

Mobility Resilience under Epidemic Hazards: A Structured Review of Risk Perception, Coping Appraisal and Post-Hazard Recovery

Jiangling Wu¹, Yating Ye¹, Linjie Tian^{1,*}, Qiuhao Lyu¹, Amit Kumar Singh² and Mengjie Li¹

¹ School of Civil Engineering and Architecture, Henan University, Kaifeng 475004, China

² WSB LLC, Austin, TX 78744, USA

* Correspondence: tlj@henu.edu.cn

How To Cite: Wu, J.; Ye, Y.; Tian, L.; et al. Mobility Resilience under Epidemic Hazards: A Structured Review of Risk Perception, Coping Appraisal and Post-Hazard Recovery. *Journal of Hazards, Risk and Resilience* **2026**, *1*(1), 26. <https://doi.org/10.53941/jhrr.2026.100026>

Received: 30 June 2026

Revised: 24 September 2026

Accepted: 28 September 2026

Published: 16 October 2026

Abstract: Epidemic hazards disturb mobility in a way that is both physical and behavioural. They reduce service supply, change perceived safety, and force travellers to decide whether a trip is necessary, safe, or replaceable. This review maps how risk perception, coping appraisal and structural constraints shaped mobility response and recovery during and after COVID-19. The literature search was completed on 21 June 2026. Searches in OpenAlex and PubMed, followed by a targeted update, identified 1263 records; 1145 unique records were screened and 70 studies were included. The evidence shows that perceived infection risk discouraged crowded and enclosed modes, especially public and shared transport. Yet risk perception alone did not explain behaviour. Travellers also needed feasible alternatives, trust in protective measures, money, time, information and social permission to adapt. Longitudinal and observed data were particularly useful for distinguishing temporary disruption from later recalibration, though these sources also carry their own limitations (e.g., sampling bias, algorithmic artefacts) and should not be treated as bias-free evidence.

Keywords: epidemic hazards; risk perception; coping appraisal; mobility resilience; public transport; post-hazard recovery

1. Introduction

Epidemic hazards do not damage transport systems in the same way as earthquakes, floods or technical failures. Tracks, roads and vehicles may remain in place, but the perceived safety of movement changes quickly. During COVID-19, many travellers reduced trips, avoided public or shared transport, shifted to private or active modes, or replaced activities with online alternatives [1–7]. These changes were partly imposed by restrictions. They were also shaped by judgement, fear, trust and the everyday question of whether another option was available.

Observed declines in public-transport use, changes in perceived crowding risk, and unequal access to private or flexible travel options have been repeatedly reported in pandemic mobility studies [1–9]. These findings show that disruption was not only a matter of whether services operated, but also whether travellers regarded those services as safe and usable.

This makes mobility a useful case for hazard and resilience research. A transport system may look operational on paper, yet remain socially fragile if travellers do not trust the service, cannot afford alternatives, or face unequal exposure to crowding. In that sense, epidemic mobility disruption is not only a demand problem. It is a risk-response problem, and it sits at the boundary between infrastructure, behaviour and governance.

The language of resilience is helpful here, but only if it is used carefully. In some studies, resilience means that a public-transport network keeps running. In others, it means that travellers adapt their routines, or that



aggregate ridership returns. These are related outcomes, but they are not identical. A metro line can operate while vulnerable travellers still feel unsafe. A household can adapt by using a car while the wider system becomes less sustainable. This review keeps these layers separate so that recovery, adaptation and equity are not folded into one loose idea of resilience.

Existing transport studies have described changes in trip frequency, mode choice and public-transport use during COVID-19. What is still less settled is how these findings should be read as evidence of resilience. A short-term fall in bus use is not the same as a durable behavioural shift. A return of ridership is not automatically a return of confidence. Likewise, an individual decision to avoid a mode may reflect personal risk appraisal, but it may also reflect service unreliability, household resources, car access, work flexibility or social norms [8–12].

This review therefore reframes post-pandemic travel behaviour as post-hazard mobility adaptation. It asks four questions: (i) how did perceived infection risk shape mobility responses; (ii) what coping capacities enabled or constrained behavioural adaptation; (iii) what evidence supports recovery, persistence or recalibration; and (iv) what lessons follow for risk communication and mobility-resilience planning? The contribution is not a new estimate of effect size. It is a clearer way of organising a scattered body of evidence so that risk, coping and resilience are not treated as interchangeable terms. The practical reason for this reframing is simple. Transport agencies cannot manage future epidemic hazards only by restoring service levels. They also need to understand how people read risk, which protective measures they believe, and which groups have no realistic way to avoid exposure. A review that brings these strands together can support more grounded recovery planning than a review focused only on mode share changes. This perspective also helps connect mobility research with the wider hazards literature. Hazards research is concerned not only with the presence of a threat, but also with exposure, vulnerability, preparedness, response and recovery. Everyday mobility contains all of these elements. Travellers are exposed through shared spaces and repeated trips; vulnerability differs by health status, income, occupation and access to alternatives; preparedness depends on agencies, employers and households; and recovery depends on both service provision and public confidence. Reading the COVID-19 mobility literature through this lens makes the transport evidence more useful for future epidemic preparedness.

The review also responds to a practical gap in the literature. Many studies were written quickly during the pandemic, when the immediate need was to document abrupt behavioural change. That work was valuable, but the language of change was sometimes loose. Decline, avoidance, adaptation, resilience and persistence were often used close together, even when the underlying data measured different things. A more careful synthesis is now possible because the literature includes both early crisis evidence and later recovery evidence. This makes it possible to ask not only what changed, but what kind of change it was, how long it lasted, and for whom it mattered most.

2. Methods

A structured scoping review was used because the evidence base is broad rather than experimentally uniform. The literature includes cross-sectional surveys, stated-preference studies, hybrid and structural choice models, smart-card and GPS records, panel studies, qualitative work and policy reviews. Scoping review guidance informed the reporting of search, screening and charting decisions [13]. No protocol was registered.

The review protocol was not registered because the study began as a structured mapping exercise rather than as a pre-registered systematic review. The search concepts, eligibility criteria and charting fields were nevertheless specified before screening. This limitation is now stated explicitly because protocol registration would have improved transparency and reproducibility.

Eligible studies were English-language journal articles or substantive reviews published from January 2020 to June 2026. Studies were included when they addressed everyday mobility, commuting, public or shared transport, active travel, school or university travel, or post-epidemic mobility recovery, and when they included at least one behavioural or psychological mechanism. Relevant mechanisms included perceived risk, threat appraisal, coping appraisal, perceived behavioural control, affect, trust, habit, persistence, recovery or resilience. Tourism destination choice, clinical travel, freight, supply chains and purely epidemiological mobility studies were excluded unless they examined behavioural adaptation or recovery. The eligibility criteria are summarised in Table 1.

Searches were completed on 21 June 2026. OpenAlex was used as a broad bibliographic index covering transport, planning, behavioural and social-science publications. PubMed was used to capture public-health and risk-perception studies that might not appear in transport searches alone. A targeted OpenAlex update added terms for post-pandemic travel persistence, public-transport recovery, university mobility and telework-related travel change. The search identified 1263 records. DOI and normalised-title deduplication removed 118 records, leaving 1145 records for screening.

The PRISMA extension for Scoping Reviews (PRISMA-ScR) informed reporting. Supplementary Table S5 identifies the corresponding manuscript sections, items that are only partly addressed and items that are not applicable. It is a reporting checklist, not a claim that every PRISMA-ScR requirement has been fully met.

The core search combined three concept blocks: epidemic hazard terms, mobility or transport terms, and behavioural or resilience terms. The generic Boolean structure was: (COVID-19 OR coronavirus OR pandemic OR epidemic OR infectious disease) AND (travel behaviour OR mobility OR transport OR transit OR public transport OR mode choice OR commuting OR telework) AND (risk perception OR perceived risk OR coping OR resilience OR recovery OR adaptation OR habit OR persistence). Search fields and syntax were adapted to each database. OpenAlex was searched across title, abstract and keyword-style metadata where available; PubMed was searched using title/abstract terms. Records were limited to English-language journal articles and reviews published from January 2020 to June 2026.

