Equity conceptualization and standards within transportation literature: a scoping review

# Introduction

An equitable transportation system, from a transportation planning perspective, is broadly defined as the fair production, distribution, and reproduction of transportation benefits, and costs within a community (Pereira, Schwanen, and Banister 2017; Sheller 2018; Pereira and Karner 2021). Transportation equity is related to another concept, mobility justice, which seeks to understand how broader power inequities, like racism, sexism and classism, inform the governance and control of movement and reproduced by mobility systems (Sheller 2018). Transportation equity is a multi-scale and multi-dimensional topic, which focuses on how transport-related benefits and burdens are distributed across population groups and communities within urban, suburban or rural areas. Benefits and burdens can include, but are not limited to, accessibility, mobility, affordability, health and environmental issues that impact individuals, marginalized members of a community, and the community as a whole (Lucas et al. 2019).

Transportation systems are complex and include multi-modal operation such as walking, cycling, public transit, cars, and emerging new technologies and service modes, which further complicate the transportation benefit-to-burden landscape (Guo et al. 2020). It is increasingly agreed upon that an equitable transportation system is not a positivist attribute and must be normatively (morally) defined by a community or broader society before or during the process of measurement and operationalization (Pereira and Karner 2021; Páez, Scott, and Morency 2012). Both academic literature and planners are grappling to contextualize what an equitable transportation system may look like along spatial, temporal, environmental, and socio-economical dimensions (Geneviève Boisjoly and El-Geneidy 2017; Pereira and Karner 2021). Synthesizing methods on how to define, measure, and operationalize transportation equity is urgently needed as planners and decision-makers are undecided on how to distribute existing transportation resources and simultaneously invest in future transportation infrastructure *fairly*.

The application of equity within the realm of transportation planning has proliferated in the academic literature but concrete adoption of the concepts in planning practice has been minimal (Pereira and Karner 2021; Geneviève Boisjoly and El-Geneidy 2017; Doran, El-Geneidy, and Manaugh 2021; Linovski 2020; Litman 2022). Academic literature has reviewed select equity dimension measures such as accessibility and activity participation (Páez, Scott, and Morency 2012; Allen and Farber 2020), affordability (Isalou, Litman, and Shahmoradi 2014), environmental impacts and safety (Guo et al. 2020), health (Fransen et al. 2015; Smith et al. 2017), conceptual frameworks for equity and social exclusion (Lucas 2006; Lucas et al. 2016), and distributive justice theories (Behbahani et al. 2019; Lewis, MacKenzie, and Kaminsky 2021; Pereira, Schwanen, and Banister 2017; Vecchio and Martens 2021), among others. However, what is missing from the literature is a comprehensive review of the academic literature from the lens of how equity is conceptualized and theorized. Who are included in the equity dimension measures (e.g., which marginalized groups, geographies, and transportation activities) and what are the equity standards (e.g., maximum or minimum travel time to opportunities). These questions are vital to planning agencies and decision-makers, and as such, this review aims to definitively benchmark the knowledge in the literature from this perspective.

Though aspects of transport equity in metropolitan planning documents such as accessibility (Geneviève Boisjoly and El-Geneidy 2017) or mode-specific equity (Doran, El-Geneidy, and Manaugh 2021) have been reviewed, no review to date captures how equity has been theorized, who has been included in equity dimensions, and how equity has been indicated in the academic scholarship. This work is needed as a reference for planners and decision-makers to see which equity dimensions, standards, and conceptualizations have been applied in the academic literature and to help identify where gaps exist in the literature. Ultimately, this review aims to collate the academic knowledge and present it in an operationalizable manner to both academics and decision-makers in hopes to catalyze the wide-scale uptake in equitable planning practices and guide future research programmes which develop definitions, measures, and recommendations for evaluating transportation equity.

This review will look at all transportation modes, all urban areas, and all geographic areas in English academic articles from general and field-specific databases. This paper is structured as follows. In Section 2, we define the dimensions, types of standards and conceptualizations equity literature categories used in the literature search and throughout the paper. In Section 3, we outline the methods used in the scoping review conducted. In Section 4, we summarize the high-level findings of the literature. In Section 5, we discuss the standards and conceptualizations along with how they connect to dimensions and measures more specifically. In Section 6, we summarize the findings and link them to future transport planning agendas in addition to visioning ways the findings can be used to build *just* transportation planning processes.

# Setting the stage

We recognize that equity within the transportation literature exist within cross-cutting categories. For the purposes of our literature review, we break down equity into *equity dimensions*, *equity standards*, and *equity conceptualizations*. We review literature within the transportation domain that have all three categories. As follows, we define what each of these categories mean within this review and how they inter-connect. We borrow a “Where?”, “When?”, “Who?”, “What?”, and “How?” framing to categorize aspects of how equity is assessed within the literature. This categorization is outlined in Jaggar (2009) to describe substantive sets of answers to questions of distributive justice (and further discussed in the context of justice within the critical human geography discipline (Przybylinski 2022)). For questions of *justice*, convincing answers to these questions require a rationale, a “Why?” (Jaggar 2009). For the purpose of this review of *equity* however, studies that substantively answer “Why?” may be included but are included as a result of addressing where, when, who, what, and how. That being said, answers to “Why?” are critical, but are not as common, and this next step in planning for *justice* transportation literature is discussed in Section 6.

