



# The characteristics of subsidised mobility services for disabled people

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## Contents

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<b>Executive summary</b> .....	<b>7</b>
<b>Abstract</b> .....	<b>10</b>
<b>1 Introduction</b> .....	<b>11</b>
<b>2 Literature review</b> .....	<b>13</b>
2.1 Types of accessible-transport services .....	13
2.1.1 Paratransit .....	14
2.1.2 Community transport .....	14
2.1.3 Public-transport services .....	14
2.1.4 Shifting passengers to mainstream public transport .....	15
2.2 Ways of delivering paratransit.....	16
2.2.1 Centralised model .....	16
2.2.2 Grassroots model .....	17
2.2.3 Technology .....	18
2.2.4 Funding.....	18
2.3 Ways of measuring accessible journeys .....	20
2.3.1 Paratransit measures .....	20
2.3.2 What we know about the benefits of paratransit .....	20
2.3.3 What we know about the challenges of paratransit .....	21
2.4 Ways of promoting the voices of marginalised people .....	22
<b>3 Case studies</b> .....	<b>24</b>
3.1 Case-study methods .....	24
3.2 Case-study contexts.....	24
3.2.1 Northern Ireland – Derry/Londonderry and Tyrone .....	25
3.2.2 Spain – Barcelona .....	25
3.2.3 Switzerland .....	26
3.3 Interview themes .....	26
3.3.1 Paratransit will always be needed.....	26
3.3.2 The perfect paratransit model does not exist.....	27
3.3.3 The true value of paratransit is not measured.....	27
3.3.4 Technology is useful, but not critical to providing paratransit .....	27
3.3.5 Transport options for disabled people are uncoordinated.....	28
3.3.6 Disabled people participate less fully in society, because of transport.....	29
<b>4 Subsidised mobility in Aotearoa New Zealand</b> .....	<b>30</b>

<b>5</b>	<b>Conclusions and recommendations .....</b>	<b>31</b>
	<b>References .....</b>	<b>33</b>
	<b>Appendix A: Shortlisted case studies .....</b>	<b>38</b>
	<b>Appendix B: Interview questions .....</b>	<b>40</b>
	<b>Glossary .....</b>	<b>41</b>

## Executive summary

In Aotearoa New Zealand, Total Mobility is a subsidised mobility scheme that provides discounted taxi fares to eligible passengers in places where the scheme operates. In 2023, we investigated how other countries provide disabled people with subsidised mobility, to gain insights that could inform a review of the Total Mobility scheme.

The research scope was reviewing international literature to find out how other countries operate subsidised mobility programmes; investigating emerging technological and social developments related to subsidised mobility for disabled people; and summarising our findings to inform a review of Total Mobility. Our methods included reviewing international academic literature and other reports, and interviewing three overseas report authors to develop case studies.

## Types of subsidised mobility

We reviewed literature on subsidised mobility from Australia, Europe, the UK and the USA. This literature refers to subsidised mobility as 'paratransit', which we define as subsidised, on-demand public, private or community-transport services that serve people who cannot easily access scheduled public-transport services. Paratransit includes services that are governed and contracted by governments, such as taxi subsidies. Community transport is a form of paratransit. We define 'community transport' as transport services that are organised and delivered by not-for-profit community groups that may receive a government subsidy to provide transport. Providers of community transport cannot specify a compulsory fare, but passengers typically pay a donation.

In the literature review, we discuss the different ways that paratransit is delivered and funded, and what we know about its advantages and disadvantages.

## Ways of delivering and funding paratransit

Many countries support disabled people's mobility through subsidised taxis. In Barcelona, the local government provides its own accessible vehicles, or those of public-transport contractors, to offer door-to-door services for eligible people. In the USA, paratransit is offered through government-run services and contracted taxi operators. In both cases, it is challenging to balance having the right number of vehicles available to meet people's needs for transport, with keeping the schemes affordable for the government. We did not find any evidence about the return on investment for paratransit, so there is no published guidance available on the 'right' level of funding.

## Ways of delivering and funding community transport

In rural and remote places where paratransit is not commercially viable, volunteer-based community transport meets many disabled people's transport needs. In Switzerland and the UK, local governments provide grants to community-transport organisations, who are typically free to organise themselves to respond directly to the needs of their local communities. This freedom means that they vary widely in relation to the type and number of vehicles they operate and the kinds of trips they provide. In the UK, community transport has special legal recognition, which means that providers have different licensing requirements to taxi companies. This makes it easier to establish community transport.

## Use of technology by subsidised mobility programmes

Recent technological advances have had an impact on subsidised mobility. The most significant of these are tools that make it easier to find out about, and use, paratransit and community transport. Many governments, paratransit operators and community-transport organisations use websites, mobile phone apps and

supporting software to advertise their transport services and enable passengers to book their travel. Some community-transport providers are less able to afford the latest software, and some passengers are less likely than others to use the new technologies. We are not aware of any studies on how technology used for subsidised mobility may exclude people from travelling.

Advances in vehicle technology, such as autonomous vehicles, have costs and benefits for subsidised mobility. There are examples of autonomous shuttles being used in settings like a hospital campus. In these settings, they can be efficient, safe and accessible. However, they lack the social connection that a driver and, potentially, other passengers provide.

## Gaps in our knowledge about subsidised mobility

We did not find any literature about the latent demand for subsidised mobility. Most monitoring relates to the number of trips taken, rather than trips that people would take if services were more readily available, affordable or accessible. The return on investment in paratransit and community transport has also not been adequately measured. Although research shows that subsidised mobility offers clear benefits to passengers, communities and economies, this value remains unquantified.

Without being able to measure this value, funding levels are necessarily ad-hoc. Even when countries have a legal obligation to provide transport for disabled people, arbitrary limits are set on funding, whether this is funding per trip, per person or per community. Some authorities describe subsidised mobility as financially unsustainable.

As well as contending with ad-hoc funding, transport providers with limited funds find it difficult to schedule door-to-door services. Scheduling software helps, but only within constraints set by the number of vehicles they have, and the times when they operate.

There are no perfect models of paratransit or community transport. All models have constraints that limit their reach, affordability and accessibility. Technology helps to manage some challenges (such as collating data and selecting the best routes), but not all challenges are technical.

## Passengers' perspectives of subsidised mobility

Where paratransit and community transport are available and accessible, they are highly valued by people who use them. Services often meet people's need to participate in everyday life in a safe, comfortable and affordable way. According to passengers, some form of paratransit and community transport will always be needed, because the nature of public transport means that it is unlikely to ever match the personalised, door-to-door service that characterises most forms of subsidised mobility.

Despite the advantages of subsidised mobility, passengers' experiences of it vary widely. Some people cannot easily afford a donation for community transport or a subsidised taxi fare. The number of available vehicles and ways that services are scheduled mean that many paratransit and community-transport services have limited timetables and flexibility. And not everyone has access to subsidised mobility, as the services are not available everywhere, all the time. The literature does not yet share the voices of people whose needs for transport are not being met.

## Recommendations for a review of Total Mobility

We found no evidence to support a specific model of subsidised mobility. This makes it difficult to recommend how the nature or extent of subsidised mobility in Aotearoa New Zealand could be improved. Therefore, we recommend putting more effort into identifying the return on investment in Total Mobility. This would inform how Aotearoa New Zealand approaches subsidised mobility and would create evidence that could support progress internationally.



Despite the lack of measures to quantify the value of subsidised mobility, evidence from passengers suggests that it is good to provide paratransit *and* community transport for disabled people. We therefore recommend that Aotearoa New Zealand:

- increases its support for community transport
- continues to improve paratransit, including using measures that demonstrate a return on investment
- continues to make mainstream public-transport services more inclusive, including using measures that demonstrate continuous improvement.

