar challenges but lack a solid empirical foundation to guide their actions.

In Latin America, and particularly in countries like Ecuador, active mobility in the university context has received little attention in institutional planning frameworks and public policy [16]. Most higher education institutions lack comprehensive assessments of student mobility and, in many cases, replicate models centered on car use or fragmented solutions [17]. Therefore, this review represents a timely and necessary contribution to highlight the issue, raise awareness about its socio-environmental implications, and promote the design of more inclusive, efficient, and sustainable strategies adapted to the realities of the Latin American context.

In light of the above, this article is structured to provide a rigorous and contextualized review of the phenomenon of active mobility on university campuses, through the analysis of recent empirical studies that address both the factors that condition student mobility patterns and the strategies implemented to promote sustainable mobility modes. The organization of the text allows for a progressive understanding of the issue, from its methodological foundation to the critical discussion of the findings, with emphasis on their applicability in contexts such as Latin America, where significant gaps remain in research, planning, and intervention. In this way, the study seeks to contribute to the advancement of interdisciplinary knowledge and

the strengthening of policies that transform university spaces into more sustainable, inclusive, and healthy environments.

2. METHODOLOGY

2.1. Study type

A literature review was conducted aimed at identifying, examining, and synthesizing the accumulated knowledge on active mobility on university campuses. The literature review was carried out using inclusion criteria and an article screening process. The PRISMA flow diagram was used to illustrate the stages of the selection and filtering process, and the extracted information was organized in a table for analysis. This review did not aim to exhaust the existing body of publications but rather to identify those that, meeting criteria for scientific quality and thematic relevance, offered significant findings on student mobility patterns and applied or proposed intervention strategies.

2.2. Bibliographic search strategy

The information search was conducted exhaustively between March and April of 2025. For this, four high-impact academic databases were consulted: Scopus, Web of Science, SpringerLink, and, complementarily, Google Scholar (as a mechanism to track grey literature and studies not indexed in the previous ones). The search languages were limited to English and Spanish, with a time range from January 2018 to April 2025, in line with the recent rise of sustainable mobility policies in higher education.

The search strings were developed using Boolean combinations: in English, "active mobility" OR "active transport" OR "non-motorized transport" AND "university campus" OR "college students" AND "sustainable transport" OR "urban planning" OR "mobility patterns," and in Spanish, "movilidad activa" OR "transporte activo" OR "transporte no motorizado" AND "campus universitario" OR "estudiantes universitarios" AND "sostenibilidad" OR "planificación urbana." Each search was manually executed, validating the thematic relevance from the titles and abstracts before proceeding to the full reading of the selected texts.

2.3. Inclusion and exclusion criteria

To ensure the coherence of the final corpus, inclusion and exclusion criteria were defined from a methodological, thematic, and linguistic perspective. Only studies were included:

Tab. 1 Inclusion and Exclusion Criteria.

Inclusion Criteria	Exclusion Criteria
Studies published between 2018 and 2025	Articles published before 2018 (except for fundamental theoretical exceptions)
Focus on active mobility in university contexts	Studies on general mobility in cities without a focus on campuses
Peer-reviewed publications (journals or scientific conferences)	Technical reports, theses, opinion columns, or non-peer-reviewed documents
Studies in English or Spanish	Publications in other languages without translation
Use of quantitative, qualitative, or mixed methods	Purely theoretical studies without empirical connection
Studies that propose or evaluate interventions	Articles without results or applicable implications

Source: Own elaboration.

This delimitation allowed the review to focus on rigorous literature, conceptually solid, and directly related to the research problem

2.4. Study selection process

The selection process was carried out in three successive stages. Initially, a preliminary screening was conducted based on the titles and abstracts, eliminating duplicates and obviously irrelevant articles. Subsequently, a detailed reading of the full texts was performed, rigorously applying the previously defined inclusion criteria. Finally, the methodological consistency and thematic relevance of each included study were validated.

The procedure was executed collectively by the research team to resolve any doubts or ambiguities in the coding. The PRISMA flow diagram was used to visually and systematically document the number of records identified, excluded, and selected at each phase of the process.

2.5. Data extraction and analysis

For the systematization of the selected corpus, a structured extraction matrix was designed, in which the following variables were coded: authorship, year, country or region of the study, type of institution, objectives,

methodological approach, main findings, factors analyzed (environmental, individual, institutional), and intervention strategies mentioned or evaluated.