**Equity dimensions**: transportation equity can be assessed across multiple dimensions which can be broadly distinguished as (1) mobility/accessibility, (2) traffic-related pollution, (4) traffic safety, and (4) health as provided in a conceptual framework provided by (Lucas et al. 2019). All papers reviewed include dimensions that cover the “What?” of the transport equity issue and can be further disaggregated across the following broad considerations:

* *What*: includes the equity dimensions (i.e., mobility/accessibility, traffic-related pollution, traffic safety, or health).
* *Who* and *When*: includes the type of population group, mode type, activity/opportunity type, transport network status, and temporal scope of the study.
* *Where*: includes the geographic areas of the study (urban areas, countries).
* *How*: includes the measure used to assess equity dimensions (i.e., mobility/accessibility measures, traffic-related pollution measures, traffic safety measures, or health measures).

**Equity conceptualizations**: in addition to including equity dimension(s), all studies have equity conceptualization(s). This includes some type of equity principle, philosophy or theory that motivate the study. Examples of these conceptualizations are broadly defined as follows:

* Theoretical and conceptual frameworks (e.g., transport-related social exclusion, transport disadvantage, transport poverty, horizontal equity, vertical equity, among others)
* Theories of justice (e.g., distributive justice, spatial justice, environmental justice, procedural justice, restorative justice, among others)
* Equity principles (typically related to theories of distributive justice as it the most commonly) (e.g., Rawl’s egalitarism, Utilitarism, Capabilities Approach, Sufficientarism)

**Equity standards**: lastly, in addition to dimensions and conceptualizations, all studies reviewed include equity standard(s). These standards should be a thresholds of some sort that when operationalized can be used to define when an aspect of the transportation system is equitable (or just), not equitable (or unjust), or somewhere in-between. These standards can be broadly summarized as quantitative thresholds, qualitative descriptions, and mixed-method thresholds and are highly dependent on the type of equity dimension and conceptualization adopted in the study. Types of equity standards can broadly include:

* Maximum or minimum travel distance/cost/time to or from key places or activities
* Distribution assessment (composite indicator, range, maximum distance or gap, etc.)
* Satisfaction or dissatisfaction;
  + With travel to and from activities, or
  + From externalities related to transportation systems

Together, studies that include equity dimensions, conceptualizations and standards should provide substantive answers to the “Where?”, “When?”, “Who?”, “What?”, and “How?” as it relates to defining equity within the context of transportation systems (i.e., the users, the infrastructure, the service, the outcomes, or a combination of all). The aim of this review is to answer the following questions:

* What are the equity dimensions, equity standards, and equity conceptualizations and how are they applied in the existing transportation equity academic literature?
* Based on how equity has been applied in the literature, what may be paths forward in theorizing justice in the context of transportation systems?

# Literature review methods

The topic of transportation equity is broad so the search strategy was carefully designed through the consultation of knowledge synthesis guidance as well as knowledge-synthesis domain experts. The method is described in two parts, the development of the search strategy and the evidence selection and data extraction process.

This review follows the Joanna Briggs Institute (JBI) approach to the conduct of scoping reviews which encompasses enhancements of the Arksey and O’Malley (2005) framework (Peters et al. 2020): the JBI is a global organization that creates frameworks, protocols and guidance for the synthesis of research. This review is also guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for scoping reviews (PRISMA-ScR) which is congruent with the JBI approach (Tricco et al. 2018). We examine the breadth and depth of the academic literature on transportation equity that analyses equity within at least one dimensions and implements equity conceptualizations and equity standards as defined in the previous section. Using the selected synthesis method allows this review to explore the broad topic of transportation equity within the literature and collate knowledge from across methodologies in the academic literature.

The primary research question and the protocol was drafted and refined from the preliminary searches and consultations with the authorship team who are engaged in transportation equity related research (Iglesias et al. 2019; Sagaris, Berrios, and Tiznado-Aitken 2020; Vecchio and Martens 2021) and a University of Toronto Research Services Librarian and Liaison Librarian in City Studies.

## Search strategy

The search of the literature is identified using a multi-database search strategy developed by the authors along with consultation with the knowledge synthesis experts. See the full search query and databases in [Figure 4](#fig-A1): the search query consists of the four additive (“AND”) sets of topic search terms (i.e., keywords in the title, abstract, or key words).