We also emphasise that these recommendations from our previous research (Doran et al., 2020) are still relevant:

- Define a vision for investment in transport that values inclusion.
- Measure accessible journeys.
- Promote the voices of marginalised people.
- Connect across government.

The key to progressing these recommendations is defining a vision for investment, so that inclusion is valued in policies and then valued in an economic sense. Once an investment objective is clearly identified, the government can more confidently invest in subsidised mobility as part of an inclusive transport system.

## Abstract

This research investigates subsidised mobility in countries other than Aotearoa New Zealand. The research is intended to inform the Ministry of Transport's review of Total Mobility, which is a government-funded scheme that provides subsidised taxis for disabled people who cannot easily use public transport. The research comprises a literature review and case studies to explore how other countries subsidise transport for disabled people. We researched academic and industry (grey) literature. Results show that transport subsidies for disabled people are not widely researched. Most literature comes from Australia, Europe, the UK and the USA. While there are differences in how countries provide subsidies, these differences have not been analysed in sufficient depth to know what combination of approaches works best in terms of meeting the needs of disabled people, and the investment objectives of governments. The two main approaches to subsidised mobility are bottom-up support for transport run by community groups, and top-down government-run models that use for-profit taxi providers. These approaches have different advantages and disadvantages, and both meet some people's needs for transport. We recommend that Aotearoa New Zealand researches both the impacts and return on investment in subsidised mobility, so that any changes in investment can be appropriately targeted.

# 1 Introduction

In 2023, we investigated how other countries provide disabled people with subsidised mobility, to gain insights that could inform a review of Aotearoa New Zealand's Total Mobility scheme. The objectives of the research were to

- review international knowledge and experience of subsidised paratransit, and find out how well it is integrated with broader transport systems
- contribute new understanding about how emerging technological and social developments can have an impact on disabled people's travel
- contextualise the findings within the Aotearoa New Zealand transport system.

We reviewed available literature and interviewed international researchers who study paratransit or broader transport services for disabled people. The literature review gives us a broad overview of trends in subsidised mobility internationally, while the interviews allow us to examine, in detail, three case studies from Northern Ireland, Spain and Switzerland.

In this report, the term 'subsidised mobility' means transport services whose operating costs (this includes staff, vehicle operations and maintenance, and other out-of-pocket expenses) are at least partly paid for by the government. 'Paratransit' is a form of subsidised mobility; it provides discounted taxi travel to eligible disabled people who cannot access public transport. Total Mobility is a paratransit scheme. 'Community transport' is another form of mobility for disabled people. Community transport is a transport service run by volunteers, which is sometimes subsidised by the government.

This report is not a review of Total Mobility. Instead, it provides useful information that can help us make decisions about how to provide Total Mobility, and complementary services, to support disabled people meet their transport needs. Our research is intentionally limited to subsidised mobility schemes overseas; however, our recommendations consider how to apply best practice here in Aotearoa New Zealand.

*Transport experiences of disabled people in Aotearoa New Zealand* (Doran et al., 2022) shows that there are significant transport problems affecting disabled people in Aotearoa New Zealand and that little progress has been made to address these problems in the past two decades. This research builds on those findings, and investigates international paratransit services to inform a review of the Total Mobility scheme.

*Transport experiences of disabled people in Aotearoa New Zealand* introduces a 'systems' approach to enabling accessible journeys for all (Doran et al., 2022). A systems approach looks broadly at all individuals, organisations or sectors that influence a vision or goal. In our case, this means looking beyond the transport sector to education, health, social and community services. We refer to the pillars of this systems approach (see Figure 1.1) when we consider how other countries provide paratransit. We are also guided by relevant local and international policies. For example, the United Nations Sustainable Development Goal target 11.2 promotes access to all, including disabled people (Lee et al., 2016).

We focus on measuring accessible paratransit journeys, connections across governments and promotion of the voices of marginalised people. This report contributes to one of the pillars of the systems approach – Question and Refresh (see Figure 1.1) – that involves research and investigation into accessible journeys.

Figure 1.1 A systems approach to accessible journeys for all (reprinted from Doran et al., 2022, p. 97)



Image description: A diagram showing the components of accessible journeys for all. The diagram is made up of three circles that sit inside each other. The centre circle is white and has black text that reads 'Accessible Journeys for All'. The white circle is inside a green circle that contains four system pillars. The system pillars are titled 'Promote Voices of Marginalised People', 'Measure Accessible Journeys', 'Question and Refresh' and 'Connect Across Government'. The green circle is inside an outer blue circle that contains five system interventions. The system interventions are titled 'Empowered Advocacy', 'Accessible Attitudes', 'Accessible Infrastructure', 'Accessible Vehicles' and 'Accessible Information'.

## 2 Literature review

Most of the literature about subsidised mobility relates to paratransit in the USA, so this context is reflected in our literature review. However, to balance this US knowledge, in section 3 we provide details from interviews in three case-study countries: Northern Ireland, Spain and Switzerland.

In this literature review section, we explore the range of accessible-transport options that different countries make available to disabled people, and how those options are delivered and funded. We also examine what is measured in the literature, and what this tells us about the benefits and challenges of the services. Finally, we find out the views of the customers of subsidised mobility schemes, which some articles have published.

### 2.1 Types of accessible-transport services

Accessible-transport services exist on a spectrum. Paratransit services are just one part of a bigger public-transport system that includes community transport, mainstream public transport – with and without concessions – and on-demand public transport (see Figure 2.1). Each type of service has different benefits and costs, to the government and passengers.