OpenAlex and PubMed were selected for pragmatic coverage of transport, behavioural and public-health literature. We recognise that TRID, Scopus and Web of Science are important databases for transport and engineering evidence. Their omission may have reduced coverage of some transport-planning and engineering studies; this has been added as a major limitation rather than treated as a minor access constraint. Accordingly, the resulting corpus is treated as a bounded evidence map rather than a comprehensive inventory of all transport and engineering studies.

Screening was conducted using the same prespecified eligibility criteria for all 1145 unique records. Yating Ye (Y.Y.) conducted the initial title-and-abstract screening of all 1145 records. Jiangling Wu (J.W.) subsequently conducted the independent second screening of the complete reconstructed record set, after which the two decision sets were compared. Assistance with organising records and materials was separate from the eligibility decisions made by the reviewer responsible for each screening pass. Before consensus, the reviewers agreed on 988 records and differed on 157 records, corresponding to an agreement rate of 86.3% and Cohen's $\kappa = 0.390$. The reviewers then discussed each disagreement against the eligibility criteria and source metadata until consensus was reached. The final screening set comprised 70 included studies and 1075 excluded records. Data charting extracted the study context, population, data source, psychological or social constructs, mobility outcomes and main implications for resilience. The study identification and screening process is shown in Figure 1.

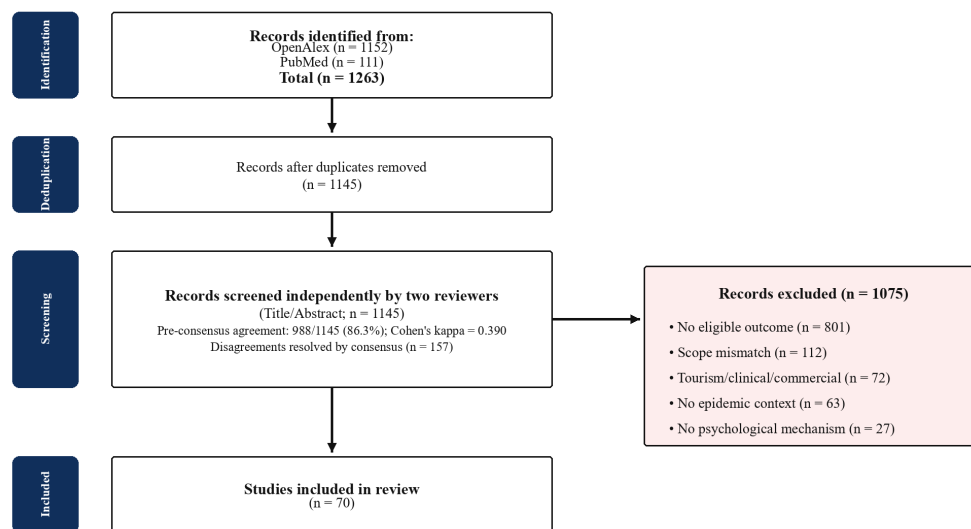
Final eligibility decisions were made by human researchers. AI-assisted tools supported manuscript preparation and checking of charted information and descriptive calculations; their role is disclosed in the AI-use statement. Both reviewers made their own screening decisions using the prespecified criteria, and J.W. did not consult the initial decisions or AI screening suggestions before recording her decisions. Tool-generated classifications or calculations were not treated as source evidence. The need to check such outputs against publications is important because assisted workflows can introduce automation bias and accountability concerns [14].

Because the included evidence comprised designs with non-equivalent bias domains, no single standardised risk-of-bias instrument was applied. The review did not assign numerical quality scores, exclude studies on the basis of an overall score, or classify one design as globally superior. Instead, claim-to-design matching limited each source to the type of inference that its design could reasonably support. Cross-sectional surveys were used for contemporaneous associations rather than causal or temporal claims; longitudinal studies were used to assess change over time; sensor-derived records were used to document observed mobility patterns but not to establish psychological mechanisms independently; and qualitative or policy evidence was used to interpret context rather than prevalence or effect magnitude. This approach is appropriate for mapping heterogeneous evidence, but it does not replace formal design-specific risk-of-bias assessment.

Claim-to-design matching is an interpretive boundary rather than a validated risk-of-bias tool. Recent scoping reviews in adjacent modelling fields highlight transparent search and charting methods [15]. Supplementary Table S1 records study characteristics and distinguishes observed change from retrospective reports and future intentions. Its interpretive-scope column describes inference limits, not a quality score. Supplementary Table S3 reports counts of the explicit charting labels, with the counting rule and contributing study IDs for each category. The categories overlap and are not exhaustive counts of every construct mentioned in the full texts. Missing extraction is distinguished from information confirmed to be absent from a source.

Table 1. Eligibility criteria.

Element	Operational Criterion
Context	Everyday mobility, public/shared transport, active travel, commuting, school or university mobility, or post-epidemic recovery
Mechanism	Risk perception, threat appraisal, coping appraisal, perceived behavioural control, affect, trust, habit, persistence, recovery or resilience
Outcome	Trip frequency, mode, route, timing, public-transport use, mobility recovery, behavioural persistence or protective travel behaviour
Excluded	Tourism choice, clinical travel, freight, supply chains, and epidemiological mobility without behavioural or recovery mechanisms

**Figure 1.** Study identification, independent verification and screening flow.

3. Results

The included studies cover the acute disruption of mobility, the gradual return of public and shared transport, the expansion of telework and digital substitution, and the uneven persistence of new routines. The first thing to note is that the evidence is not equally strong. Cross-sectional surveys are useful for identifying perceived risk and intention, but they cannot prove long-term persistence. Panel data, repeated mobility observations, smart-card records and GPS traces provide stronger evidence because they can distinguish temporary restriction effects from later recovery or recalibration [16–18].

Sensor-derived and administrative mobility data should not be treated as neutral ground truth. GPS traces, smartphone records and smart-card transactions can contain sampling bias, missing trips, mode-classification errors, platform effects and algorithmic artefacts. For this reason, the review treats them as stronger for temporal observation than cross-sectional stated intentions, but not as automatically bias-free evidence [19].

The 70 included studies are listed in Supplementary Table S1 and correspond to references [1–12,16–18,20–74]. References [13–15,19,75] provide methodological or contextual support and are not part of the 70-study evidence set. The study IDs in Supplementary Table S1 are distinct from the main-text reference numbers; the corresponding main-text reference number is provided with each full citation in that table.

The literature also differs in what it treats as the main outcome. Some papers focus on individual mode choice; others examine city-level mobility, public-transport ridership, telework, or perceived well-being. These outcomes should not be collapsed too quickly. Mode choice is a behavioural outcome. Ridership recovery is a system-level outcome. Well-being and social equity are consequences of mobility conditions. A useful resilience reading needs all three levels, but it should not pretend they measure the same thing.

A second feature of the evidence is its uneven geography. The evidence was concentrated in Europe (n = 22, 31.4%), North America (n = 15, 21.4%), and East Asia (n = 10, 14.3%), while region-specific studies from the Middle East (n = 3, 4.3%) and Southeast Asia (n = 2, 2.9%) were less numerous (see Supplementary Table S2 for

the full geographical distribution). Each study was assigned to one geographical category. Studies spanning multiple regions or having a global scope accounted for 7 studies (10.0%). No study was classified as exclusively Africa-focused, but African settings were represented in cross-regional evidence, including Ghana and South Africa in study 2 of Supplementary Table S1. Regional counts therefore should not be interpreted as an exhaustive country-level coverage assessment or as an income-group classification. This matters because coping capacity is strongly shaped by urban form, income, informal transport, household structure and digital access. The same advice to avoid crowded vehicles can mean very different things in a car-oriented suburb, a dense city with good cycling infrastructure, and a city where public or informal transport is the only affordable option. The evidence base therefore supports broad mechanisms, but not one universal policy script.