To guide the conceptual search strategy and the strategic selection of search terms within the search query, **inclusion** and **exclusion** criteria were developed (Peters et al. 2020). For the inclusion criteria, the mnemonic PCC (population, concept, and context) was adopted and is described as applied to the search query as follows:

* **Population**: the focus of the included studies should be on individuals, groups, communities, or entire regional areas that are impacted by passenger transportation infrastructure and systems (i.e., all modes and flows) from the perspective of equity (i.e., fair distribution, production, and re-production of burdens and benefits). This criteria is reflected in the creation of the first set of topic search terms that relate to transportation modes (e.g., “walking” OR “cycling” OR “transit” - see green text in [Figure 4](#fig-A1) for the full list).
* **Concept**: the included studies should also include equity dimensions and conceptualizes equity as discussed in the previous section. This inclusion criteria is reflected in the second and third set of topic search terms developed in the search strategy. These terms relate to types of equity dimensions (e.g., “accessibility” OR “mobility” or “transport-related air pollution” - see blue text in the [Figure 4](#fig-A1) for the full list) and equity conceptualizations (e.g., “Justice” OR “equity” - see purple text in [Figure 4](#fig-A1) for the full list).
* **Context**: the included studies should also be limited to publications that include equity standards. Context can be more difficult to explicitly search for with key terms so synonyms for ‘standards’ were added to the query as a four set of topic search terms (e.g., threshold, indicator, criteria - see orange text in [Figure 4](#fig-A1) for full list). Additionally, journal article and conference papers, English-language literature from any country, any study design (e.g., quantitative, qualitative, or mixed-method studies, or conceptual frameworks), and any record published within the past 30 years are included (January 1992 to March 2022). The time period is selected as the first (to the authors knowledge) peer-reviewed article which operationalized equity standards and equity conceptualization was published in 1996 (Khisty 1996); we are broadening the search by a few years for completeness. English is selected as it is the common language spoken across the authorship team. Furthermore, records that explicitly fall within the Transportation or related topic/category is included in the query (e.g., “Transportation”, “Social Sciences”, “Geography”, “Civil Engineering”, “Philosophy” - see the [Figure 4](#fig-A1) for full query).

The **exclusion criteria** for the search are records that are not within the inclusion criteria. Specifically:

* Literature published before January 1992.
* Articles which do not include transportation equity dimensions.
* Grey as concepts contained within are frequently published in a more developed form in journals.

The search strategy was developed iteratively in the following stages:

1. An initial limited search of Web of Science (WoS) was undertaken to identify key articles and evidence. Terms for ‘transportation’ were generated and terms for ‘equity’ were generated. The text words contained in the titles and abstracts of relevant articles, the index terms used to describe the articles, and subject heading searches when available (depending on the platform). This search was iterated on and and initially took the general form:

* (“Transport” OR …1) AND (“Equity” OR “Justice”…2)
* …1,2 signifies additional related terms combined with OR operators

1. Upon inspection of the preliminary search results, authorship team consensus, and similar methods used in step 1, terms describing equity dimensions and terms describing standards were iteratively added to the preliminary search query. The finalized search query takes the following general form:

* (“Transport” OR …1) AND (“Equity” OR “Justice”…2) AND (“Accessibility” OR “Mobility” OR …3) AND (“Standard” OR “Threshold” OR …4)
* …1,2,3,4 signifies additional related terms combined with OR operators
* The search strategy, including all identified keywords and index terms, were as consistently applied to each database and platform searched (Web of Science General Collection -Science Citation Index Expanded, Social Sciences Citation Index (Web of Science), and Transportation Research International Documentation (TRID)). The exports of the final search query was completed by the lead researcher on March 21st 2021.

## Evidence selection and data extraction

Evidence selection consists of scanning the records from the search strategy and retaining the ones that fit the inclusion and exclusion criteria. The search strategy allows us to identify records that are candidates for inclusions or exclusion, the evidence selection process allows us to confirm inclusion or exclusion. This process is described as three steps and is completed in *Covidence*, an online application that facilitates screening and data extraction. The process is briefly described as follows and refers to the evidence selection framework shown in [Figure 1](#fig-fig1) which was pilot-tested with a subset of records before implementation:

1. The first step (orange in [Figure 1](#fig-fig1)) includes screening all titles and abstracts of records on whether they include transportation equity as defined by the population, concept, and potential presence of context. All records are voted on by two independent reviewers for inclusion, exclusion, or uncertain inclusion. All uncertain records, conflicting records, and records missing abstracts are voted on by a third reviewer for inclusion or exclusion.
2. The second step (green in [Figure 1](#fig-fig1)) includes reviewing all full-text records which pass step 1. These records are reviewed based on if their study design includes an equity standards and an equity conceptualization. All records are voted on by two independent reviewers for inclusion or exclusion. If an article is voted to be excluded it is tagged with one of five possible reasons, namely (1) no standards included, (2) no conceptualizations included, (3) no standard and no conceptualization included, (4) send back – QA issue, (5) other. Discrepancies are resolved by a third reviewer.
3. A data extraction template was filled out for each record one reviewer for the third and final step (purple in [Figure 1](#fig-fig1)). The data extraction template was created as a balance between complexity of categories and simplicity of summary; information related to “What?” (equity dimension), “Who?” (population group, mode type, type of destination/activity), “Where?” (region of study), “How?” (how the record measured equity standards), and “What?” (what is the equity standard(s) and associated conceptualization(s)) was filled out for each study. [Figure 5](#fig-A2) contains the template that was input into Covidence and used in this review.