**Figure 2.1** Different types of mobility service

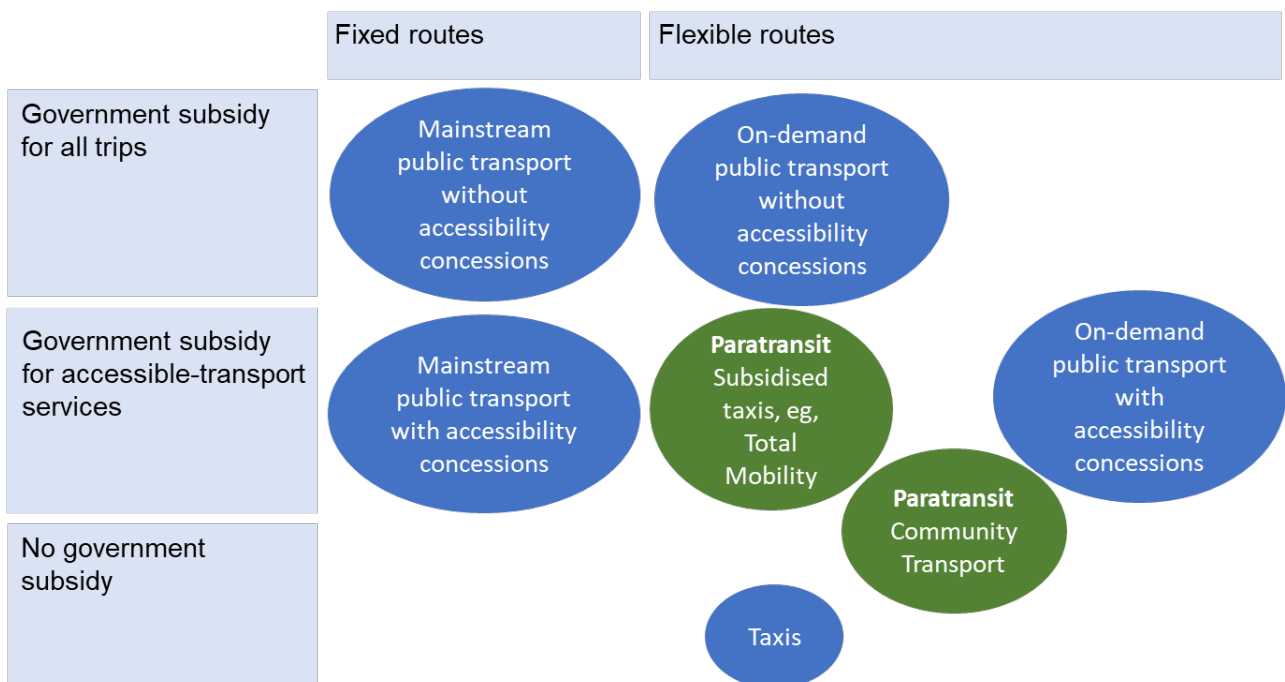


Image description: A table with two columns and three rows. From left to right, the column headings are 'Fixed routes' and 'Flexible routes'. From top to bottom, the row headings are 'Government subsidy for all trips', 'Government subsidy for accessible-transport services' and 'No government subsidy'. The top-left cell contains a blue bubble labelled 'Mainstream public transport without accessibility concessions'. The top-right cell contains a blue bubble labelled 'On-demand public transport without accessibility concessions'. The middle-left cell contains a blue bubble labelled 'Mainstream public transport with accessibility concessions'. The middle-right cell contains a green bubble labelled 'Paratransit Subsidised taxis, eg, Total Mobility' and a blue bubble labelled 'On-demand public transport with accessibility concessions'. Overlapping the middle-right and bottom-right cells is a green bubble labelled 'Paratransit Community Transport'. The bottom-left cell is empty. The bottom-right cell contains a blue bubble labelled 'Taxis'.

### 2.1.1 Paratransit

Paratransit is a personalised type of public transport that is usually very accessible. Disabled passengers can be sure that the vehicle will be accessible for them, and that door-to-door support will likely be available, if they need it (Arif Khan et al., 2021; Wang et al., 2022). Paratransit is made available to disabled people who cannot use public transport, because it is inaccessible for them.

Paratransit is provided in the form of a taxi or dedicated van for trips that a disabled passenger would otherwise make using public transport (Koffman, 2016; NSW Government, 2020), or not at all. In the studies we reviewed, the cost to passengers for a paratransit service varies. It ranges from a fare that is comparable with local public transport (Wang et al., 2022) to a fare that is equivalent to 50% of the cost of a taxi (NSW Government, 2020).

### 2.1.2 Community transport

Community transport is another form of personalised transport for people who are underserved by their local transport network (Battellino & McClain, 2011; Denmark & Stevens, 2016; Hagan, 2020). Community transport tends to respond to a very local transport need. It is often run by volunteers and not for profit (Nelson et al., 2017). Like paratransit, there are different scales of community transport, ranging from one person providing rides in their own car, through to large organisations that have paid coordinators managing a fleet of cars and vans.

Internationally, there is some overlap between paratransit and community transport. For example, in many countries disabled people can access a door-to-door ride that they do not have to share. They may also be able to access a shared ride in a van that picks up and drops off other passengers along the way. Both these services could be called paratransit or community transport (Ashour & Shen, 2022; Koffman, 2016; Kotecha et al., 2017; Nelson et al., 2017; Wang et al., 2022). The main difference is the type of organisation that provides the service. Community transport is provided by a community group or not-for-profit organisation (Kotecha et al., 2017), while paratransit is provided by a private company or government organisation (Ashour & Shen, 2022; Wang et al., 2022). Given these similarities, when we consider personalised transport services in this review, we include studies of paratransit and community transport.

### 2.1.3 Public-transport services

On-demand public transport is an increasingly popular form of public transport. It responds to customer demand, rather than operating on a fixed route or to a fixed timetable. On-demand public transport tends to operate within a specific area or have a trunk route from which the service may deviate when a customer requests it. Customers typically request a ride through an app or phone call. A van or small bus provides them with a corner-to-corner service, potentially picking up and dropping off other passengers along the way. Unlike paratransit and community transport, on-demand public transport serves everyone, instead of a specific underserved group.

In contrast to on-demand public-transport services, mainstream public transport has fixed routes. In general, its vehicles are designed to cater to the non-disabled majority, although they usually have some accessibility features. Despite governments increasing their efforts to make public transport inclusive, it still tends to be inaccessible for many disabled people. The reasons for this include:

- inaccessible vehicles (ferries, trains and buses)
- inaccessible routes to and from public transport
- disabling attitudes from others
- unaffordable fares (Doran et al., 2022).

The unaffordability of public transport for disabled people has led many public-transport authorities to provide disabled people with free or discounted travel (Fei & Chen, 2015; Stancliffe, 2014). In Figure 2.1, his type of intervention is represented as 'Mainstream public transport with accessibility concessions'.

## **2.1.4 Shifting passengers to mainstream public transport**

The high cost of providing disabled people with personalised transport services means that many countries have developed strategies to include more disabled customers in mainstream public transport. These strategies involve travel training (Battellino & McClain, 2011; Murdoch et al., 2022; Ranahan et al., 2018) and physical improvements to the public-transport system (Kim et al., 2020).

### **2.1.4.1 Travel training**

Based on the literature we reviewed, travel training is the most common strategy to shift paratransit trips to mainstream public transport.

Travel training programmes follow a similar format. Transport authorities or operators identify customers who could potentially use public transport if they have support (Battellino & McClain, 2011). They are then assigned a travel trainer who travels with them on the public-transport routes they want to use, until they are confident to travel independently. One study reports that travel training takes 12 to 18 hours (Menninger & Werly, 2014). Travel training tends to focus on public-transport routes that the customer could use often. After the training, many customers will still use paratransit instead of public transport for routes they take infrequently, or routes that have barriers that training cannot overcome (such as an inaccessible route to or from a bus stop) (Battellino & McClain, 2011). Most of the literature on travel training comes from the USA (eg, Battellino & McClain, 2011; Menninger & Werly, 2014; Ranahan et al., 2018), where 50% of paratransit providers are estimated to be providing travel training (Menninger & Werly, 2014).

Travel training works best when the travel trainer understands well the disabled person and their specific context. The travel trainer can highlight the benefits of using mainstream public transport. These include:

- flexibility, as the customer does not have to book a service in advance and can take more spontaneous trips (Ranahan et al., 2018)
- social benefits of travelling with others (Egger et al., 2022)
- financial benefits for the public-transport authority, as the per-trip cost of public transport is less than that of paratransit (Ranahan et al., 2018).

By shifting disabled passengers from paratransit to mainstream public transport, governments have been reported to make savings of up to US\$1 million per year at county level (Menninger & Werly, 2014).

### **2.1.4.2 Physical improvements to the public-transport system**

Some authorities use travel training to identify physical improvements they could make to the public-transport system, to make it more accessible (Battellino & McClain, 2011; Menninger & Werly, 2014). For example, public-transport authorities or operators have moved bus stops by 50 metres, if a paratransit customer cannot use public transport because their local stop is too far away (Battellino & McClain, 2011). Other authorities have installed new footpaths or built new bus shelters (Menninger & Werly, 2014). These types of interventions are rarely made, as they are seen as expensive; however, in the long run, they may provide significant cost savings (Murray, 2017).