The data analysis was predominantly qualitative and thematic, using open and axial coding procedures to identify emerging categories related to mobility patterns and policies promoting active mobility. This phase did not involve a statistical synthesis (meta-analysis), given the heterogeneity of methodologies and contexts across the included studies.

2.6. Ethical Considerations

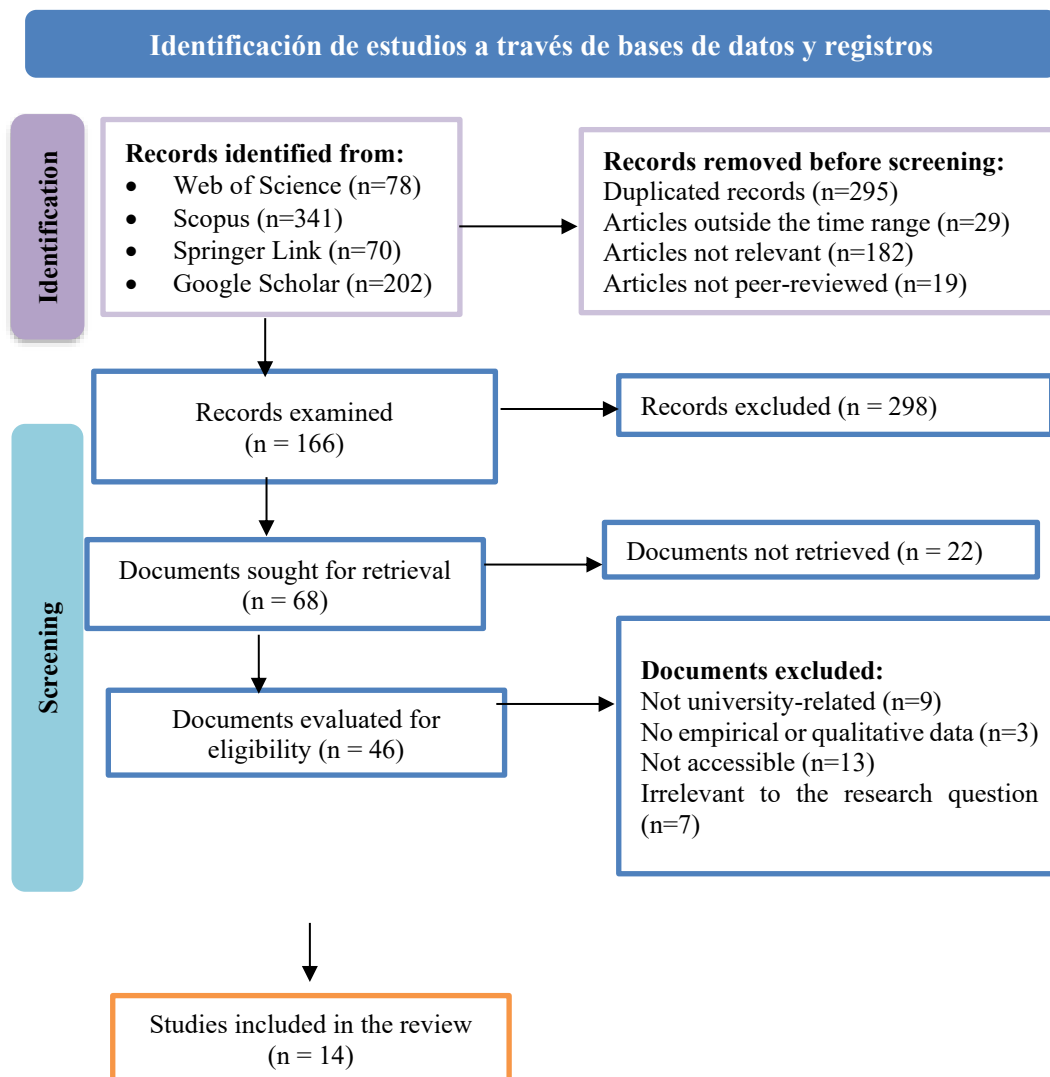
Since this research was based exclusively on publicly accessible secondary sources and did not involve the direct collection of personal data, approval from an ethics committee was not required. However, strict adherence to the principles of academic integrity, transparency in the use of information, and proper citation of the sources used was ensured.

3. RESULTS

The diagram presented below summarizes the different stages of the process of identification, screening, eligibility, and inclusion of the documents analyzed in this review. Initially, 691 records were identified from the four mentioned databases. After eliminating duplicates and records that did not meet the established criteria (by date, thematic relevance, or lack of peer review), 166 documents were examined. Subsequently, 46 full-text studies were retrieved and evaluated, of which 14 met all the inclusion criteria and were considered in the final synthesis of results. The specific reasons for exclusion are documented at each phase of the diagram.

