

Full-Chain Health Impact Assessment of Autonomous Vehicles: A Review of Literature and a Conceptual Framework

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Motivation:

Every year, 1.4 million people die in roadway crashes, in addition to the huge mortality and morbidity toll of traffic through traffic-related air pollution, heat, stress, and noise, which affect low-income communities and ethnic minorities disproportionately.

Automated vehicle (AV) technologies are some of the most highly disruptive transportation technologies that have the potential to transform the existing transportation system and the associated impacts on public health and health equity.

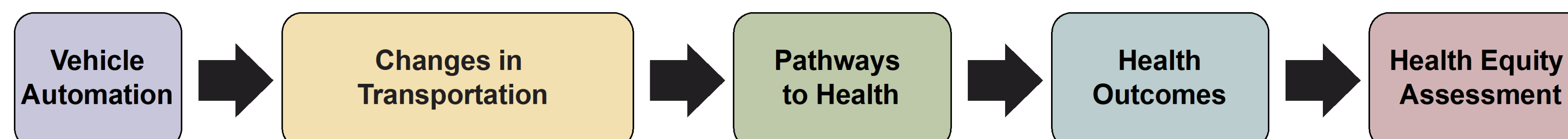
There have been numerous attempts to recognize and frame the consequences of AVs on public health; however, the discussion around this topic is still in its infancy, while studies quantifying these impacts are non-existent.

Objective:

In this study, we propose a conceptual framework for estimating AVs' health impacts at the system level by estimating the changes in transportation and subsequent changes in roadway crashes and traffic-related air pollution.

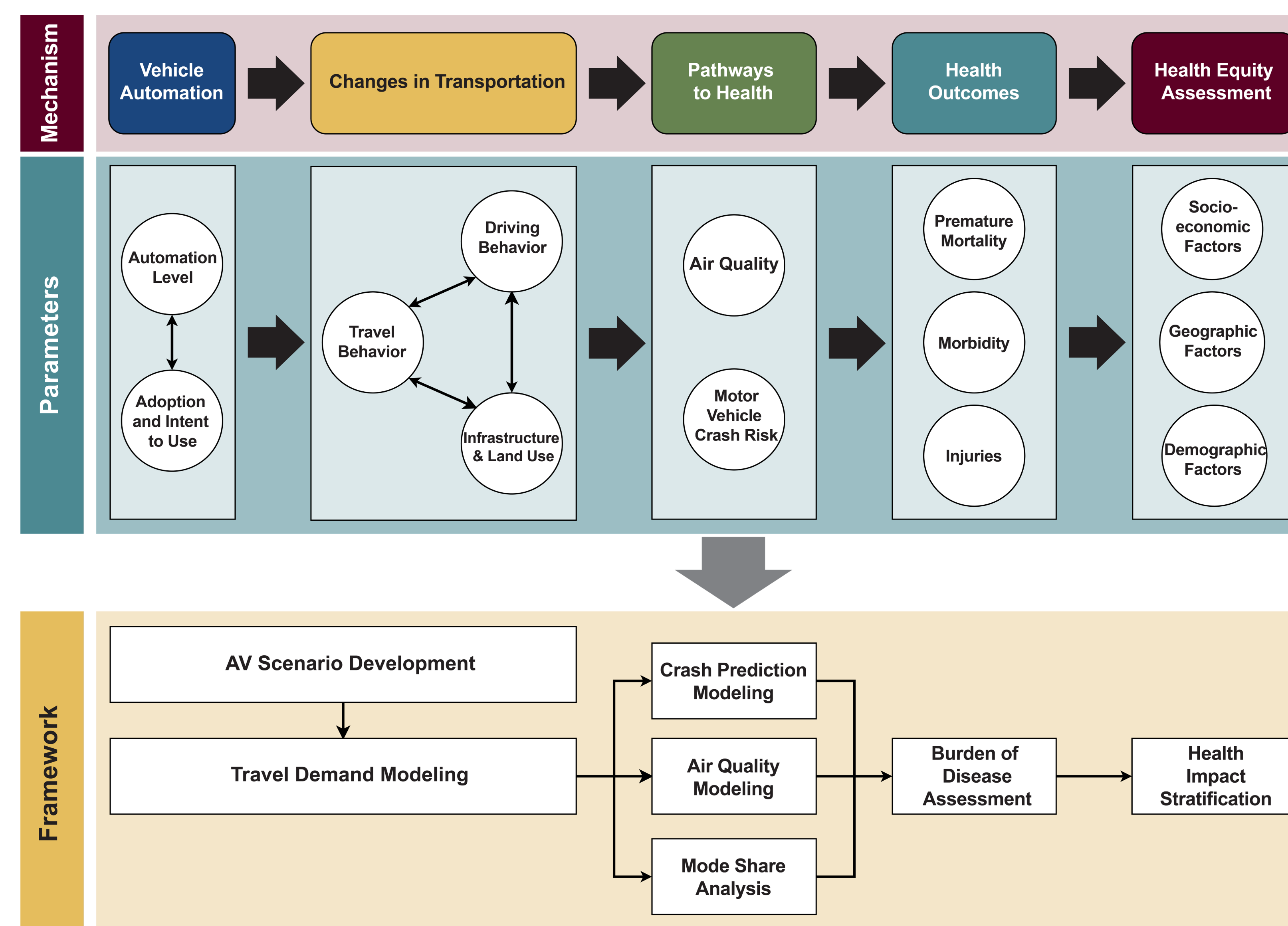
Method:

To develop this framework, we first assess the mechanisms through which AVs impact health and equity and then review the existing literature on the quantification of AVs' impacts on public health.



| Study | Review type | Studied AV impacts |
|------------------------------------|----------------------------------|---|
| Wang et al. (2020) | Systematic review—Meta-analysis | Traffic safety |
| Kopelias et al. (2020) | Narrative review | Energy, emissions, air pollution, and noise |
| Rojas-Rueda et al. (2020) | Narrative review | Public health |
| Soteropoulos et al. (2019) | Systematic review | Travel behavior and demand |
| Dean et al. (2019) | Systematic review—Scoping review | Public health |
| Faisal et al. (2019) | Systematic review | Car ownership, energy, transport infrastructure, car ownership, land use, safety, and public health |
| Taiebat et al. (2018) | Narrative review | Energy, emissions, and air pollution |
| Duarte and Ratti (2018) | Narrative review | Travel demand, parking, urban areas, and transport infrastructure |
| Martinez-Diaz and Soriguera (2018) | Narrative review | Traffic flow, travel demand, safety |
| Montanaro et al. (2018) | Narrative review | Traffic flow and energy |
| Milakis et al. (2017) | Systematic review | Travel cost, travel time, value of time, travel comfort, road and intersection capacity, travel choice, vehicle ownership, land use, transport infrastructure, fuel and energy efficiency, emissions and air pollution, safety, social equity, economy, and public health |
| Sousa et al. (2017) | Narrative review | Urban areas, congestion, car ownership, driver behavior, emissions and energy, safety and lower insurance costs, traffic flow, equity, and unemployment |
| Baglooei et al. (2016) | Narrative review | Safety, congestion, emissions and energy, car ownership, road congestion, value of time, land use, travel demand, and vehicle routing |
| Fagnant and Kockelman (2015) | Narrative review | Safety, traffic flow, congestion, travel behavior, car ownership, economic, travel demand, parking, and freight transportation |
| Hoogendoorn et al. (2014) | Narrative review | Traffic flow and road capacity |

Results:



Takeaways:

- ❑ AV health impact assessment is a multidisciplinary research
- ❑ AV adoption rate needs to be considered before attempting to quantify the impacts
- ❑ Higher levels of uncertainties are expected for long-term predictions of AV impacts on transportation
- ❑ The changes in exposure (e.g., traffic volume) should be considered in safety analysis
- ❑ The impacts of AVs on emissions are studied, but air quality impacts received less attention
- ❑ Very few studies have assessed the health and health equity impacts of AVs, and those that do are speculative

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