Risk appraisal was the most visible mechanism. Travellers often perceived crowded, enclosed and shared modes as riskier than walking, cycling or private cars [20–22]. This pattern helps explain reductions in public-transport demand, but it should not be treated as a universal law. Local infection levels, government rules, crowding, ventilation, route familiarity and pre-existing habits all changed how risk was interpreted. A person who feared infection might avoid a train if a car was available, but take the train anyway if the alternative was unaffordable or impossible.

Several studies show that the same transport mode could carry different meanings in different settings. Public transport could be seen as a source of exposure, a necessary service for essential workers, or a symbol of urban recovery. Private cars could be interpreted as safer for infection control but worse for congestion and emissions. Walking and cycling could be low-risk options for short trips, but not for long commutes, poor weather, disability or unsafe street environments. At the same time, recreational mobility patterns also shifted: urban park visitation changed during the pandemic as people sought local outdoor spaces for physical activity and relief from restrictions [68]. Surveys of visitors to urban natural areas confirmed that local green spaces became more important for physical activity and mental well-being during restrictions, highlighting the role of accessible local environments in supporting mobility adaptation [69]. These examples show why epidemic mobility response cannot be reduced to a simple ranking of modes.

Risk appraisal also changed over time. During acute outbreaks, travellers were often responding to immediate information about infection, restrictions and crowding. Later, as vaccination, changing rules and pandemic fatigue altered the social context, the same trip could be judged differently. This temporal movement is important. A study conducted in the first months of the pandemic captures a different risk environment from a study conducted during reopening. Treating all pandemic-period evidence as if it came from one stable context would flatten the very process that resilience research is meant to understand.

Temporal interpretation distinguishes acute disruption, restriction/reopening, transition and later recovery, but the evidence does not form a phase-harmonised longitudinal dataset. Table S1 identifies the observation period where extracted and distinguishes observed mobility records, retrospective survey reports and expectations about future travel. For example, the Seoul study follows transport-card observations from January 2019 to December 2023 [47], whereas several surveys ask about intended behaviour after restrictions rather than observe it. The influenza-risk study uses March 2016 survey data and is retained as epidemic-risk evidence, not classified as an observation of the COVID-19 acute phase [41]. Publication year is not treated as the observation period. Consequently, differences between these sources cannot establish a quantified shift from risk appraisal to coping capacity across pandemic phases.

Coping appraisal explains many of these risk-behaviour gaps. People did not simply ask, ‘Is this mode risky?’ They also asked, ‘Can I avoid it, and at what cost?’ Perceived behavioural control, alternative modes, remote work or study, service frequency, information quality and trust in protective measures shaped whether risk perception became actual behaviour [8–12,23,24]. This is where mobility resilience becomes social rather than purely technical. A city can reopen services, but recovery will remain partial if travellers lack credible, affordable and reliable options.

Trust is especially important because it links personal judgement to institutional action. Travellers may not know the actual infection probability on a bus or train, but they can observe crowding, cleanliness, mask compliance, ventilation messages and service reliability. These visible cues shape whether official risk communication feels believable. In this sense, operational performance is part of risk communication. It is not separate from it.

This finding has a methodological implication. If a study measures only perceived risk but ignores service conditions, it may misread the source of behaviour. Avoidance may reflect fear, but it may also reflect long waiting times, unreliable service, reduced frequency or lack of information. Conversely, a return to public transport may reflect confidence, but it may also reflect necessity. Stronger future studies should therefore pair psychological measures with contextual variables. This would make it easier to distinguish voluntary adaptation from constrained exposure.

Affect and social influence also mattered. Fear, anxiety, subjective norms and descriptive norms influenced willingness to travel and willingness to return to shared transport [5–7]. These variables are sometimes treated as soft additions to transport models, but under epidemic hazards they become central. They help explain why two travellers facing similar objective conditions may behave differently: one may trust the service and resume travel, while another may continue to avoid it. Beyond mode choice, broader changes in time use and activity participation during the pandemic had implications for subjective well-being, with some groups experiencing greater disruption than others [70].

The evidence on persistence is mixed and should be interpreted carefully. Some studies show mobility recovery after restrictions were relaxed, while others show lasting or semi-lasting changes in telework, trip timing, route choice and public-transport confidence [8–11]. Stated intention alone is weak evidence of persistence. A traveller may say they plan to avoid public transport, but that does not prove a new habit. Stronger claims require repeated observations or designs that link perceived risk to later behaviour. City-level evidence from 62 North American cities further shows that downtown visitation recovery was uneven across places, with some downtowns recovering faster than others depending on local conditions [71]. That study used weekly location-based-services observations from March 2020 through May 2022 and compared downtown visitation with the corresponding weeks in 2019. Because local epidemiological and policy phases occurred at different times and intensities, the findings represent heterogeneous recovery trajectories within a common calendar window rather than a phase-harmonised comparison.

In this review, constrained mobility refers to limited practical capacity to change trips, modes, timing or destinations despite perceived risk. Indicators included lack of car access, inflexible work or caregiving duties, low income, dependence on public transport, limited digital access, disability or health vulnerability, and residence in areas with weak transport alternatives. Vulnerability refers to higher exposure or harm, whereas constraint refers to reduced room for behavioural adjustment.

Vulnerability and constraint affect the options available for mobility adaptation. Supplementary Table S4 maps explicitly charted populations and settings, including low-income respondents, older adults, educational travellers, workers, women and public-transport users. It distinguishes focal populations from broader settings: campus-location data do not identify every visitor as a student, commuting does not establish essential-worker status, and ordinary transit use does not establish lack of car access. The table is not an exhaustive prevalence estimate of subgroup evidence. A zero indicates that a direct population label was not identified in the charting, rather than proof that no relevant evidence exists. Recovery estimates and coping measures are not sufficiently comparable to pool across these groups. The implications are therefore interpreted through service continuity, affordability, information access and available alternatives, without claiming that every vulnerable group has a common observed recovery pattern. Public transport remains important both as a shared setting in which infection risk is perceived and as an essential mobility option for people with limited alternatives.

Digital substitution, especially telework and online services, is another double-edged adaptation. It reduced travel for some workers and students, and in that sense it acted as a coping resource. However, digital access itself is unevenly distributed; broadband quality, device availability and digital literacy vary across households and neighbourhoods, meaning that the ability to substitute physical travel with online alternatives is not equally available [72]. Many service workers, low-income workers and care-related travellers could not simply move activities online. For women with caregiving responsibilities, remote work could reduce commuting but also intensify work-family role congestion, showing that digital substitution is not a neutral coping strategy [73]. This means that digital substitution should not be described as a universal resilience strategy. It is better understood as one coping pathway available to some groups, with indirect effects on travel demand, social participation and equity.

Digital substitution also has a psychological cost. Telework, online shopping and remote services reduce physical exposure, but forced digital immersion may increase cognitive load, attentional fragmentation and fatigue. These effects matter for resilience because a behaviour that is epidemiologically protective may still be difficult to sustain if it erodes well-being or thinking time [75].

A further theme is that adaptation can transfer risk rather than remove it. A traveller who switches from a crowded bus to a private car may reduce perceived infection exposure but increase congestion, emissions and household transport costs. A shift to cycling may improve health and reduce exposure for some people but leave others excluded if infrastructure is poor or trip distances are too long. These trade-offs matter because resilience is sometimes described as if any successful adaptation is positive. The reviewed evidence suggests a more careful reading: adaptation is only resilient when it maintains access, manages risk and avoids creating new burdens elsewhere.

The evidence on students and other semi-dependent groups illustrates this point. Students may have some flexibility through online learning, but they can also face long-distance home-university trips, limited budgets, luggage, parental financial support constraints and dependence on intercity connections. Older adults may reduce

travel for safety, but that reduction can also mean isolation. Low-income workers may maintain travel because work cannot be done remotely. These cases show why the review uses the phrase constrained mobility groups rather than simply vulnerable groups. Constraint is not only a personal characteristic; it is produced by schedules, institutions, infrastructure and money. The principal mechanism domains identified in the review are summarised in Table 2.