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| Figure 1: Evidence selection process framework. Step 1 (orange) is title and abstract screening, step 2 (green) is full-text review, and step 3 (purple) is data extraction. |

The evidence selection process is reported using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram (Page et al. 2021) in **?@fig-fig2**. Note, 487 records entered step 3 (purple) but only 166 records remained. Applying the data extraction template by the reviewers (authorship team) in step 3 revealed that inclusion was too generous, and records often did not have a sufficiently strong equity standard and/or equity conceptualization.

# Summary of findings

The data extraction records for each paper was used to synthesize the following findings. Recall, all records have equity dimensions, conceptualizations, and standards. Of note, the ways in which the records are summarized are less granular than originally extracted (according to the data extraction template in [Figure 5](#fig-A2)).

## Journal publications throughout the years

[Figure 2](#fig-fig3) displays the papers included in this review by year of publication and case study continent. Of particular note is the geographic scope of the case studies present in the papers. The majority of papers (60%) contain case studies based in the Global North (e.g., North America, Europe, or Oceania). How *equity* is operationalized is context specific, and with the majority of transportation systems *not* in the Global North, the literature included in this review falls short in representing the global perspective. That said, the literature that does study cases in the Global South acknowledges this systematic absence from the academic transportation literature.

Studies in the Global South are predominately in the **Asian** continent, specifically China but also India…. etc.. These articles focus on a variety of modes, population groups and equity conceptualizations and standards but namely, for papers that focus on cases in the Asian content outside of China, they state…. . In China, though formally considered a country within the Global South is developed in terms of data and analysis (?).

Within studies that examine **South America**, many studies mention an absence of evidence on topics that are relevant to the region.. In Brasil, Benevenuto and Caulfield (2020) examines the transport needs of populations in Northeastern Brasil and suggests context matters especially for the selected case study as “the links between transport development, social exclusion, and poverty have been increasingly recognised in the literature” and even when poverty levels are particularly high, “the social dimension of transport has been continuously neglected at the planning stage”. Similarly, Boisjoly et al. (2020) examines public transit accessibility measures for various cities in Brazil and also mentions this gap. Furthermore, the importance in examining region-specific transport equity concerns in South America is highlighted. For instance, Falavigna and Hernandez (2016) recognize that in “Latin American cities, public transport affordability is one of the main obstacles to mobility” and that motivated their study in Montevideo, Uruguay and Cordoba, Argentina. Similar motivations can be found in , Rivas et al. (2021) who examines transportation affordability in 12 cities in South America and the Caribbean.. In Santiago de Chile, Tiznado-Aitken, Munoz, and Hurtubia (2018) examines public transport accessibility and quality of walking environments, identifying two dimensions that are not usually studied hand in hand despite the multidimensional mobility inequities observed in Latin America.

Studies focusing on **Africa**, are even more sparse compared to South America but on different topics. Fried et al. (2020) applies the Sustainability Development Goals (SDG) on Nairobi’s Matatus; Thondoo et al. (2020) examines infrastructure needs from the perspective of transport poverty for Port Luis city, Mauritius; Saving Mothers et al. (2019) examines timely access to emergency and newborn care for mothers in Uganda; Berhe, Martinez, and Verplanke (2014) examines perceived and measured quality of life indicators in Mekelle, Ethiopia. These papers usually use own data collection on objective and subjective measures, given the lack of official, open and georeferenced data that could advance straightforward studies around transport justice.

From all the studies included in the review, 85% focus on urban context. This focus leans into an existing case selection bias: research institutions are often in urban areas and thus, they study and identify gaps in what is proximate and where most data are available. However, some studies are still focus on rural regions. For instance, Cao and Stanley (2017) examine transportation disadvantage from the perspective of inter-island transport planning in the rural Philippines. Residences (who are often socially disadvantaged) in these remote places rely on infrequent inter-island ferry trips to secure necessities. This paper indicate that social exclusion may be alleviated in increasing the level of service of these inter-island transport modes. Other papers focus on road development, classically seen as an economic driver and contributor to urban agglomeration effects, which may be more harmful than helpful (Parry et al., 2018). The authors study remote communities in the Amazonian and suggest that “increasing accessibility through road building would be maladaptive, exposing marginalized people to further harm and exacerbating climatic change by driving deforestation”.