One study from Salt Lake County, Utah, highlights the importance of bus stops in making public transport more accessible and reducing demand for paratransit (Kim et al., 2020). Salt Lake County upgraded many of its bus stops by adding shelters, improving footpath connections, and constructing flat concrete pads from which people can board a bus using a wheelchair. The researchers compared the improved bus stops with

unimproved bus stops in similar contexts, to understand what difference the bus-stop quality makes to the use of paratransit. They found that, while use of paratransit was increasing across the county, the increase was 141% higher around the unimproved bus stops (Kim et al., 2020). This shows that improving the accessibility of mainstream public transport can reduce the demand for paratransit.

## 2.2 Ways of delivering paratransit

The previous explanation of moving a bus stop being cost-effective, by shifting passengers from paratransit to public transport, applies only if the same branch of government funds bus-stop infrastructure and paratransit subsidies. In reality, the funding and delivery of transport services are often complicated, with different levels of government having different responsibilities.

Transport services do not exist in isolation; they exist to connect people with services and activities (eg, health, education and social services) that fall within the jurisdiction of other, non-transport, government departments. Therefore, it is important that different levels of government, and different government departments, are well connected, to ensure everyone's transport needs are being met in cost-effective ways (Doran et al., 2022).

The literature we reviewed shows a range of delivery and funding models are used for paratransit, and these vary in terms of how they connect different parts of government. In some places, such as the USA, the delivery and funding of paratransit uses a centralised model and is well integrated into the transport industry at central, state and local levels of government (Ashour & Shen, 2022; Lewis & Regan, 2020). In other countries, such as the UK and Switzerland, the delivery of paratransit responds directly to community needs, with funding secured from different government budgets depending on those needs (Egger et al., 2022; Kotecha et al., 2017; Mulley & Nelson, 2012; Nelson et al., 2017).

Paratransit tends to be delivered through a centralised 'top-down' model or grassroots 'bottom-up' model. The centralised model is often a government's response to disability anti-discrimination legislation (Lewis & Regan, 2020). Typically, it involves the government, or public-transport authority, providing paratransit services through dedicated vehicles; contracting taxis to provide paratransit via a brokerage model; or using a combination of these two methods. In the grassroots model, community groups mostly use dedicated vehicles owned by a trust to provide their services. Alternatively, volunteer drivers provide rides in their own cars (Egger et al., 2022).

The delivery of paratransit is supported by technology, such as software for booking and scheduling to support efficient route planning. Paratransit is starting to be integrated with rideshare-technology companies, such as Lyft or Uber, and with autonomous vehicles (Kahn et al., 2022; Riggs & Pande, 2022).

### 2.2.1 Centralised model

A centralised paratransit model is used throughout the USA and in Barcelona, albeit in slightly different ways. In the USA, paratransit is a direct response to the Americans with Disabilities Act 1990. The Act legislates that people cannot be excluded from the transport system and sets out specific parameters for avoiding this exclusion (Ashour & Shen, 2022; Lewis & Regan, 2020). Local governments are responsible for complying with the Act, by providing disabled people who cannot use public transport independently with an equivalent service. In the USA, a paratransit service must be available for all trips that start and end within 1.2 km of a fixed-route public-transport service (Chen, 2015) and cost no more than twice the fare for the same trip on mainstream public transport (Fei & Chen, 2015; Gupta et al., 2010).

Barcelona's centralised paratransit model is called the Special Municipal Transport Service. This service provides door-to-door rides for the estimated one-third of disabled people who meet certain disability criteria.



Eligible passengers must book a ride 48 hours in advance. Bookings are accepted between 7am and midnight, Sunday to Thursday; and 7am to 2am, on a Friday, Saturday or day before a public holiday. Rides are provided in a Special Municipal Transport Service taxi, which may be an adapted taxi if a passenger needs one. The service operates on a first-come, first-served basis, so it cannot assign trips after it has reached its limit (Portell et al., 2022; Wilson, 2016).

There are two main ways to operate centralised paratransit: a government-run model or a brokerage model. Barcelona uses a government-run model; the local authority, or its public-transport contractor, provides paratransit in dedicated vehicles (Portell et al., 2022). Many parts of the USA also use a government-run model, including King County, Washington State (Ashour et al., 2021); select counties in Virginia (Bruun & Marx, 2006; Fei & Chen, 2015); and New Jersey (Deka, 2015).

The brokerage model has been studied more than the government-run model, so more information about this model is available in the literature. Under a brokerage model, a transport authority uses non-dedicated fleets of vehicles (such as local taxi companies) to provide paratransit services (Koffman, 2016; Maciá, 2016). This model is used throughout the USA, including in Santa Clara, California (Chira-Chavala et al., 2000); San Francisco, California (Koffman, 2016); and Houston, Texas (Koffman, 2016). Some authorities use a combination model, which provides some paratransit rides through a small, dedicated fleet, and other rides through taxis under a brokerage arrangement (Koffman, 2016). Table 2.1 summarises the strengths and weaknesses of the brokerage model, compared with the government-run model.

**Table 2.1 Strengths and weaknesses of a brokerage model for centralised paratransit**

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>• Responds well to fluctuating demand (Koffman, 2016; Maciá, 2016).</li> <li>• Provides efficiency, by allowing vehicles to be used for other purposes when they are not providing paratransit (Koffman, 2016; Maciá, 2016).</li> <li>• Reduces the cost of providing paratransit by 20 to 30% (Maciá, 2016).</li> <li>• Promotes competition between brokers, which may improve service quality (Maciá, 2016).</li> <li>• Increases the capacity of the fleet (Koffman, 2016).</li> <li>• Makes it easier to provide same-day services (Koffman, 2016).</li> </ul>	<ul style="list-style-type: none"> <li>• A perception or risk that the taxi industry is shrinking, due to competition with rideshare, and may not be available for paratransit in the future (Koffman, 2016).</li> </ul>

### 2.2.2 Grassroots model

Paratransit services governed by a grassroots model exist in Australia (Mulley & Nelson, 2012); Switzerland (Egger et al., 2022); and the UK (Hagan, 2020; Kotecha et al., 2017; Nelson et al., 2017). These services are provided by community trusts, set up to directly respond to a need in the community (Egger et al., 2022; Hagan, 2020; Kotecha et al., 2017; Nelson et al., 2017). The scale of their operations ranges from volunteers providing single rides in their own car, through to community groups providing regular services on fixed routes (Kotecha et al., 2017; Nelson et al., 2017). In Switzerland and the UK, collectively, community groups provide almost complete coverage of their country (Egger et al., 2022; Mulley & Nelson, 2012).

In Switzerland and the UK, local governments recognise the value of community groups and have funding schemes to support them (Egger et al., 2022; Nelson et al., 2017). In the UK, community-transport providers that can demonstrate they meet a genuine social or welfare need have a different legal recognition to taxi operators and public-transport operators. This legal recognition reduces their costs and operating licensing requirements, making it easier for them to enter the market (Mulley & Nelson, 2012).

The main strength of community-run paratransit is that it fills a transport need that would otherwise be unmet. This is usually because public transport is not available in the area, and a taxi service would not be commercially viable (Nelson et al., 2017).

### 2.2.3 Technology

In the literature we reviewed, the most commonly described technology used in paratransit is software for booking and scheduling rides (Chira-Chavala et al., 2000; Kotecha et al., 2017; Maciá, 2016; Mulley & Nelson, 2012). This software provides functions such as trip routing, employee and volunteer management, online booking and fleet management (Kotecha et al., 2017; Mulley & Nelson, 2012). Some systems also enable the main office and driver to communicate during trips, which allows real-time tracking and route updates (Battellino & McClain, 2011).