This process allowed for the formation of a robust and representative literature corpus, aligned with the objectives and research questions posed, and focused exclusively on empirical studies on active mobility in university campuses published between 2018 and 2025.

Fig. 1 PRISMA diagram





On the other hand, Table 2 presents the structured synthesis of the 14 empirical studies selected for inclusion in the review, following the process detailed in the PRISMA diagram. For each publication, key aspects are identified, such as the type of institution and its geographic location, the methodological approach adopted, the determining factors of active mobility addressed, the intervention strategies proposed or evaluated, and the main conclusions drawn.

The systematization was carried out using a thematic extraction matrix, which allowed for the identification of recurring patterns, divergent approaches, and knowledge gaps in the analyzed corpus. This information forms the empirical basis for the critical interpretation of the findings, the comparative discussion, and the recommendations presented in the following sections.

Tab. 2 Methodological and Thematic Characteristics of the Studies Included in the Review (2018–2025)

N ^o	Author	Type of institution – Geographic location	Methodological approach	Determinant factors	Intervention strategies	Conclusions
1	(Nash & Mitra, 2019) [18]	Public – Universities in Toronto, Canada	Latent class analysis, transportation behavior survey	Socio-demographic characteristics, attitudes toward transportation, neighborhood type, residential preferences	Improve active transportation infrastructure, promote multimodal options (walking, cycling, public transport)	The study identifies five distinct groups of university students based on their transportation behavior. Public transport dependence and the use of active modes such as walking and cycling are highlighted. Transportation policies should consider the socio-economic characteristics and urban environment of students to promote sustainable mobility behavior.

2	(Papantoniou et al., 2020) [6]	Public - Greece, Malta, Italy	Review of mobility plans + Proposed action plan	Location (urban/suburban), transportation infrastructure, socio-demographic characteristics, public policies	Development of a strategic plan with steps: Study, Planning, Implementation, Review. Focus on technical, economic, and social sustainability	The proposed action plan is a strategic framework adaptable to different campuses, considering comprehensive sustainability.
3	(Balsero et al., 2021) [19]	Public - Polytechnic University of Madrid (Spain)	Mobility surveys 2018 and 2021, pattern analysis and comparison	Campus location (urban, metropolitan, isolated), accessibility to public transport, socio-economic characteristics of users	Restriction of private vehicles, promotion of electric vehicles, improvement of infrastructure for bicycles and walking, promotion of shared vehicles, flexible schedules	Sustainable mobility solutions tailored to the characteristics of the campus and users should be encouraged. The use of bicycles is a promising option.
4	(Wang et al., 2021) [20]	Public - Anhui University (China)	Analysis of smart card consumption data and mobility prediction with Markov chains	Student consumption data, activity locations, schedule regularity, movement patterns on campus	Use of prediction models based on Markov chains of different orders	Students are more predictable in their movements on campus, and higher-order Markov models improve prediction accuracy.
5	(Ferretto et al., 2021) [21]	Public - University of Aberdeen (Scotland)	Cost-benefit analysis, case studies, and scenario simulations	Congestion, accidents, pollution, urban space, geographic and social characteristics	Reduction of parking, promotion of bicycle use, reconfiguration of urban space, pricing policies	Successful and cost-effective strategy to promote active mobility, with long-term benefits for health, air quality, and reduction of externalities.
6	(Sgarra et al., 2022) [22]	Public - Sapienza University	Mobility survey, development of a	Public transport vs. private vehicles, campus	Strategies in five areas: Smart Strategies,	The Sapienza SUMP provides a sustainable