Table 2. Main mechanism domains identified in the review.

Domain	Main Constructs	Interpretive Role
Risk appraisal	Infection risk, severity, vulnerability, crowding, controllability	Explains perceived safety of travel modes and settings
Coping capacity	Alternatives, trust, cost, time, self-efficacy, service reliability	Explains whether perceived risk can become actual adaptation
Mobility response	Trip suppression, mode shift, timing/route change, digital substitution	Captures immediate behavioural adjustment
Resilience outcome	Recovery, persistence, recalibration, equity effects	Captures longer-term system and behavioural consequences

4. Epidemic-Hazard Mobility Resilience Framework

The framework is anchored in several related theoretical traditions. Protection Motivation Theory helps explain why perceived severity, vulnerability and response efficacy shape protective intentions. Coping theory clarifies why stress appraisal alone is insufficient unless people believe that feasible coping options exist. The Theory of Planned Behavior is relevant because perceived behavioural control, social norms and intention help translate risk judgement into action. Vulnerability and disaster-resilience frameworks add a system lens: exposure, resources, institutional support and recovery capacity determine whether adaptation is protective, costly or unequal.

The synthesis points to a five-stage framework: hazard context, risk appraisal, coping capacity, mobility response and longer-term resilience outcome. Hazard context includes epidemic intensity, restrictions, built environment and baseline mobility. Risk appraisal includes perceived infection risk, severity, vulnerability and controllability. Coping capacity includes available alternatives, trust, cost, time, information and self-efficacy. Mobility response includes trip suppression, mode change, route or timing changes, digital substitution and protective practices. Resilience outcomes include recovery, selective persistence, new routines and equity effects.

This framework is deliberately modest. It does not claim that a single psychological construct explains post-hazard mobility. It instead shows where psychological mechanisms enter a system shaped by infrastructure and social resources. The same risk perception can produce different behaviours depending on whether a traveller has money, time, a car, a safe walking route, a reliable bus service or permission to work remotely.

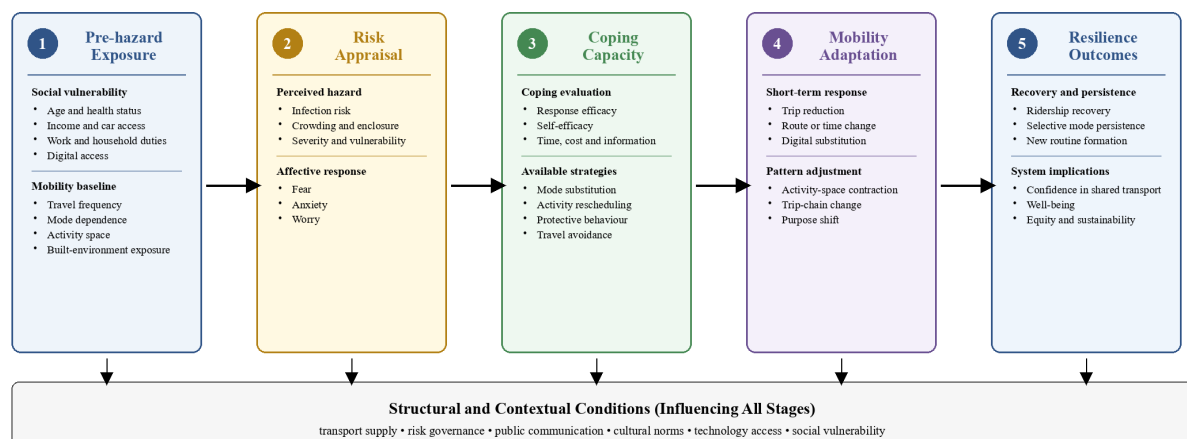
The framework also helps explain apparent contradictions in the literature. A survey conducted during high infection risk may find strong avoidance of public transport, while a later ridership study may show recovery. Both findings can be true. The first captures risk response; the second captures adaptation and system recovery. Without a temporal lens, the literature looks more inconsistent than it really is. The 62-city comparison should therefore not be interpreted as evidence of a synchronised North American recovery process and cannot isolate the causal contribution of any individual restriction, reopening measure, infection wave or vaccination phase.

A further value of the framework is that it keeps agency and constraint in the same picture. Travellers make decisions, but they make them within a field of options created by employers, schools, transport operators, households and governments. In future epidemic hazards, mobility resilience will depend on how these actors interact. Remote work rules, school attendance policies, service frequency, fare policy and health messaging can either widen or narrow the choices available to travellers. The framework can also guide empirical design. A study focused on the first two stages should measure perceived severity, vulnerability, controllability and affect. A study focused on coping should measure available alternatives, cost, time, trust and information access. A study focused on resilience outcomes should use repeated behavioural observations where possible. Making this distinction explicit would reduce the tendency to use one-off intention data as evidence for all stages of the process. The framework is also useful for policy timing. During the acute phase of an epidemic, agencies may focus on keeping essential mobility available and communicating immediate risk controls. During the transition phase, the priority shifts toward rebuilding confidence, monitoring uneven return, and protecting users who still have limited alternatives. During the recovery phase, the question becomes whether temporary adaptations should be retained, revised or discouraged. Treating these phases separately would prevent a common planning mistake: using

recovery-stage ridership as if it fully explains acute-stage risk perception, or using acute-stage fear as if it predicts permanent behaviour.

The framework should not be read as a linear path that every traveller follows in the same order. In practice, people move back and forth between stages. New infection waves, policy changes, family health concerns or service disruptions can push travellers back into risk appraisal after they had resumed travel. Similarly, a coping strategy can become a routine, and a routine can later be abandoned if costs become too high. The arrows in the framework therefore represent a recurring process rather than a one-time transition from crisis to recovery.

The framework should be read as a logical sequence rather than as a mathematical transition model. A traveller may move back from adaptation or recovery to renewed risk appraisal when perceived hazard rises, when service trust falls, when protective measures are relaxed, when a new outbreak occurs, or when a coping strategy becomes too costly. In simple terms, feedback occurs when the perceived balance between threat, coping capacity and travel necessity changes. The resulting five-stage framework and its contextual conditions are shown in Figure 2.



Note: The framework reads post-epidemic travel change as a resilience process. Travellers first encounter unequal exposure, then appraise hazard and coping options, adapt mobility routines, and finally contribute to recovery, persistence or uneven resilience outcomes.

Figure 2. Epidemic-hazard mobility resilience framework.

5. Implications for Risk Governance and Resilience Planning

For risk governance, the review suggests that communication and service design need to be treated together. Safety messages may help rebuild confidence, but they will not work well if travellers still experience crowding, unreliable services or poor information. In epidemic hazards, trust is partly communicated and partly observed. Travellers look at what the system does, not only at what agencies say. The effectiveness of public-health communication, however, is not independent of the broader political and institutional context. Evidence from the United States shows that partisan affiliation shaped compliance with public-health recommendations, which has implications for how transport and health agencies design risk messages across different communities [74].

For resilience planning, the evidence argues against a narrow ‘return to normal’ benchmark. Some recovery is desirable, especially when it restores access to work, education, health care and social participation. Yet some recalibration may also be beneficial, such as safer active travel or flexible activity patterns. The harder question is who gets to benefit from adaptation. A shift away from public transport may reduce perceived infection risk for some travellers while increasing car dependence, emissions and inequality for others.

This matters for evaluation. If success is defined only as ridership recovery, agencies may overlook whether passengers feel safe or whether vulnerable users have returned. If success is defined only as reduced travel, planners may overlook isolation, lost access and unequal ability to work from home. A resilience-oriented evaluation should therefore ask three questions at once: Did mobility access recover? Did perceived and actual risk become manageable? Were the benefits and burdens of adaptation fairly distributed?