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| Figure 2: Papers included in the review by year of publication and case study continent. |

## Modes, population, and destinations of interest

[Figure 3](#fig-fig4) displays the proportion of papers focused on each population group(s) on the left and transport mode(s) of study (e.g., transit, cycling, etc.) on the right .

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| Figure 3: The porportion of papers that investiage each type of population group (left) and each type of mode (right). Categories for modes and population groups were generated upon data extraction. |

*What* population groups the papers’ studies is of interest. From the left plot (blue) in [Figure 3](#fig-fig4),

We can see that the majority of papers have a focus on how transportation impact income groups within the population differently. For example, Peungnumsai et al. (2020) outlines a methodology to detect gaps in supply where there is unmet demand for public transit in the Bangkok Metro area (Thailand). They focus on equity in the ratio of supply and demand between all population groups. Similarly, Zhao, Li, and Liu (2020) identifies spatially unequal accessibility to health care services in Beijing (China) and suggests access should be equal across income groups.

Falavigna and Hernandez (2016) approaches equity from the perspective of affordability and adopts a threshold that monthly transport by public transit should not be more than 10% of an individual’s monthly income. They suggest that the middle-income travel patterns reflect ‘met’ transportation demand and, as such, identify neighborhoods where populations experience transport unaffordability (typically, low income populations).

Most papers that consider income as a population characteristic focus on how those with the lowest incomes experiences the greatest burdens of transport inequities (be it accessibility, affordability, or other dimensions). For example, Falavigna and Hernandez (2016) approaches equity from the affordability perspective, focusing on those who spend more than 10% of their monthly income in public transport.

Literature subset population groups based on income because there is an abundant amount of results that suggest income is a significant determinate of inequities: income defines class (XXXXXXXXXXXXX).

It is important to note that income also frequently co-occurs alongside other SES. (XXXX)

From the left plot (blue) in [Figure 3](#fig-fig4), we can also see that age is significant, particularly children and older aged people

Composite vulnerability almost always includes income and age (in addition to other SES). Intersectionality approach

Age needs to be considered in its interplay with other significant characteristics as income, gender, or race (Vecchio et al., 2023)

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* But what’s missing from the subset of papers included? Some of the papers tell us… For example, indigenous is missing – Canada context.
* Gender, despite the vast literature showing how mobility is different for men and women, and more recently, the experiences of the non-cis and transgender population
* Disabilities, especially from a quantitative perspective, allow us to understand to what extent the identified mobility barriers are present in different contexts

We can see that the most studied mode is transit. Transit as almost always present in multi-modal comparisons as well. For instance, transit vs. car. transit in addition to active transportation…

* Pedestrian is then the second most common. It is often studied alone as ‘walkability’ or it is part of a thematic active transportation way of moving, which focuses on both walking, bicycle and/or transit (not always). For instance, XXX focuses on walkability. Alternative, XX frames active transportation.. without focusing on transit. XX frames active transportation and includes transit.

Studied modes are likely to be selected because they are within the ‘public realm’ and can be altered to address inequities. For this reason, cars are infrequently the only mode within a paper that is studied and it is used typically as a comparison, e.g. versus transit accessibility, quantifying resulting externalities (road safety, air pollution) for active modes. When studied alone, it is usually to flect their externalities (XX).

What destinations are of interest within the context of equity matter. However, it should be acknowledged that within this review most papers actually do not focus on on any particular destination (e.g., 15% of studies). These papers are interested in some other aspect of equity (e.g., quality of infrastructure, quality of the transportation trip, affordability in general, etc.)) (XXXX).

The most common destinations studied includes Healthcare (15%), where public health planning is a significant focus. Employment accounts for 14%). The source of this data is typical in travel surveys: location of work can be easily gleaned in Global North contexts, and is the usual focus of accessibility measures.

The next most significant destination is a focus on “all” activities (i.e., a bundle of trips, all trips made in a month, enough for ‘sufficient’ quality of life). These studies make up 13% of the papers. These papers typically look at trip-taking holistically, all the trips that users make. XX approaches…

The lesser commonly studied trip type includes: places for shopping such as grocery stores or markets (12%), places for leisure including green space, recreational centres, and places for entertainment (11%), educational facilities including primary school, secondary school, and post-secondary school (11%), community locations including public service centres, places of community support, and places of worship (6%), and places for childcare (3%). These studies focus on.. XXXX

It is worthwhile discussing some interesting cross-tabulations between destination type and population group. In terms of the destination types that most frequently appear together, most commonly, ‘employment’, ‘healthcare’, and ‘education’ destinations are conceptualized across ‘income’ groups and ‘age’ groups most commonly. Examples of these types of destinations include answers to: what makes a safe (equitable) trip to school for children on bike? What is equitable travel distance and availability to health care facilities for older aged people? Many of these papers discuss observed journeys and source their data from regional travel surveys. XXXXX

Furthermore, papers that focus on ‘all activities’ are most frequently of interest for (Dis)Abilities and Gender. The papers take on a more holistic view of users’ travel. For instance, XXXX. They also often focus on users’ capabilities, i.e., what can and do you want to access? For instance, XXXX. Some papers focus on observed journeys (e.g., “where do you go, because you can?” XXX) and some focus on *potential* journeys (e.g., “where do you want to go?” XXX). Many of these papers that focus on ‘all activities’ utilize smaller data sources XXXX. They also focus on synthesizing the gaps in the system XXXX.