The literature highlights some challenges with this technology. It can be expensive to implement, especially for community groups that are less likely to have the funds for this type of capital investment (Mulley & Nelson, 2012). Using the technology can also be challenging, particularly when services are mostly provided by volunteers (Mulley & Nelson, 2012).

The literature explores the concept of integrating rideshare apps with paratransit, to give paratransit passengers the option of more spontaneous trips (Ashour & Shen, 2022; Choi & Maisel, 2022). Disabled people are less likely to use a rideshare service than non-disabled people; however, disabled people who do use rideshare use it much more often (Eisenberg et al., 2022). This suggests that rideshare works well for disabled people, once they have overcome the initial barriers, such as technological illiteracy (Eisenberg et al., 2022). In the USA, transport authorities have had mixed success with trialling integration of rideshare and paratransit (Ashour & Shen, 2022; Choi & Maisel, 2022). One study shows that rideshare-based paratransit offers initial cost savings, but, because it is such an attractive service, the demand grows quickly and, overall, increases costs for transport authorities (Ashour & Shen, 2022).

Researchers are also starting to explore using autonomous vehicles for paratransit (Etminani-Ghasrodashti et al., 2021; Hwang et al., 2020; Khan et al., 2022; Riggs & Pande, 2022). Autonomous vehicles could provide more flexible transport services, improve road safety and give disabled people more autonomy (Hwang et al., 2020; Riggs & Pande, 2022). Most of the literature describes autonomous vehicles as technology that is not yet sufficiently developed to be widely implemented (Etminani-Ghasrodashti et al., 2021; Khan et al., 2022). However, there are some practical examples of autonomous shuttles. These appear to be most successful when operated within a constrained geography, such as a university or hospital campus (Riggs & Pande, 2022). In section 2.3, we discuss benefits of paratransit that could not be provided by a fully autonomous service – namely the companionship and help provided by a human driver.

### 2.2.4 Funding

Literature on how paratransit is funded comes from Barcelona (Portell et al., 2022), New South Wales (Battellino, 2009; Denmark & Stevens, 2016; NSW Government, 2020), the UK (Kotecha et al., 2017; Mulley & Nelson, 2012; Nelson et al., 2017) and the USA (Chen, 2015; Pande, 2012; Wilson, 2016). Table 2.2 summarises the information available on funding methods in these countries and their impact on the provision of paratransit.

Australia's National Disability Insurance Scheme (NDIS) provides individual disabled people with funds to use service providers, to remove their barriers to participating in everyday life. The scheme enables them to make their own decisions about the nature and extent of support they receive. Australians who are eligible for NDIS support can access funding for transport to work, education and other activities. They can use the funding for brokered subsidised taxis, which operate in most Australian states. Since the NDIS was

introduced, social participation has improved, although an evaluation of the scheme finds that difficulties with transportation persist (Mavromaras et al., 2018).

For a more in-depth discussion of funding, see section 2.3.3.1.

**Table 2.2 Sources, methods and impacts of funding for paratransit in four countries**

Country	Funding source and method	Impact of funding
Australia	<ul style="list-style-type: none"> <li>Federal government provides funding to the state government to support community-transport services (Battellino, 2009; Denmark &amp; Stevens, 2016).</li> <li>New South Wales state government provides interest-free loans to disabled people to buy or modify an accessible vehicle (NSW Government, 2020).</li> <li>Many states provide taxi subsidies to disabled people who cannot easily use mainstream public transport (Stancliffe, 2014; Wong et al., 2020).</li> <li>Eligible disabled people can use individualised funding for transport (Mavromaras et al., 2018).</li> </ul>	<p>Most funding for community transport sets limits on providers for the services they can provide and the groups they can provide them to (Battellino &amp; McClain, 2011).</p> <p>The NDIS has improved disabled people's social participation, but transport barriers remain a problem (Mavromaras et al., 2018).</p>
Spain (Barcelona)	<ul style="list-style-type: none"> <li>The Municipal Institute for Disabled People and the Barcelona Metropolitan Area jointly fund the Special Municipal Transport Service. This service is provided on a first-come, first-served basis (Portell et al., 2022).</li> </ul>	<p>The first-come, first-served basis for this service is due to the municipality setting an annual service limit based on its budget. In practice, this means that 550 trips are available each day. This limit is reached nearly every day, except during the COVID-19 pandemic. The Special Municipal Transport Service provider estimates there is a significant unmet demand for the service (Portell et al., 2022).</p>
UK	<ul style="list-style-type: none"> <li>Local public-transport budgets give grants for community transport (Nelson et al., 2017).</li> <li>Some community groups have service agreements with social services, and education and health departments (Nelson et al., 2017).</li> <li>Central government provides grants for transport, mainly for disabled people, older people or people who face social exclusion due to economic factors (Department for Transport, 2022).</li> <li>The private sector provides grants for transport through community foundations or lottery funds (Community Transport Association, n.d.; Kotecha et al., 2017).</li> </ul>	<p>Many community groups appreciate having funding available from different sources, as they typically provide transport to people who cannot afford to cover the full costs (Kotecha et al., 2017; Mulley &amp; Nelson, 2012). However, this heavy reliance on funding can also make it difficult for some organisations to plan, when long-term funding is not guaranteed (Kotecha et al., 2017).</p>
USA	<ul style="list-style-type: none"> <li>Local transport authorities usually fund transport, with support from the state and federal governments (Chen, 2015; Choi &amp; Maisel, 2022).</li> <li>State governments exclusively fund some paratransit services, if they provide services</li> </ul>	<p>The USA is unique in that disabled people have a legal right to transport. This legislation, plus funding from the state and federal governments, means there are virtually no limits on how many trips people can make or the purposes they</p>

Country	Funding source and method	Impact of funding
	outside of what is legislated (Fei & Chen, 2015).	can use paratransit for (Chira-Chavala et al., 2000). Paratransit fares must not exceed twice the cost of the same trip by mainstream public transport (Battellino & McClain, 2011). This limits the potential for transport authorities to recover more of the cost of providing transport from passengers, but it makes paratransit more affordable for passengers.

## 2.3 Ways of measuring accessible journeys

Measurement is a critical part of enabling accessible journeys for disabled people.

In this section, we explore what the paratransit sector is measuring, and what these measures tell us about the services currently provided. The literature suggests that most routine monitoring of paratransit relates to how many rides are provided and whether schedules are adhered to. Information about the benefits and challenges of paratransit tend to be the result of one-off academic studies, rather than routinely collected data. However, there is a lot of literature about the challenges of funding and scheduling paratransit.

### 2.3.1 Paratransit measures

A handful of the studies we reviewed include information about monitoring paratransit services. Most of them simply state the importance of monitoring and evaluation (Battellino, 2009; Choi & Maisel, 2022; NSW Government, 2020; Pande, 2012), but some provide insights into successful monitoring programmes (Bruun & Marx, 2006; Maciá, 2016; Menninger & Werly, 2014).

Most monitoring programmes reported in the literature collect data on how many rides are provided and whether schedules are adhered to. Paratransit providers use this data to forecast levels of future ridership (Ashour et al., 2021; Bruun & Marx, 2006) and plan routes, based on external factors like congestion (Chen, 2015). This information is also important for commercial providers under the paratransit brokerage model, as they must report to their local transport authority to meet their contractual obligations (Maciá, 2016).

We did not find any examples of routine, ongoing monitoring of disabled people’s experiences of paratransit or satisfaction with services. We are also not aware of any studies that have measured latent demand for paratransit trips. It would be useful if monitoring captured the number of paratransit trips that disabled people did not make, because services were unavailable or too expensive, or another barrier got in the way. This type of monitoring may be happening; however, if it is, the results are not publicly available.