For research design, future studies should separate risk appraisal, coping capacity and resilience outcomes. They should report actual behaviour where possible, rather than relying only on intention. They should also examine heterogeneous effects for captive users, students, older adults, disabled travellers and low-income groups. This is not a minor subgroup issue. Under epidemic hazards, the distribution of coping capacity is part of the resilience problem itself.

The review also suggests that future research should connect psychological constructs with observable service conditions. Measures such as fear, perceived severity and trust are useful, but they become more informative when linked to crowding, headway, fare cost, trip distance, neighbourhood design and access to private

vehicles. This kind of mixed evidence would make it easier to distinguish a communication failure from a service failure, or an individual preference from a structural constraint. For practice, the findings point to several low-regret actions. Transport agencies can maintain clearer real-time information on crowding and service reliability, design contingency plans for spacing and ventilation, protect minimum service for captive users, and coordinate mobility advice with schools and employers. These actions are not only technical. They also shape perceived controllability, which is one of the conditions under which travellers feel able to resume necessary movement. A system that feels unpredictable will struggle to regain trust even when formal restrictions have ended. Equally, planners should avoid treating behavioural recovery as automatic once a hazard weakens. Trust can return slowly, especially when travellers experienced inconsistent rules, crowded vehicles or poor information during the crisis. Recovery plans therefore need a behavioural component as well as an operational one. This point is central for future preparedness. The review also points to a need for coordination beyond transport agencies. Employers influence commuting through remote-work rules, universities influence student travel through timetables and campus requirements, and health agencies influence perceived risk through public advice. If these actors send inconsistent signals, travellers face uncertainty even when transport services are available. Future preparedness plans should therefore include communication protocols between transport operators, public-health authorities, schools, employers and local governments.

One practical implication is that mobility resilience should be included in public-health preparedness exercises. These exercises often focus on hospital capacity, emergency communication and continuity of essential services. Everyday mobility deserves the same attention because it determines whether workers, patients, students and caregivers can reach the places they need. Scenario planning could test how service reductions, crowding controls, school closures, telework policies and public advice interact. It could also identify which groups would lose access first and which services should be protected as minimum mobility lifelines.

Another implication is that agencies should monitor behavioural recovery with more than ridership counts. Ridership is important, but it does not reveal who has returned, who remains absent, who travels under stress, or who has shifted to more costly alternatives. Short passenger surveys, crowding data, service reliability indicators and targeted engagement with vulnerable users would give a richer picture. In hazard terms, this would turn recovery monitoring from a simple volume measure into an assessment of access, confidence and distributional impact.

Finally, the evidence suggests that resilience planning should be evaluated before the next crisis, not only after it. Agencies can identify routes serving hospitals, schools, low-income districts and carless households; test communication materials with different user groups; and prepare flexible service plans that protect essential access while managing crowding. These preparations may look ordinary compared with emergency response, but they are exactly the kinds of ordinary arrangements that determine whether mobility remains usable during a prolonged hazard. The resulting priorities for future hazard-mobility research are summarised in Table 3.

Table 3. Recommendations for future hazard-mobility research.

Priority	Recommended Practice
Measurement	Separate risk appraisal, coping capacity, trust, perceived control and observed behaviour
Temporal design	Use panel data, repeated surveys, smart-card/GPS records or before-after links
Equity	Estimate heterogeneous effects for vulnerable and constrained mobility groups
Policy evaluation	Assess risk communication together with service reliability, crowding management and affordability

6. Limitations

Compared with earlier COVID-19 mobility reviews, the added value of this review is not simply listing travel changes. Its contribution is to connect risk appraisal, coping capacity and structural constraint within a hazard-resilience frame. This makes it possible to distinguish acute disruption from longer-term recalibration, and to show why behavioural resilience can be uneven across traveller groups and sometimes in tension with sustainability goals.

For policy use, the framework can be translated into measurable resilience indicators. Relevant indicators include minimum service availability for captive users, crowding levels, ventilation or perceived air-safety information, service reliability, affordability, access to essential destinations, perceived passenger confidence, speed of ridership recovery, continuity of essential-worker mobility, and distributional impacts across income, gender, age, disability and car-ownership groups.

This review has several limitations. First, the search used OpenAlex and PubMed rather than Scopus, Web of Science or TRID. Some transport-engineering and disaster-management studies may therefore have been missed. The omission of specialist and comprehensive databases means that incomplete retrieval remains possible, and the corpus should not be interpreted as an exhaustive census of the field. Second, the initial screening by Y.Y. was completed before the full second-reviewer assessment by J.W. was documented. During the present revision, however, J.W. independently assessed all 1145 reconstructed records before comparison with the initial decisions made by Y.Y. The pre-consensus comparison produced 988 agreements (86.3%), 157 disagreements and Cohen's $\kappa = 0.390$; all disagreements were subsequently resolved through discussion, yielding a final set of 70 included studies and 1075 exclusions. Because this complete second assessment was conducted during revision rather than concurrently with the original screening, its timing remains a methodological limitation even though every record ultimately received two human decisions and consensus review. Third, full texts were not available for every record, and some charting relied on abstracts and bibliographic information. Fourth, no formal risk-of-bias scoring was conducted. Claim-to-design matching provides a transparent boundary for interpretation, but it is not a validated risk-of-bias assessment and does not eliminate reviewer judgement; the absence of formal, design-specific appraisal tools limits the certainty that can be assigned to the synthesis. These limits mean that the review maps mechanisms and evidence patterns, but it does not estimate pooled effects or validate a causal model.

The scope is also intentionally narrow. The paper focuses on epidemic hazards and everyday mobility. It does not review all pandemic policies, all telework effects, or all disaster-related transport studies. That boundary keeps the synthesis coherent, but it means that some relevant resilience literature sits outside the review. A final limitation concerns terminology. The reviewed studies did not use risk, coping, adaptation, persistence and resilience in a uniform way. Some papers used these concepts directly; others measured related constructs under different labels. The framework proposed here therefore involves interpretation. It is meant to make the evidence easier to compare, not to impose a single theory on all studies.

7. Conclusions

Epidemic hazards reshape mobility through more than physical restrictions. They change perceived risk, trust, coping options and the social conditions under which people decide whether and how to travel. Public and shared transport were often perceived as risky, but risk perception alone did not determine behaviour. Coping capacity and structural constraint explained why similar risk appraisals led to different mobility responses.

The best summary of the evidence is selective recalibration rather than a universal 'new normal'. Some behaviours recovered, some persisted, and some changed only for travellers with enough resources to adapt. For hazard and resilience research, the key lesson is that mobility resilience is not only about keeping services open. It is about keeping safe, credible and affordable mobility choices available when people are making decisions under uncertainty.

This conclusion is deliberately cautious. The reviewed studies do not support a single permanent post-pandemic mobility pattern, and they do not show that all travellers adapted in the same way. They do show that risk perception, coping resources and service conditions need to be studied together. Future epidemic preparedness should therefore treat mobility as part of social resilience: a condition that allows people to maintain work, education, care and community life while managing health-related uncertainty. This framing makes mobility planning a core part of hazard governance, not a secondary operational concern. It also gives future reviews a clearer basis for comparison.

Supplementary Materials

The additional data and information can be downloaded at: <https://media.sciltp.com/articles/others/2610131510527487/JHRR-26060280-Supplementary-Materials.xlsx>. The accompanying Supplementary Materials file contains the following supporting information: Table S1, Characteristics of the 70 included studies; Table S2, Geographical distribution of the 70 included studies; Table S3, Descriptive synthesis of key mechanisms and evidence types; Table S4, Evidence concerning constrained and vulnerable mobility groups; and Table S5, PRISMA-ScR checklist.