## Equity conceptualizations and standards

In this subsection, we provide a sample of the equity conceptualizations and standards. They are discussed from the perspective of *equity dimensions* (e.g., the “What”, “Who”, “When”, “Where”, and “How” across mobility/accessibility, traffic-related pollution, traffic safety, and/or health).

*Equity conceptualizations* that are present in the papers are grouped and defined as follows:

* **Restorative justice** – e.g., repairing harm (0.4%)
* **Utilitarian** – e.g., maximizing benefits overall (0.8%)
* **Sufficientarism/Capabilities** – e.g., what is ‘sufficient’ based on individual capabilities (3%)
* **Rights** – e.g., fundamental rights to access (9%)
* **Inequitable externalities** – e.g., resulting externalities should be equitable (11%)
* **Horizontal/vertical /spatial equity** – e.g., equal across the population (11%), prioritization of disadvantaged groups (15%), and equal/prioritized across space (16%), respectively.
* **Well-being** – e.g., livability, quality of life, subjective well being (17%).
* **Transport-related exclusions** – e.g., focus on how lacking transport access results in social exclusions (17%).

*Equity standards* types are summarized for discussion as follows:

* **Environment +** – e.g., noise, air, pollution criteria (3%).
* **Infrastructure** – e.g., level of service, universal design standards (21%).
* **Population** – e.g., transport-related affordability level, perceived equitable trip (32%)
* **Opportunity** - e.g., Opportunity demand vs. supply – e.g., ratio value (3%); Opportunity accessibility threshold – e.g., an access indicator value (11%); Travel impedance – e.g. 300m to bus stop (24%)
* **Perceived equity** studies, typically qualitative and based on users’ experiences (7%)

We can identify a dimension, conceptualization, and standard for each paper. Rather than analyzing all possible combinations, we illustrate examples of the different varieties we found in Table XXXX. TThis table is useful to begin our discussion on how equity standards connect to conceptualizations, lay out unifying definitions, and identifying potential gaps. and Ultimately, the ranges presented are large because this review searches global studies. A short-term equity goal for a city in an underdeveloped city is different than a long-term equity goal in an overdeveloped city, and we include different contexts in this table to highlight these differences