### 2.3.2 What we know about the benefits of paratransit

Research on the benefits of paratransit mainly focuses on older people who use the services, so these benefits may not apply to all groups, including disabled people (Hagan, 2020; Nelson et al., 2017). The benefits all relate to people being able to travel to places that they would otherwise have no way of getting to (Kotecha et al., 2017; Nelson et al., 2017). Paratransit creates opportunities for people to access social, leisure, education, employment and health services (Nelson et al., 2017; NSW Government, 2020; Sitter & Mitchell, 2020).

A review of Australia’s NDIS finds that, on average, subsidies improve disabled people’s access to transport services, but individuals’ experiences of the services vary considerably. The review does not report any

specific monetised return on investment, to quantify the impact that the NDIS has on disabled people participating in everyday life (Mavromaras et al., 2018).

Paratransit provides people with opportunities to socialise with other passengers and interact with the driver. This is especially important for older people in rural areas who have no other transport options, as they have limited opportunities for social interaction (Nelson et al., 2017). Passengers often look forward to talking with their driver (Durand & Zijlstra, 2023; Nelson et al., 2017). Many drivers also help passengers get in and out of the vehicle, share information throughout the journey and help with tasks like carrying groceries (Durand & Zijlstra, 2023; Hagan, 2020).

Some passengers experience physical health benefits by interacting with their driver, as the driver notices changes in their health and can take appropriate action (Nelson et al., 2017). Other health benefits arise because paratransit enables passengers to get to medical appointments. Approximately 40% of respondents in a Scottish study of older community-transport passengers agree that community transport plays an important role in them accessing healthcare (Nelson et al., 2017). This highlights how community transport provides people with a 'safety net' or backup option if their regular transport falls through (Nelson et al., 2017). Having this backup option can reduce disabled people's anxiety, as they can be sure they will make it to their appointments.

### **2.3.3 What we know about the challenges of paratransit**

In the literature we reviewed, two themes emerge related to paratransit challenges: funding and scheduling. Over the past two years, other challenges associated with Covid-19 have emerged, and we have included these to highlight the pervasive recent challenges of providing paratransit.

#### **2.3.3.1 Funding**

Funding is the most significant challenge discussed in the literature. In the USA, paratransit customers are guaranteed the right to unlimited rides, so many authorities struggle to fund the service (Battellino & McClain, 2011; Choi & Maisel, 2022; Miah et al., 2020). In Barcelona, Switzerland and the UK, funding is capped. This means rides are limited and people may miss out (Egger et al., 2022; Portell et al., 2022).

In the USA, paratransit is essential to the people who use it. However, it is also very expensive for transport agencies to provide (Ashour & Shen, 2022; Choi & Maisel, 2022; Menninger & Werly, 2014). In 2011, providing a paratransit system under the Americans with Disabilities Act 1990 cost US\$3.5 billion nationwide (Menninger & Werly, 2014). Estimates suggest that – per person – providing paratransit costs between 3.5 and 8.5 times more than providing fixed-route public transport (Kuzio, 2021). As discussed in section 2.1.3, because public transport is inherently inaccessible in the USA, paratransit is a legal requirement to avoid discrimination on the grounds of disability (Chen, 2015). Therefore, some see paratransit as a temporary measure while mainstream public transport is made more accessible, or a last resort for a small part of the population who will never be able to access public transport (Kuzio, 2021). Because improvements to public transport have not occurred, the demand for paratransit is high and it has become financially unsustainable and unreliable (Murray, 2017).

Outside the USA, there is no legal right to paratransit rides, so private transport providers tend to make less profit from providing paratransit. Transport authorities typically have a set budget for paratransit, so they impose a limit on rides. For example, in Barcelona there is a limit on the number of rides available per day (Portell et al., 2022); and in Sweden there is a limit on the number of rides each user can have in a time period (Pettersson, 2012). While limiting rides helps control costs when there is a budget, this approach is heavily criticised by disability organisations, because it limits disabled people participating in society (Pettersson, 2012).

### 2.3.3.2 Scheduling

Scheduling is the other significant challenge discussed in the literature. This is commonly referred to as the 'dial-a-ride problem' (Gupta et al., 2010; Häll & Peterson, 2013; Karabuk, 2009; Posada et al., 2017). This problem is characterised by difficulties finding an efficient route to pick up and drop off multiple passengers with different origins and destinations, coupled with each person having a preferred pick-up time window and particular accessibility needs, which have an impact on the type of vehicle that they can access. Passengers prefer having the flexibility to book rides close to their departure time, rather than booking hours or days ahead. If paratransit providers offer this flexibility, it limits their ability to plan routes in advance (Gupta et al., 2010; Häll & Peterson, 2013; Karabuk, 2009; Posada et al., 2017).

A significant amount of literature is dedicated to overcoming the dial-a-ride problem (Chira-Chavala et al., 2000; Fittante & Lubin, 2015; Gupta et al., 2010; Häll & Peterson, 2013; Karabuk, 2009; Lu et al., 2014; Posada et al., 2017). The wealth of literature shows us that this is a very complex problem. Most papers offer algorithms (Häll & Peterson, 2013; Karabuk, 2009) or software (Chira-Chavala et al., 2000; Fittante & Lubin, 2015; Gupta et al., 2010) to automate the process and produce the most efficient route. Some papers offer a theoretical solution that needs further refining before it can be put into practice (eg, Karabuk, 2009). Overall, it seems that improving scheduling can improve efficiency of paratransit by 5% (Gupta et al., 2010; Häll & Peterson, 2013). In Sweden, this translates to an annual nationwide saving of €13.5 million (NZ\$23.7 million) (Häll & Peterson, 2013).

### 2.3.3.3 Covid-19

Covid-19, and the ongoing effects of the pandemic, has created new challenges for transport operators and customers. In some instances, the pandemic has also highlighted the need for accessible, inclusive transport (Ashour et al., 2021). The more robust services are, the more likely they will be able to continue providing transport for people when they need it most. In this section, we explore how Covid-19 has affected paratransit in the USA, where all published literature on the topic originates from.

During the pandemic, paratransit operators experienced dramatic reductions in ridership. For example, in King County, Washington State, each new wave of Covid-19 resulted in a new reduction to paratransit ridership (Wang et al., 2022). In a way, this helped with social distancing. Operators had to put strict limits on the number of people in each vehicle, to reduce the risk of infection spreading among passengers and the driver (Ashour et al., 2021; Wang et al., 2022).

However, this large change in demand made it difficult to manage the paratransit workforce. Many operators could not afford to keep all their staff, which resulted in staff being furloughed and laid off when it was hard to find new work (Wang et al., 2022). This uncertainty about demand continues, meaning paratransit operators continue to face problems with workforce planning, which creates anxiety for workers about their job security (Ashour et al., 2021).

Paratransit operators have also seen their costs increase, due to Covid-19 public health measures. A high proportion of paratransit users face a high risk of experiencing Covid-19 complications, so they are afraid of catching the virus (Ashour et al., 2021; Nie et al., 2022). Operators took a cautious approach. In many cases, they limited rides to a single customer, when they would previously have provided a shared ride to reduce costs and promote efficiencies (Ashour et al., 2021; Wang et al., 2022). These measures were important for protecting vulnerable customers.