Author Contributions

Conceptualization, J.W., Y.Y. and L.T.; methodology, Y.Y. and J.W.; initial literature screening and charting, Y.Y.; independent second screening of the complete reconstructed record set, J.W.; organisation of records and materials, J.W. and Y.Y.; consensus resolution of screening disagreements, J.W. and Y.Y.; writing-original draft

preparation, Y.Y. and J.W.; writing-review and editing, L.T., Q.L., A.K.S. and M.L.; supervision, L.T. All authors have read and agreed to the submitted version of the manuscript.

Funding

This research received no external funding.

Institutional Review Board Statement

Not applicable. This study is a review of previously published literature and did not involve human participants or animals.

Informed Consent Statement

Not applicable. This study did not involve human participants.

Data Availability Statement

No new empirical data were generated in this review. The bibliographic records, charting fields and second-reviewer verification workbook used for the revision can be made available by the corresponding author upon reasonable request.

Conflicts of Interest

Amit Kumar Singh is employed by WSB LLC. The company had no role in the design, literature screening, interpretation, writing or decision to submit this review. The remaining authors declare no conflicts of interest.

Use of AI and AI-Assisted Technologies

During preparation and revision, the authors used OpenAI ChatGPT for language editing, text organisation, formatting, reference-style checking, figure refinement and assistance with checking extracted study characteristics, classifications and descriptive counts. Tool-generated suggestions were not treated as independent evidence or as human reviewer decisions. Y.Y. made the initial screening decisions; J.W. made the second-reviewer decisions without access to the initial decisions or AI screening suggestions, before comparison and consensus. The authors retain responsibility for checking source-based corrections and calculations, approving the classifications and interpretations, and the accuracy and integrity of the published work.

References

1. Anwari, N.; Ahmed, M.T.; Islam, M.R.; et al. Exploring the travel behavior changes caused by the COVID-19 crisis: A case study for a developing country. *Transp. Res. Interdiscip. Perspect.* **2021**, *9*, 100334. <https://doi.org/10.1016/j.trip.2021.100334>.
2. Barbieri, D.M.; Lou, B.; Passavanti, M.; et al. Impact of COVID-19 pandemic on mobility in ten countries and associated perceived risk for all transport modes. *PLoS ONE* **2021**, *16*, e0245886. <https://doi.org/10.1371/journal.pone.0245886>.
3. Harrington, D.M.; Hadjiconstantinou, M. Changes in commuting behaviours in response to the COVID-19 pandemic in the UK. *J. Transp. Health* **2022**, *24*, 101313. <https://doi.org/10.1016/j.jth.2021.101313>.
4. Irawan, M.Z.; Belgiawan, P.F.; Joewono, T.B.; et al. Exploring activity-travel behavior changes during the beginning of COVID-19 pandemic in Indonesia. *Transportation* **2022**, *49*, 529–553. <https://doi.org/10.1007/s11116-021-10185-5>.
5. Parady, G.; Taniguchi, A.; Takami, K. Travel behavior changes during the COVID-19 pandemic in Japan: Analyzing the effects of risk perception and social influence on going-out self-restriction. *Transp. Res. Interdiscip. Perspect.* **2020**, *7*, 100181. <https://doi.org/10.1016/j.trip.2020.100181>.
6. Pawar, D.S.; Yadav, A.K.; Akolekar, N.; et al. Impact of physical distancing due to novel coronavirus (SARS-CoV-2) on daily travel for work during transition to lockdown. *Transp. Res. Interdiscip. Perspect.* **2020**, *7*, 100203. <https://doi.org/10.1016/j.trip.2020.100203>.
7. Mehdizadeh, M.; Fallah Zavareh, M.; Nordfjaern, T. Explaining trip generation during the COVID-19 pandemic: A psychological perspective. *J. Transp. Health* **2022**, *26*, 101390. <https://doi.org/10.1016/j.jth.2022.101390>.
8. Tirachini, A.; Cats, O. COVID-19 and Public Transportation: Current Assessment, Prospects, and Research Needs. *J. Public Transp.* **2020**. <https://doi.org/10.5038/2375-0901.22.1.1>.
9. Vickerman, R. Will Covid-19 put the public back in public transport? A UK perspective. *Transp. Policy* **2021**, *103*, 95–102. <https://doi.org/10.1016/j.tranpol.2021.01.005>.

10. Bandyopadhyaya, V.; Bandyopadhyaya, R. Understanding public transport use intention post Covid-19 outbreak using modified theory of planned behavior: Case study from developing country perspective. *Case Stud. Transp. Policy* **2022**, *10*, 2044–2052. <https://doi.org/10.1016/j.cstp.2022.09.002>.
11. Zafri, N.M.; Khan, A.; Jamal, S.; et al. Impacts of the COVID-19 Pandemic on Active Travel Mode Choice in Bangladesh: A Study from the Perspective of Sustainability and New Normal Situation. *Sustainability* **2021**, *13*, 6975. <https://doi.org/10.3390/su13126975>.
12. Wang, Y.; Gao, Y. Travel satisfaction and travel well-being: Which is more related to travel choice behaviour in the post COVID-19 pandemic? Evidence from public transport travellers in Xi'an, China. *Transp. Res. Part A Policy Pract.* **2022**, *166*, 218–233. <https://doi.org/10.1016/j.tra.2022.10.003>.
13. Tricco, A.C.; Lillie, E.; Zarin, W.; et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann. Intern. Med.* **2018**, *169*, 467–473. <https://doi.org/10.7326/m18-0850>.
14. Ben Saad, H.; Dergaa, I.; Ghouili, H.; et al. The assisted Technology dilemma: a reflection on AI chatbots use and risks while reshaping the peer review process in scientific research. *AI Soc.* **2025**, *40*, 5649–5656. <https://doi.org/10.1007/s00146-025-02299-6>.
15. Dhahbi, W.; Jebabli, N.; Souaifi, M.; et al. Application of Artificial Intelligence for Predicting Sports Injuries and Customizing Personalized Prevention Strategies: A Scoping Review. *Bioengineering* **2026**, *13*, 692. <https://doi.org/10.3390/bioengineering13060692>.
16. van Wee, B.; Witlox, F. COVID-19 and its long-term effects on activity participation and travel behaviour: A multiperspective view. *J. Transp. Geogr.* **2021**, *95*, 103144. <https://doi.org/10.1016/j.jtrangeo.2021.103144>.
17. Ceccato, R.; Rossi, R.; Gastaldi, M. Travel Demand Prediction during COVID-19 Pandemic: Educational and Working Trips at the University of Padova. *Sustainability* **2021**, *13*, 6596. <https://doi.org/10.3390/su13126596>.
18. Airak, S.; Sukor, N.S.A.; Rahman, N.A. Travel behaviour changes and risk perception during COVID-19: A case study of Malaysia. *Transp. Res. Interdiscip. Perspect.* **2023**, *18*, 100784. <https://doi.org/10.1016/j.trip.2023.100784>.
19. Dhahbi, W.; Chamari, K. The Algorithmic Athlete: A Call to Standardize Assessment of Sensor Technologies and Artificial Intelligence. *Int. J. Sport. Physiol. Perform.* **2026**, *21*, 505–506. <https://doi.org/10.1123/ijsp.2025-0547>.
20. Aaditya, B.; Rahul, T.M. Psychological impacts of COVID-19 pandemic on the mode choice behaviour: A hybrid choice modelling approach. *Transp. Policy* **2021**, *108*, 47–58. <https://doi.org/10.1016/j.tranpol.2021.05.003>.
21. Zhang, X.; Liu, D.; Wang, Y.; et al. Behavioral Intentions of Urban Rail Transit Passengers during the COVID-19 Pandemic in Tianjin, China: A Model Integrating the Theory of Planned Behavior and Customer Satisfaction Theory. *J. Adv. Transp.* **2021**, *2021*, 1–12. <https://doi.org/10.1155/2021/8793101>.
22. Zhao, P.; Gao, Y. Public transit travel choice in the post COVID-19 pandemic era: An application of the extended Theory of Planned behavior. *Travel Behav. Soc.* **2022**, *28*, 181–195. <https://doi.org/10.1016/j.tbs.2022.04.002>.
23. Aloi, A.; Alonso, B.; Benavente, J.; et al. Effects of the COVID-19 Lockdown on Urban Mobility: Empirical Evidence from the City of Santander (Spain). *Sustainability* **2020**, *12*, 3870. <https://doi.org/10.3390/su12093870>.
24. Wang, J.; Huang, J.; Yang, H.; et al. Resilience and recovery of public transport use during COVID-19. *npj Urban Sustain.* **2022**, *2*, 18. <https://doi.org/10.1038/s42949-022-00061-1>.
25. Adam, M.; Sayagh, D.; Buhler, T. Changes in cycling practices in France during the Covid-19 pandemic. An illusory reduction in inequalities. *J. Transp. Health* **2023**, *32*, 101655. <https://doi.org/10.1016/j.jth.2023.101655>.
26. Molloy, J.; Schatzmann, T.; Schoeman, B.; et al. Observed impacts of the Covid-19 first wave on travel behaviour in Switzerland based on a large GPS panel. *Transp. Policy* **2021**, *104*, 43–51. <https://doi.org/10.1016/j.tranpol.2021.01.009>.
27. Awad-Núñez, S.; Julio, R.; Gomez, J.; et al. Post-COVID-19 travel behaviour patterns: impact on the willingness to pay of users of public transport and shared mobility services in Spain. *Eur. Transp. Res. Rev.* **2021**, *13*, 20. <https://doi.org/10.1186/s12544-021-00476-4>.
28. Magassy, T.B.; Batur, I.; Mondal, A.; et al. Evolution of Mode Use During the COVID-19 Pandemic in the United States: Implications for the Future of Transit. *Transp. Res. Rec. J. Transp. Res. Board* **2024**, *2678*, 567–579. <https://doi.org/10.1177/03611981231166942>.
29. Bouzaghrane, M.A.; Obeid, H.; González, M.; et al. Human mobility reshaped? Deciphering the impacts of the Covid-19 pandemic on activity patterns, spatial habits, and schedule habits. *EPJ Data Sci.* **2024**, *13*, 24. <https://doi.org/10.1140/epjds/s13688-024-00463-4>.
30. Campisi, T.; Basbas, S.; Al-Rashid, M.A.; et al. A region-wide survey on emotional and psychological impacts of COVID-19 on public transport choices in Sicily, Italy. *Trans. Transp. Sci.* **2022**, *12*, 34–43. <https://doi.org/10.5507/tots.2021.010>.
31. Chen, C.; Feng, T.; Gu, X. Role of latent factors and public policies in travel decisions under COVID-19 pandemic: Findings of a hybrid choice model. *Sustain. Cities Soc.* **2022**, *78*, 103601. <https://doi.org/10.1016/j.scs.2021.103601>.