| Continent (city, country) | Equity Dimension | Associated equity conceptualizations and standards |
| --- | --- | --- |
| South America ()  (not complete) | Mobility | Rivas et al. (2021), a conference paper. How affordable is Transportation in Latin America and the Caribbean? Equity is conceptualization as affordability, especially for the most economically vulnerable (**vertical equity**).  **Opportunity** standards:   * bundle of trips per month..   **Population** standards:   * financial benchmarks for bottom quantile |
| Asia (Bangkok, Thailand)  (not complete) | Mobility, traffic-related pollution, safety, and health | From the conception of improving citizen well-being broadly, (Alderton et al. 2019) establish short-, medium-, and long-term goals for the city in collaboration with technical leaders within the municipal government. Many of the standards recommended relate directly to transportation systems. Indicators of **well-being** (urban livability) are inspired and guided by the Sustainable Development Goals (SDGs) (UN 2023) as well other planning standards from around the world. The following are taken as equity standards:  **Opportunity** standards:   * on average all neighbourhoods should have ….. Maximize the percentage of residents living less than 400 m of public open space, large park and/or local park**.** * accessible transit maximize the percentage of residents living less than 400 m of a local bus stop and less than 800m from a train station [@agost-felipInclusiveModelAssessing2021] * community centers: maximize % of residents living less than 400 m [@agost-felipInclusiveModelAssessing2021]   **Population** standards:  **Infrastructure** standards:  **Environment +** standards: |
| Asia (Chennai, India) | Health | From the perspective of gender equity in physical activity, Adlakha and Parra (2020) focuses on women’s cycling in an urban Indian context. They advocate for all people achieving physical activity thresholds (**horizontal equity**) but prioritize women and especially women in neighbourhods with low-walkablity and socio-economic status (**vertical equity**). As a result of existing health disparities and cultural gender roles, a gender-based perspective is necessary and this paper conducts a cross-sectional questionnaire. The use a physical activity threshold recommended by the WHO (and other agencies such as the US Department of Health and Human Services and UK Department of Health) that we classify as follows:  **Population** standards:   * All people should get 150 min of moderate activity a week or 75 min of vigorous physical activity per week. |
| Africa () | Accessibility, health | Berhe, Martinez, and Verplanke (2014) is a paper that we implicitly extract standards from. This paper examines adaption and dissonance in Quality of Life (QoL) of residents. QoL is conceptualized along the lines of **well-being** and aspects of QoL directly tie into transport systems. This study conducts a qualitative QoL survey of residents on the topic of three QoL domains: housing quality, access to important destinations, and affordability. They also measure quantitative indicators associated with these domains. We assume the equity goal for this paper is that subjective and objective QoL measures should not be mismatched: as discussed by the authors of this study, subjective QoL is higher than objective QoL the participant is experiencing ‘adaption’ and in the reverse scenario the participant is experience ‘dissonance’. The reasons for adaption and dissonance are interesting, but ultimately high QoL (tied to **well-being**) is seen as the equity goal. They measure the following QoL indicators that are suggested and we interpret as standards (only those discussing transport are summarized). They are retrieved from academic literature or planning documents:  **Opportunity** standards:   * Access to primary education facility, percentage of households living within 1 km (walking distance) from a primary school. * Access to secondary education facility, percentage of households living within 2 km (walking distance) from a secondary school. * Access to health facility, percentage of households within 40 min walking time from a health facility. * Access to public transport, percentage of households within a distance of 500 m from a mini-bus stop .   **Population** standards:   * Adequate family income, percentage of households earning more than the official poverty line (BOFED, 2011). * Subjective QoL is constructed based on the household’s level of satisfaction for each of the eight indicators using a six point Likert-scale (1=very satisfied to 6=very dissatisfied). |
| North America () |  | should be an example of **Rights** |
| Europe (Castellon, Spain) | Mobility, safety, health | Agost-Felip, Rua, and Kouidmi (2021) conceptualizes equity through age-friendly urban spaces that reduce (and eliminate) conditions for **transportation-related social exclusion** for older populations and prioritize those who are economically vulnerable (**vertical equity**). These guidelines are inspired by the SDGs (UN 2023) in addition to planning guidelines used national, regional, and local guidelines used in Spain. Only the guidelines with numeric standards are summarized below:  **Opportunity** standards:   * Access to facilities needed for old age health are critical. As such, minimum distance thresholds are suggested from the geometric center of neighborhood. Neighbourhood centers should be *at least*: 1000 m from health facilities (600 m or less is preferred), elderly-specific care facilities and shops should be 600 m (300 m or less is preferred).   **Population** standards:   * Certain neighbourhoods should be prioritized above others. From this paper’s focus on age-friendly urban environment, they suggest that if the neighbourhood has an average old age indicator (i.e., greater than 64 years, and/or greater than 79 years, and/or aging ratio of persons aged greater than 64 relative to 15 to 64 age) should be prioritized. * Economic vulnerable and non-civically engaged neighbourhoods should also be prioritized. If the neighbourhood has a lower percentage of civic associations within the neighbourhood than average, and/or household income, and/or a higher than average ‘interventions for dependency’ and/or ‘social subsidies’, they should be priorized.   **Infrastructure** standards:   * Green space: should be at least 10 m2 per inhabitant in the neighbourhood, greater than 15 m2 per inhab. is the goal. * As related to sidewalk infrastructure a*t least* 50% of all sidewalks (preferably 75% or greater) should: have a width of 1.5m or larger, ramps should have a grade of 8% or less, be ‘well maintained’ (free from deficiencies), be paved for pedestrian use, and cover public transit stops * Lighting is critical for traffic-safety and a sense of safety overall. As such, *at least* 50% roads should: have a min. of 35 lux (road traffic) and 20 lux (pedestrian streets), and adapted traffic lights. * Buildings should be age-friendly. As a proxy for the quality of residential living space quality, *at least* 50% of residential buildings in a neighbourhood should be built within the last 50 years (preferably 75% or more). In terms of physical access into the buildings, *at least* 10% should have elevators and accessible entrances (preferably 25% or more).   **Environment +** standards:   * Noise at the street level should be less than 55 dB and 45 dB (but preferably less than 50 dB and 40 dB) in the daytime and nighttime, respectively. |
| Oceania () |  |  |
|  |  | should be an example of **Restorative justice** |
|  |  | should be an example of **Utilitarian** |
|  |  | should be an example of **Sufficientarism/Capabilities** |
|  |  | **Inequitable externalities** |
|  |  | **spatial equity** |

In connecting the findings in Table XX. It is useful to broadly summarize how equity conceptualizations explicitly connect with standards, a few examples to begin the discussion:

* Well-being, this is related to quality of life of users within the context of transportation -> population (standard) are often used. The methods include…
* Spatial equity, this is disparity analysis -> opportunity measures (standard) are often used. The methods include…
* Rights, this is related to conceptualizing access to destination as a basic right for all -> often, infrastructure (standard) are used such as accessible bus stops, etc. ..
* Inequitable exposure, this is related to externalities associated with transportation systems -> mostly Environmental + (relative) related to air pollution XXX.