## 2.4 Ways of promoting the voices of marginalised people

Promoting the voices of marginalised people is a critical part of enabling them to have accessible journeys. We uncovered only six studies that involved passengers themselves (Egger et al., 2022; Hagan, 2020;

Márquez et al., 2022; Murray, 2017; Nie et al., 2022; Sitter & Mitchell, 2020), which means we know little about disabled people’s experiences. This section summarises the findings from those papers that include disabled people’s perspectives of paratransit.

Disabled people’s perspectives of subsidised mobility can be broadly split into two categories: positive perspectives and negative perspectives. These perspectives are summarised in Table 2.3.

**Table 2.3 Disabled people’s perspectives of subsidised mobility**

Positive perspectives	Negative perspectives
<ul style="list-style-type: none"> <li>• <b>Autonomy:</b> Paratransit gives people more autonomy and enables them to travel independently (Egger et al., 2022; Hagan, 2020). Feelings of autonomy are linked with higher rates of paratransit use (Márquez et al., 2022).</li> <li>• <b>Cost:</b> Passengers appreciate paratransit that is low cost or free of charge (Egger et al., 2022).</li> <li>• <b>Safety:</b> Paratransit is seen as safer than other modes of transport (Egger et al., 2022).</li> <li>• <b>Support:</b> Paratransit passengers feel supported by their driver (Egger et al., 2022; Hagan, 2020).</li> <li>• <b>Social benefits:</b> Passengers appreciate the social benefits (see section 2.3) of paratransit and being able to connect with their friends and family (Sitter &amp; Mitchell, 2020).</li> <li>• <b>Reliability:</b> Paratransit is sometimes seen as more reliable than the bus, as passengers know they can fit their mobility aid on board (Murray, 2017).</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Availability and reach:</b> Paratransit is not always available or accessible (Häll &amp; Peterson, 2013; Portell et al., 2022).</li> <li>• <b>Cost:</b> When paratransit is not provided free of charge, or at a low cost, passengers find the fare is a barrier to using the service (Egger et al., 2022; Murray, 2017).</li> <li>• <b>Physical barriers:</b> The built environment and infrastructure make it difficult to access paratransit (Egger et al., 2022; Murray, 2017; Sitter &amp; Mitchell, 2020).</li> <li>• <b>Service quality:</b> When services are poor quality, passengers find them stressful to use and this creates an emotional toll (Murray, 2017; Sitter &amp; Mitchell, 2020). This problem intensified during the Covid-19 pandemic (Nie et al., 2022).</li> <li>• <b>Booking:</b> Paratransit is difficult to book and often involves long wait times (Sitter &amp; Mitchell, 2020).</li> </ul>

## 3 Case studies

Studies from the USA dominate the literature on paratransit, so we used three case studies to better understand how paratransit works elsewhere. We examined key literature for three different authorities and interviewed the authors of the literature to gain their insights into the challenges and opportunities of paratransit.

In this section we set out the methods we used to select and analyse the three case studies. Next, we provide some context for the case studies and interviews. Finally, we present the main themes discussed in the interviews. These themes provide lessons about how paratransit provided overseas can inform a review of Total Mobility in Aotearoa New Zealand.

### 3.1 Case-study methods

To develop our case studies, we interviewed three academic researchers, based at a university or research institution, who have published articles about paratransit.

While we were reviewing the literature, we developed a shortlist of possible interviewees based on these factors:

- **Publication date** – we wanted to interview researchers who were easy to contact and had up-to-date information.
- **Research methods** – we wanted to include a range of quantitative and qualitative studies.
- **Location** – we wanted to learn about experiences in a range of different places.
- **Key words** – we wanted to find out about different aspects of paratransit (eg, challenges, benefits, customer experience, supply, demand and travel behaviour).
- **Integration with other transport modes** – we wanted to understand how paratransit works within the whole transport system.
- **Technology** – we wanted to find out about how paratransit providers are using technology overseas.

Although it was not an explicit consideration, we also looked for case studies that would provide a range of scale – from small, rural community transport through to city or nationwide schemes.

We shortlisted six studies to include in this research. We confirmed this list with the project steering group before contacting the lead author of each study. In Appendix A: Shortlisted case studies we have summarised each study we chose and the reasons why. Three of the authors replied to us and, in the interests of time, we proceeded to interview those three.

One member of our research team conducted each interview, online and in English. The interviews were recorded and automatically transcribed. A second member of our research team reviewed the transcription and identified key themes. The two research team members worked together to confirm the key themes that emerged from the interviews. Appendix B: Interview questions includes the full list of interview questions.

### 3.2 Case-study contexts

We interviewed researchers that had led studies in Northern Ireland, Spain and Switzerland. Each study has a different geographical scale, which adds richness to our data:

- **Northern Ireland** – this study focuses on two small counties in the west: Derry/Londonderry and Tyrone.
- **Spain** – this study focuses on the city of Barcelona.
- **Switzerland** – this study covers the whole country.



In sections 3.2.1, 3.2.2 and 3.2.3, we provide an overview of how paratransit is provided in each context and explain the focus of each study. In these sections, we draw on information from the relevant article, supplemented with information from the interviews, where necessary.

### **3.2.1 Northern Ireland – Derry/Londonderry and Tyrone**

In this study, Hagan used semi-structured interviews to explore the experiences of rural-dwelling older people who use community transport in two counties in the west of Northern Ireland (Hagan, 2020). In Northern Ireland, there is a high dependence on cars and underinvestment in public-transport options (R. J. Hagan, personal communication, 4 July 2023).

The study centres around an organisation that provides a community-transport service for older people in rural areas. The organisation was established in 2012 for people who have difficulty accessing transport. Volunteers provide door-to-door rides on a shared bus, which operates on a dial-a-ride basis between Monday and Friday, from 8am to 6pm. Outside these times, volunteers provide rides in their own cars. The shared bus provides nearly 20,000 trips each year (Hagan, 2020).

Hagan's qualitative study centres on three themes: reducing isolation, loss and loneliness; supporting people's autonomy; and enabling people to make connections with others on the bus. Although each person uses the community-transport service for a specific purpose, most participants mention these themes. It is evident that the benefits of the service go far beyond being able to complete a trip (Hagan, 2020).

### **3.2.2 Spain – Barcelona**

In this study, Portell et al. analysed anonymised data about disabled people, paratransit service users and the types of paratransit trips taken in Barcelona (Portell et al., 2022). The data was provided by the paratransit providers.

In Barcelona, the government provides paratransit to people who have a certain level of disability.<sup>1</sup> Passengers can book a door-to-door ride in an adapted or non-adapted taxi, but they must book at least 48 hours in advance. Each day, 550 trips are available. Once these trips are assigned, no more can be booked. Trips are available between Sunday and Thursday from 7am to midnight, and on Fridays, Saturdays and the days before public holidays from 7am to 2am the following day. In 2019, the Barcelona Special Municipal Transport Service provided over 150,000 trips (Portell et al., 2022).

This quantitative study analysed potential and actual paratransit passengers. By analysing the behaviour of passengers, the study shows that the top 1% most frequent users take 19% of the paratransit trips. By analysing the actual trips that passengers take, Portell et al. provide insights into the distances that people travel, and the differences between trip distances and purposes between different neighbourhoods (Portell et al., 2022). The study recommends changing how trips are prioritised – away from a first-come, first-served model – to improve services for disabled people in Barcelona. The proposed model would instead prioritise trips based on passengers' disability score, the frequency that they use the service, the purpose of their trips, the time of day of their trip, the distance of their trip, and whether accessible alternatives are available to them (Portell et al., 2022).

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<sup>1</sup> In Spain, disability is recognised using a category system that ranges from 0% to 100% disabled. To be legally recognised as disabled and have access to paratransit, a person must score at least 33%.