32. Ciriaco, T.G.M.; Pitombo, C.S.; Assirati, L. Travel behavior and activity resilience regarding the COVID-19 pandemic in Brazil: An approach based on smartphone panel data. *Case Stud. Transp. Policy* **2023**, *12*, 100998. <https://doi.org/10.1016/j.cstp.2023.100998>.
33. de Palma, A.; Vosough, S.; Liao, F. An overview of effects of COVID-19 on mobility and lifestyle: 18 months since the outbreak. *Transp. Res. Part A Policy Pract.* **2022**, *159*, 372–397. <https://doi.org/10.1016/j.tra.2022.03.024>.
34. Chalabi, G.; Dia, H. The Impacts of Remote Work and Attitudinal Shifts on Commuting Reductions in Post-COVID Melbourne, Australia. *Sustainability* **2024**, *16*, 7289. <https://doi.org/10.3390/su16177289>.
35. Victoriano-Habit, R.; El-Geneidy, A. Studying the Interrelationship between Telecommuting during COVID-19, residential local accessibility, and active travel: a panel study in Montréal, Canada. *Transportation* **2024**, *51*, 1149–1166. <https://doi.org/10.1007/s11116-022-10369-7>.
36. Garaus, M.; Garaus, C. The Impact of the Covid-19 Pandemic on Consumers' Intention to Use Shared-Mobility Services in German Cities. *Front. Psychol.* **2021**, *12*, 646593. <https://doi.org/10.3389/fpsyg.2021.646593>.
37. Gnerre, M.; Abati, D.; Bina, M.; et al. Risk perception and travel satisfaction associated with the use of public transport in the time of COVID-19. The case of Turin, Italy. *PLoS ONE* **2022**, *17*, e0265245. <https://doi.org/10.1371/journal.pone.0265245>.
38. Helfers, A.; Reiserer, M.; Schneider, N.; et al. Should I Stay or Should I Go? Risk Perception and Use of Local Public Transport During the COVID-19 Pandemic. *Front. Psychol.* **2022**, *13*, 926539. <https://doi.org/10.3389/fpsyg.2022.926539>.
39. Aparicio, J.T.; Arsenio, E.; Henriques, R. Understanding the Impacts of the COVID-19 Pandemic on Public Transportation Travel Patterns in the City of Lisbon. *Sustainability* **2021**, *13*, 8342. <https://doi.org/10.3390/su13158342>.
40. Hiselius, L.W.; Arnfalk, P. When the impossible becomes possible: COVID-19's impact on work and travel patterns in Swedish public agencies. *Eur. Transp. Res. Rev.* **2021**, *13*, 17. <https://doi.org/10.1186/s12544-021-00471-9>.
41. Hotle, S.; Murray-Tuite, P.; Singh, K. Influenza risk perception and travel-related health protection behavior in the US: Insights for the aftermath of the COVID-19 outbreak. *Transp. Res. Interdiscip. Perspect.* **2020**, *5*, 100127. <https://doi.org/10.1016/j.trip.2020.100127>.
42. Bagdatli, M.E.C.; Ipek, F. Transport mode preferences of university students in post-COVID-19 pandemic. *Transp. Policy* **2022**, *118*, 20–32. <https://doi.org/10.1016/j.tranpol.2022.01.017>.
43. Xu, N.; Nie, Q.; Liu, J.; et al. Post-pandemic shared mobility and active travel in Alabama: A machine learning analysis of COVID-19 survey data. *Travel Behav. Soc.* **2023**, *32*, 100584. <https://doi.org/10.1016/j.tbs.2023.100584>.
44. Pawluk De-Toledo, K.; O'Hern, S.; Koppel, S. "I saw a fox in Melbourne CBD": Urban travel behaviour changes during COVID-19 and beyond. *Transp. Res. Part F Traffic Psychol. Behav.* **2024**, *100*, 115–132. <https://doi.org/10.1016/j.trf.2023.11.010>.
45. König, A.; Dreßler, A. A mixed-methods analysis of mobility behavior changes in the COVID-19 era in a rural case study. *Eur. Transp. Res. Rev.* **2021**, *13*, 15. <https://doi.org/10.1186/s12544-021-00472-8>.
46. Lucchesi, S.T.; Tavares, V.B.; Rocha, M.K.; et al. Public Transport COVID-19-Safe: New Barriers and Policies to Implement Effective Countermeasures under User's Safety Perspective. *Sustainability* **2022**, *14*, 2945. <https://doi.org/10.3390/su14052945>.
47. Lee, S.; Kim, J.; Cho, K. Temporal dynamics of public transportation ridership in Seoul before, during, and after COVID-19 from urban resilience perspective. *Sci. Rep.* **2024**, *14*, 8981. <https://doi.org/10.1038/s41598-024-59323-w>.
48. Luan, S.; Yang, Q.; Jiang, Z.; et al. Exploring the impact of COVID-19 on individual's travel mode choice in China. *Transp. Policy* **2021**, *106*, 271–280. <https://doi.org/10.1016/j.tranpol.2021.04.011>.
49. Manout, O.; Bouzouina, L.; Kourtiti, K.; et al. On the bumpy road to recovery: resilience of public transport ridership during COVID-19 in 15 European cities. *Lett. Spat. Resour. Sci.* **2023**, *16*, 14. <https://doi.org/10.1007/s12076-023-00338-8>.
50. Mashrur, S.M.; Wang, K.; Loa, P.; et al. Application of Protection Motivation Theory to Quantify the Impact of Pandemic Fear on Anticipated Postpandemic Transit Usage. *Transp. Res. Rec. J. Transp. Res. Board* **2023**, *2677*, 267–286. <https://doi.org/10.1177/03611981211065439>.
51. Moslem, S.; Campisi, T.; Szmelter-Jarosz, A.; et al. Best–Worst Method for Modelling Mobility Choice after COVID-19: Evidence from Italy. *Sustainability* **2020**, *12*, 6824. <https://doi.org/10.3390/su12176824>.
52. Nice, K.A.; Thompson, J.; Zhao, H.; et al. Effects of city design on transport mode choice and exposure to health risks during and after a crisis: a retrospective observational analysis. *Lancet Planet. Health* **2025**, *9*, e467–e479. [https://doi.org/10.1016/s2542-5196\(25\)00088-9](https://doi.org/10.1016/s2542-5196(25)00088-9).
53. Suzuki Goshima, C.Y.; Dias, V.C.; Pedreira Junior, J.U.; et al. Relationships between Teleworking and Travel Behavior in the Brazilian COVID-19 Crisis. *Future Transp.* **2023**, *3*, 739–767. <https://doi.org/10.3390/futuretransp3020043>.
54. Goodland, F.; Potoglou, D. The resilience of public transport post-COVID: The case of Great Britain. *Case Stud. Transp. Policy* **2023**, *14*, 101088. <https://doi.org/10.1016/j.cstp.2023.101088>.
55. Dias, G.; Arsenio, E.; Ribeiro, P. The Role of Shared E-Scooter Systems in Urban Sustainability and Resilience during the Covid-19 Mobility Restrictions. *Sustainability* **2021**, *13*, 7084. <https://doi.org/10.3390/su13137084>.