		of Rome (Italy)	Sustainable University Mobility Plan (SUMP)	characteristics, user perception	Pedestrian Mobility, Cycling Mobility, Public Transport, Private Transport	strategy tailored to the needs of the campus and the city of Rome, useful for other universities.
7	(Ruiz-Padillo & de Oña, 2024) [23]	Public - Federal University of Santa Maria, Brazil	Structural Equation Modeling (SEM-MIMIC)	Infrastructure, transportation operation, safety, urban environment factors, and user perception	Improve safety perception, service adequacy, encourage the use of public transport	Safety perception and the interaction between infrastructure and operation are key to improving public transport at universities.
8	(Usman et al., 2024) [24]	Public - University of Tennessee, Knoxville, USA	Binary Logit Model, Survey	Bicycle infrastructure, safety, travel time, social attitudes, and user perception	Develop bicycle infrastructure (lanes, maps, lighting, showers), awareness programs	Improve bicycle infrastructure and increase campus safety to encourage its use.
9	(Bakioglu, 2024) [25]	Public - Not specified	Hybrid MCDM approach: SWARA + EDAS under fuzzy image sets	Carbon emissions, air quality, transportation infrastructure, unsustainable transportation practices	Facilities for cyclists, parking reorganization, sustainable transport policies	Short-term strategies such as bicycle facilities and parking reorganization are feasible due to their immediate feasibility and cost-effectiveness.
10	(Cunha & Cadima, 2024) [26]	Public - University of Porto, Portugal	Mobility survey, spatial analysis, binary logit model	Social behavior, socio-economic factors, spatial location	Improve pedestrian infrastructure, promote active modes (walking, cycling, e-scooters), flexibility in university schedules	The study reveals that students at universities in car-dependent cities are increasingly adopting active mobility, but barriers such as the lack of safe infrastructure persist. Interventions in

						infrastructure and policies that favor active and accessible transportation are recommended
11	(Guido et al., 2025) [7]	Public - Aristotle University of Thessaloniki (Greece) and University of Calabria (Italy)	Comparison of sustainable university mobility plans (HUTP)	Environmental impact, quality of public transport, mobility infrastructure, private transport habits	Encourage the use of public transport, carpooling, cycling, pedestrian zones, and micro-mobility areas	The implemented measures decrease the carbon footprint, reduce congestion, improve air quality, and enhance the health of students and staff.
12	(Papafoti et al., 2025) [27]	Public - University of Warwick, United Kingdom	Qualitative interviews with students and staff; thematic analysis of data	Travel cost, availability of services, schedules and flexibility, pro-sustainability attitudes, awareness, social norms, travel experience, safety, and health	Introduction of shared mobility services such as e-scooters, on-demand transport, bicycle rental, and a mobile app with rewards to encourage behavior change	Changes in travel behavior are possible, but there are barriers such as lack of awareness about the services, car dependence, and lack of adequate infrastructure. The use of fair pricing, improved road safety, more digital integration of services, and expansion of infrastructure are recommended
13	(Cadena et al., 2025) [28]	Public - Federal University of Pernambuco (UFPE), Brazil	Empirical study based on law review and improvement proposals	Use of private car, road infrastructure, public policies, proximity to stations, distance reduction	Promotion of multimodality, encouragement of bicycle use, traffic interventions (mini	The implementation of measures that reduce travel distances and increase infrastructure

					roundabouts, lane reduction), public transport connection, and improvement of campus transport infrastructure	for active transport (bicycles, walking) facilitates the transition to sustainable mobility, improving safety and reducing car use on campus
14	(Fitch-Polse & Agarwal, 2025) [29]	Public – University of California, Davis, USA	Systematic review of studies, analysis of intervention benefits	Transportation infrastructure, road safety, physical activity, reduction of emissions and vehicle trips	Improvement of pedestrian and bicycle infrastructure, bike-sharing programs, pricing policies, and lane reduction for vehicles	The review demonstrates that active transportation interventions have broad social benefits, particularly in terms of public health and the sustainability of the transportation system. However, the effects may vary depending on the local context, so interventions must be adapted to the specific characteristics of each area

Source: Own elaboration

4. DISCUSSION

The analyzed studies allowed the identification of a series of common patterns in the configuration of active mobility within university campuses, as well as the strategies that have been proposed or implemented to promote this type of mobility. First, it is observed that the factors influencing active mobility are multi-causal and vary depending on the geographical location, campus design, characteristics of the university population, and the normative and infrastructural context. Research such as that by Nash and Mitra, Cunha and Cadima, and Wang et al. [18], [20], [26] highlights how modal decisions are determined both by structural variables (accessibility, infrastructure, distance to campus) and individual elements (perceptions of safety, pro-environmental attitudes, social habits).

Furthermore, the reviewed works agree that the implementation of strategies to promote active mobility requires a holistic and interdisciplinary approach. These interventions range from physical improvements (such as cycling or pedestrian infrastructure) to technological components (e.g., mobile applications, usage pattern monitoring), economic incentives (preferential rates, reward programs), and normative or institutional

reforms (sustainable mobility plans, parking management). Notable examples include the SUMP developed by Sgarra et al. [22] at the Sapienza University of Rome, the methodological proposal by Papantoniou et al. [6] for adaptable action plans, and the cost-benefit simulations by Ferretto et al. [21] in Aberdeen. Together, the findings reaffirm that there is no one-size-fits-all solution for all campuses; rather, strategies must respond to the socio-spatial and institutional particularities of each university environment.