In all these example, population standards i.e., thresholds associated with *who* is suffering an inequity, are often suggested. Population standards co-occur often XXX.

The literature shows several papers doing disparity analysis without engaging with equity conceptualizations. For example, within the mobiblity/accessibility dimension, metrics of accessibility (usually 15 to 60 minutes) are used to show differences among areas and groups but with scarce policy and practice implications of those results. Aiming at specific goals and standards tied to conceptualizations is the ideal case. When these analysis engage with metrics that may be tied to conceptualizations (like Gini coefficient or Theil index), they usually fall short of assessing the result’s good or bad. If a Gini coefficient of 0 means that all people have the same access to public transport stops, what does it mean a 0.2, 0.3, or 0.4? Is this good or bad news for decision-makers? Are new policies needed to reduce that number to a certain threshold, orienting future interventions? These questions usually remain unanswered despite its importance.

Conversely, the health dimension shows established and robust approaches compared to mobility/accessibility. Standards for physical activity, emissions, and health burdens were recurrent in our review, usually tied to planning guidelines from global organisms, NGOs, or public organizations. For example, …

Despite the need and importance of setting more standards, some proposals seem arbitrary. For example, XXXX proposes 20 ferrys per day to avoid social exclusion. Justifications for this number were lacking. It is unclear if 10 or 30 ferries would make a difference in a specific quality-of-life outcome or if that number is tied to funding/resource constraints.

# (TO DISCUSS AFTER THE ABOVE IS DRAFTED) Equity Concepts and how standards, measurements and dimensions are reflected within them

NOTE: This should set up a discussion on calibrating the standards to align with outcomes in addition to what we want to know more about - i.e., discuss the gaps!

## Horizontal, Vertical, and Spatial equity – balancing distributions

* Horizontal/vertical /spatial equity – e.g., equal across the population, prioritization of disadvantaged groups, and equal/prioritized across space, respectively.
* Utilitarian – e.g., maximizing benefits overall

## Measuring disparities - negatives

* Inequitable externalities – e.g., resulting externalities should be equitable – air, noise

## Measuring equities - positives

* Wellbeing – e.g., livability, quality of life, subjective wellbeing.

## Transport-related exclusions

* Transport-related exclusions – e.g., focus on how lacking transport access results in social exclusion.

## Explicitly justice driven :

* Equity is not justice.
* Restorative justice – e.g., repairing harm
* Sufficientarism/Capabilities – e.g., what is ‘sufficient’ based on individual capabilities
* Rights – e.g., fundamental rights to access; positive rights

# Way forwards (identifying gaps and possible agenda for the future)

* We decide what is equal and not equal through planning decisions. Whether implicit or not.

## Prioritizing areas

* Relative measures: context, temporal, and group specific
* E.g. a certain group should have more access in certain situations.
* Community

## Disparity analysis and the intentional analysis of equity

## What’s there: and what’s missing

While, what *is not* in the included literature is not the focus of the review, what may be missing is worthwhile for comment. - Some standards seem arbitrary, some conceptualizations are implicit - What are the sources of data and what are the motivations or a few significant categories? POI databases typically - grandma’s house is not there. - Within ‘community’ are organizations, government services, visiting friends/family – very broad. But still not significantly represented. - Childcare, typically daycare or facilities – domestic work, mobilities of care, not here. - Leisure destinations (e.g., green space, parks, recreation) are less studied in this context. - Some categories are missing all together – mobilities of care. Issue of data availability, subjective! - Some papers that are included… miss the mark! XXXX - Canadian perspectives: what do we need.

There is a need to evaluate more equity interventions or policies. In our review, only XX% of the papers assess specific projects with an equity lens. This is a key step towards transport justice; assessing the effects of policies on different dimensions and populations groups and evaluating if a specific context is moving towards equitable standards over time.

A more robust assessment of the implications of equity standards on life outcomes is still pending. Estimating the benefits of increased mobility or accessibility, or reducing affordability burdens and transport externalities needs to be associated with outcomes like life and neighborhood satisfaction, subjective well-being, mental and physical health, social capital, among others.

On the methodological side, more mixed methods are needed in transport equity research. Conceptualizations and standards are usually discussed from purely qualitative or quantitative approaches, a missed opportunity to combine the strengths of both approaches, whether by deep diving into some particular experiences or perceptions through qualitative methods or tailoring more meaningful quantitative analysis after qualitative explorations.

# Concluding remarks

* TBD

# Appendix

Search query:

|  |
| --- |
| Figure 4: The search query. TS = topic search (keywords, abstract, title). TASCA = subject categories. Green text area transportation system related terms, blue text are equity dimension related terms, purple text are equity/justice conceptualization related terms, and orange text are standards related terms. Hits corresponds the number of articles that the search yielded and was retained into the evidence selection process. |

The data extraction template:

|  |
| --- |
| Figure 5: The data extraction template with associated defintions. |

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