56. Rostami, A.; Kamjoo, E.; Bamney, A.; et al. Investigating changes in travel behavior over time in response to the COVID-19 pandemic. *Transp. Res. Part F Traffic Psychol. Behav.* **2023**, *96*, 133–154. <https://doi.org/10.1016/j.trf.2023.06.001>.
57. Saha, T.; Lee, K.; Hyun, K.K.; et al. Understanding Travel Behaviors and Mobility Challenges Faced by Older Adults during the COVID-19 Pandemic. *J. Ageing Longev.* **2024**, *4*, 177–187. <https://doi.org/10.3390/jal4030012>.
58. Islam, M.R.; Saphores, J.D.M. WILL COVID-19 jump-start telecommuting? Evidence from California. *Transportation* **2025**, *52*, 349–380. <https://doi.org/10.1007/s11116-023-10424-x>.
59. Sevtsuk, A.; Hudson, A.; Halpern, D.; et al. The impact of COVID-19 on trips to urban amenities: Examining travel behavior changes in Somerville, MA. *PLoS ONE* **2021**, *16*, e0252794. <https://doi.org/10.1371/journal.pone.0252794>.
60. Song, Y.; Lee, C.; Tao, Z.; et al. COVID-19 and campus users: A longitudinal and place-based study of university mobilities in Texas. *Sustain. Cities Soc.* **2023**, *96*, 104656. <https://doi.org/10.1016/j.scs.2023.104656>.
61. Sträuli, L.; Tuvikene, T.; Weicker, T.; et al. Beyond fear and abandonment: Public transport resilience during the COVID-19 pandemic. *Transp. Res. Interdiscip. Perspect.* **2022**, *16*, 100711. <https://doi.org/10.1016/j.trip.2022.100711>.
62. Tori, S.; de Séjournet, A.; Macharis, C. Reactions of the public transport sector to the COVID-19 pandemic. Insights from Belgium. *Travel Behav. Soc.* **2023**, *31*, 244–253. <https://doi.org/10.1016/j.tbs.2023.01.001>.
63. Wang, Y.; Choudhury, C.; Hancock, T.O.; et al. Influence of perceived risk on travel mode choice during Covid-19. *Transp. Policy* **2024**, *148*, 181–191. <https://doi.org/10.1016/j.tranpol.2024.01.009>.
64. Zafri, N.M.; Khan, A.; Jamal, S.; et al. Risk perceptions of COVID-19 transmission in different travel modes. *Transp. Res. Interdiscip. Perspect.* **2022**, *13*, 100548. <https://doi.org/10.1016/j.trip.2022.100548>.
65. Fallah Zavareh, M.; Mehdizadeh, M.; Nordfjærn, T. Demand for mitigating the risk of COVID-19 infection in public transport: The role of social trust and fatalistic beliefs. *Transp. Res. Part F Traffic Psychol. Behav.* **2022**, *84*, 348–362. <https://doi.org/10.1016/j.trf.2021.12.010>.
66. Zhang, S.; Jing, P.; Yuan, D.; et al. On parents' choice of the school travel mode during the COVID-19 pandemic. *Math. Biosci. Eng.* **2022**, *19*, 9412–9436. <https://doi.org/10.3934/mbe.2022438>.
67. Zhang, X.; Shao, C.; Wang, B.; et al. The Impact of COVID-19 on Travel Mode Choice Behavior in Terms of Shared Mobility: A Case Study in Beijing, China. *Int. J. Environ. Res. Public Health* **2022**, *19*, 7130. <https://doi.org/10.3390/ijerph19127130>.
68. Geng, D.C.; Innes, J.; Wu, W.; et al. Impacts of COVID-19 pandemic on urban park visitation: a global analysis. *J. For. Res.* **2021**, *32*, 553–567. <https://doi.org/10.1007/s11676-020-01249-w>.
69. Grima, N.; Corcoran, W.; Hill-James, C.; et al. The importance of urban natural areas and urban ecosystem services during the COVID-19 pandemic. *PLoS ONE* **2020**, *15*, e0243344. <https://doi.org/10.1371/journal.pone.0243344>.
70. Batur, I.; Dirks, A.C.; Bhat, C.R.; et al. Analysis of Changes in Time Use and Activity Participation in Response to the COVID-19 Pandemic in the United States: Implications for Well-Being. *Transp. Res. Rec. J. Transp. Res. Board* **2024**, *2678*, 512–526. <https://doi.org/10.1177/03611981231165020>.
71. Leong, M.; Huang, D.; Moore, H.; et al. Can we save the downtown? Examining pandemic recovery trajectories across 62 North American cities. *Cities* **2023**, *143*, 104588. <https://doi.org/10.1016/j.cities.2023.104588>.
72. Budnitz, H.; Tranos, E. Working from Home and Digital Divides: Resilience during the Pandemic. *Ann. Am. Assoc. Geogr.* **2022**, *112*, 893–913. <https://doi.org/10.1080/24694452.2021.1939647>.
73. Adisa, T.A.; Aiyenitaju, O.; Adekoya, O.D. The work–family balance of British working women during the COVID-19 pandemic. *J. Work.-Appl. Manag.* **2021**, *13*, 241–260. <https://doi.org/10.1108/jwam-07-2020-0036>.
74. Grossman, G.; Kim, S.; Rexer, J.M.; et al. Political partisanship influences behavioral responses to governors' recommendations for COVID-19 prevention in the United States. *Proc. Natl. Acad. Sci. USA* **2020**, *117*, 24144–24153. <https://doi.org/10.1073/pnas.2007835117>. Correction in *Proc. Natl. Acad. Sci. USA* **2024**, *121*, e2420903121.
75. Dhahbi, W.; Pyne, D.B.; Dergaa, I.; et al. Science Is About Thinking: How Can We Protect Thinking Time in a Distracted Digital World? *Brain Sci.* **2026**, *16*, 677. <https://doi.org/10.3390/brainsci16070677>.