The factors influencing active mobility patterns on university campuses are organized into three main dimensions: individual, infrastructural, and institutional. On the individual level, the reviewed studies emphasize the influence of attitudes, perceptions, and social behaviors on modal choice. For example, Nash and Mitra [18] identify differentiated student profiles based on their residential preferences, attitudes towards active transport, and sociodemographic determinants. Similarly, Cunha and Cadima [26] confirm that students with favorable attitudes towards active mobility, particularly those living within 3 km of the campus, are more likely to walk or cycle. In this sense, psychosocial aspects, such as perceptions of safety [24] or the value placed on travel time [20], also emerge as critical elements.

Regarding infrastructural factors, the availability, connectivity, and quality of infrastructure for non-motorized modes are consistently identified as key determinants. The lack of bike lanes, adequate sidewalks, or safe transit areas represents a significant structural barrier, especially in peripheral or low-density urban contexts [7], [19]. The analysis by Ferretto et al. [21] illustrates how urban space reconfiguration, combined with parking reduction policies, can substantially modify modal distribution. Similarly, Bakioglu [25] argues that reorganizing parking spaces and providing facilities for cyclists are cost-effective short-term measures.

In the institutional and regulatory dimension, several studies agree that the presence of regulatory frameworks, economic incentives, and an organizational culture oriented towards sustainability is crucial for promoting active mobility. The approach by Papantoniou et al. [6], through a phased strategic plan, shows the importance of articulating actions between internal and external actors to the university, integrating performance indicators and evaluation mechanisms. The SUMP at Sapienza University [22] reflects how university governance can align infrastructure, public transport policies, and measures to discourage the use of private vehicles. In summary, active mobility patterns result from complex interactions between individual, physical, and political conditions, the management of which requires a systemic and adaptive approach.

The review highlights a wide range of intervention strategies aimed at promoting active mobility in university contexts, which can be grouped into four main categories: infrastructural, regulatory, behavioral, and technological. In the infrastructural domain, the creation or improvement of bike lanes, pedestrian zones, bike stations, showers, and secure parking has been a constant. Usman et al. [24] highlight that appropriate cycling infrastructure, along with safety measures like nighttime lighting, are determining factors for encouraging bicycle use. Likewise, studies like those by Sgarra et al. [22] and Balsero et al. [19] emphasize that interventions in pedestrian and cyclist connectivity, combined with restrictions on private vehicle use, generate positive impacts on campus sustainability.

Regulatory and institutional planning strategies have proven to be especially effective when structured under systemic models. Papantoniou et al. [6] proposes a four-phase strategic plan (diagnosis, planning, implementation, and review), which allows interventions to be adapted to the particularities of the campus and its urban environment. In this same line, Guido et al. [7] show how comprehensive plans (HUTP) applied in Greece and Italy manage to integrate the promotion of active modes with incentives for public transport use, carpooling, and micro-mobility zones. In turn, Ferretto et al. [21] offer a cost-benefit approach that demonstrates that active mobility measures, in addition to being effective, are economically and socially profitable.

From a behavioral perspective, the most effective strategies have been those that recognize the diversity of perceptions, needs, and habits of the different groups that make up the university community. Fitch-Polse and Agarwal [26], [29] warn that educational programs, awareness campaigns, and digital rewards for sustainable practices are key to generating lasting changes in modal behavior. Similarly, Cunha and Cadima [26] stress the importance of differentiated policies based on socioeconomic conditions, promoting greater equity in access to sustainable options.

Finally, technological-based interventions that leverage data analysis and digital tools to plan mobility have been identified. The study by Wang et al. [20], using Markov chain models applied to smart card consumption data, represents a breakthrough in predicting pedestrian flows and allows for more efficient management of campus space and services.

However, a critical analysis reveals that many of these strategies have not been evaluated longitudinally, and their effectiveness may vary significantly depending on the institutional, cultural, and geographical context. In Latin America, where deficient infrastructure and limited investment in active mobility prevail, the transferability of these models requires careful adaptation. Countries like Ecuador, for example, still lack robust regulatory frameworks and specific university policies in this area, which limits the effective implementation of successful interventions from other settings [16].

The findings of this review allow for the extraction of relevant practical implications for universities in different contexts, especially those located in regions where mobility systems face structural setbacks, such as Latin America. In general, it is clear that the planning of active mobility cannot be conceived as an isolated or reactive action, but rather as part of an integral institutional project, transversal and aligned with public sustainability policies. Models such as those in Sapienza, Rome [22], Madrid [19], or Thessaloniki and Calabria [7] reveal that active mobility is only consolidated when robust institutional frameworks, intersectoral coordination, and clear political will are present.

In the Latin American case, structural barriers persist that hinder the adoption of successful strategies. Many universities are located in urban environments characterized by peripheral expansion, a lack of infrastructure for pedestrians and cyclists, and a high dependence on informal or motorized transport [23], [28]. Furthermore, university mobility is often absent from municipal urban plans, and few higher education institutions have technical assessments or budgets oriented towards sustainable mobility.

Particularly in Ecuador, active mobility on university campuses has been scarcely addressed both in institutional planning and academic research [16]. Ecuadorian universities face specific challenges: peripheral locations without safe access to public transport, lack of pedestrian and cycling infrastructure, and regulatory frameworks poorly integrated with sustainability agendas. Therefore, the application of successful strategies like those implemented in Europe or North America requires a contextualized adaptation process that considers the territorial, economic, and cultural constraints of the country.

In this context, Ecuadorian universities have the opportunity to position themselves as agents of change by incorporating active mobility into their strategic plans, developing participatory diagnostics, and establishing partnerships with municipalities, ministries, and civil organizations. The implementation of local pilots – for example, internal bike lanes, bike-sharing systems, or incentives to walk – can constitute a viable starting point, as long as they are accompanied by awareness campaigns, investment in basic infrastructure, and institutional policies committed to sustainable development.

This analysis, consequently, reveals both significant advances and persistent gaps in the field of study of active mobility on university campuses. One of the main challenges identified is the need to deepen longitudinal studies that allow for the evaluation of the real and sustained impact of implemented interventions. Despite the existence of comprehensive proposals such as SUMP [22] or phased strategic plans [6], few studies have empirically documented changes in modal patterns over the medium and long term. This limits the ability to replicate and formulate recommendations based on measurable results.

Furthermore, there is a notable lack of studies focused on universities in Global South countries, particularly in Latin America, Africa, and Asia, regions that face specific urban mobility challenges but are underrepresented in major scientific databases. Including these contexts would enrich the comparative analysis and incorporate structural variables such as transport informality, urban insecurity, or territorial inequality. For Ecuador, a priority research line emerges: the characterization of student mobility patterns in various university cities and the evaluation of viable strategies from a perspective of spatial justice and inclusive sustainability.

Another emerging area is the use of digital tools, artificial intelligence, and data analysis to understand and manage mobility flows on campuses. The study by Wang et al. [20] represents an innovative example of how data generated by smart cards can be used to model travel behaviors. In the future, research is expected to grow that incorporates sensors, mobile applications, and collaborative platforms for the adaptive design of infrastructure and transportation services.

5. CONCLUSIONS

The findings demonstrate that active mobility is a complex phenomenon, influenced by individual, infrastructural, and institutional dimensions, and that its promotion requires a multidimensional approach that integrates urban planning, university policies, applied technologies, and participatory processes. Among

the most recurrent strategies are interventions on pedestrian and cycling infrastructure, incentives for public transport use, reorganization of urban space, and the deployment of technological tools for the smart management of mobility. A significant contribution of this study is the systematization of international experiences applicable to diverse contexts, providing a robust empirical foundation for designing sustainable mobility policies in university environments. It has been shown that universities can play a central role in the transition towards more sustainable transportation models, not only acting as spaces with direct influence on thousands of users but also as agents promoting social, environmental, and technological innovation. On the other hand, although this review adopted a qualitative and thematic approach to manage the methodological, geographical, and contextual diversity of the selected studies, this very diversity imposes restrictions on the possibility of establishing generalizable causal relationships or comparing impacts quantitatively. Additionally, there remains a clear concentration of studies in European and North American contexts, highlighting an imbalance in academic production and limiting the systematized knowledge about realities in regions like Latin America. Consequently, it is recommended to broaden the scope of future research to underrepresented regions, particularly in countries like Ecuador, where universities still lack comprehensive diagnostics on student mobility and institutional active mobility plans. It is also suggested to strengthen the use of mixed methodologies, longitudinal studies, and interdisciplinary approaches that integrate social, environmental, and technological dimensions.

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