### 3.2.3 Switzerland

In this study, Egger et al. conduct focus-group interviews with disabled people in Switzerland, to understand their experiences of paratransit, what helps them to access the service and what hinders them (Egger et al., 2022).

The Swiss paratransit system differs between each of Switzerland's 26 cantons,<sup>2</sup> as services are provided locally. Each canton has a different way of organising and financing paratransit, and offers different levels of service (Egger et al., 2022). Many paratransit operators receive funding from the government to cover the cost of vehicles and fuel; they rely on volunteer drivers to provide the rides (S. M. Egger, personal communication, 26 June 2023). This study sought to find out how the differences between paratransit operators and services affect disabled people's experiences of paratransit.

Although disabled people's experiences of paratransit are highly individualised, key themes emerge from the study. Paratransit is an important service that enables disabled people to take part in society. It saves them time and energy, compared with catching public transport, and enables them to travel independently. People's views about paratransit are influenced by a range of environmental factors, such as the level of support they have from others, their perceptions of the service (such as how safe it is, what it costs, what quality of infrastructure it uses, and what support and information is available), and how their travel is affected by the weather and climate (Egger et al., 2022).

## 3.3 Interview themes

We reviewed the interview transcripts to find out which insights about subsidised mobility were repeatedly mentioned. In this section, we describe the most common themes that emerge from the interviews.

We discussed various topics in the interviews, ranging from researchers' ideas about the need for paratransit, through to their thoughts about operations, such as how technology is used.

During the interviews we heard that there will always be a need for paratransit, regardless of how accessible mainstream public transport becomes. We learned that there is no perfect way to provide paratransit, as each interviewee described different strengths and weaknesses of the system they were studying. Despite the literature and interviews discussing the benefits of paratransit, their actual value is rarely systematically measured. The interviews show that technology is useful for supporting paratransit, but it is not a critical barrier or enabler. Overall, we find that transport options for disabled people are not well connected with each other, and this has a negative impact on disabled people's ability to participate in everyday life. Because transport is consistently too difficult or expensive to use, disabled people reportedly accept this lower standard.

### 3.3.1 Paratransit will always be needed

From the interviews with Egger and Portell, it is clear that disabled people will always need the highly personalised transport services that paratransit provides.

*We realised that, even if it would be totally accessible, there would be still people who can't use public transport. So, at the end, paratransit services are always needed.* (S. M. Egger, personal communication, June 2023)

*In some cases, it's just because of the degree of disability that they cannot take the public transport, even if it's "accessible".* (L. Portell, personal communication, June 2023)

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<sup>2</sup> Cantons are similar to New Zealand regions.

Despite Portell and Egger studying city-wide (Barcelona) and nationwide (Switzerland) initiatives to improve the accessibility of mainstream public transport, they both recognise that public transport will never be accessible to everyone. It is important to make public transport as accessible as possible, and then support disabled people to use it, if they can. This will benefit individuals by allowing them to make more spontaneous trips than they could with paratransit. The interviewees are hopeful that the more inclusive that scheduled public-transport services become, the less demand there will be for paratransit. This would increase the availability of paratransit to people who need it the most (S. M. Egger, personal communication June 2023; L. Portell, personal communication, June 2023).

### **3.3.2 The perfect paratransit model does not exist**

In each case study, the provider has a very different approach to providing paratransit; these approaches each have strengths and weaknesses. For example, while Barcelona's daily limit of 550 paratransit trips is limiting, the operating hours of the service (the service runs as late as midnight or 2am) mean that disabled people can get a ride home after a late night out. This is rarely a benefit of paratransit in other locations. In contrast, the small-scale responsive model used in Northern Ireland is perfect for that isolated rural population, but may not suit Barcelona, which has a much larger population and service demand.

Despite the volume of literature seeking to solve the dial-a-ride problem, a perfect solution does not appear to exist. Portell gave us insights into how it is practically impossible for an optimisation model to account for every aspect of a customer's needs and trip characteristics, and still provide a quality service. Either essential information about a customer will be unavailable, or fulfilling each person's preference will mean they need their own taxi, which will reduce the number of people who the transport authority can fund trips for (L. Portell, personal communication, June 2023).

### **3.3.3 The true value of paratransit is not measured**

The interviews show that, currently, there is no way of consistently and comprehensively capturing the benefits of paratransit, in terms of their impact on disabled people's lives or as a monetised return on investment. We asked each researcher we interviewed how the country they are studying measures inclusive access. As in Aotearoa New Zealand, the countries have no known work underway to understand whether disabled people are making all the trips they want, or if transport problems are preventing them from doing so. We know that paratransit alters many people's lives. However, because we do not measure and accurately quantify this value, it is difficult to understand what value communities and governments are getting from their investment in paratransit.

Portell says that most measurement in Spain is done through a complaints process. Service providers encourage feedback, so that services can be improved in the future. However, this process does not measure the value of the service (L. Portell, personal communication, June 2023). Egger says that it is difficult to understand who is underserved by paratransit, since measurement revolves around people who already use the service (S. M. Egger, personal communication, June 2023).

### **3.3.4 Technology is useful, but not critical to providing paratransit**

In each interview we asked the researchers how technology is used in the paratransit service they are studying. Our findings reflect what we uncovered in the literature review – specific technology supports paratransit services, but it is not essential to provide a quality service, nor does not having it prevent improving a service.

In Barcelona, technology is mainly used to collect data and optimise routes. Portell described how the booking system has recently been upgraded to collect data about people's paratransit trips. She also

explained how her research is using mathematics to develop optimised routes for paratransit, although there are significant challenges to achieving this (L. Portell, personal communication, June 2023). In Switzerland, the main technology used is phone apps for making bookings (S. M. Egger, personal communication, June 2023). The paratransit system in Northern Ireland lacks new technology. Hagan discussed the relational value gained by ringing for a service and speaking to someone, compared with an impersonal experience of booking a ride through an app. This is particularly important in the area Hagan is studying, as the passengers are older and have lower incomes, so they are less likely to have access to a smartphone with data (R. J. Hagan, personal communication July 2023).

These different experiences highlight that the use of technology is context specific. In Barcelona and Switzerland, where paratransit is provided on a large scale by government organisations, using technology to optimise routes is probably more useful than in a smaller-scale operation, such as that run by community-transport providers in Northern Ireland. Perhaps the biggest benefit to be gained from technology is automated data collection, to help measure disabled people's paratransit trips and understand their true value.

### 3.3.5 Transport options for disabled people are uncoordinated

The interviews highlight that transport options are not well connected with each other. The interviewees describe there being separate systems to register for paratransit, obtain a disability parking permit and apply for public-transport-accessibility concessions. Barcelona is an exception – disabled people can apply for a 'white card' that entitles them to paratransit and public-transport concessions, among other things.

A person's disability results from their personal characteristics interacting with the environments they navigate. This means it is up to each disabled person to find out which different options are available to them, based on their individual circumstances, wants and needs. Even if a disabled person is aware of their options, they still face several different administrative processes to use everything they are entitled to (Egger et al., 2022).

In our interview with Hagan, he shared interesting insights about how transport in Northern Ireland is integrated with social care.

*So Northern Ireland is quite unusual in this extent. You know you won't have this in England, but a lot of these community-transport services are free at the point of entry, so to speak, because it comes under the social care funding within the NHS system. ... The integrated health and social care system actually comes out of The Troubles and the conflict, and the fact that actually because of all the difficulties that there were historically, there was a kind of expediency in keeping health and social care services together. (R. J. Hagan, personal communication, July 2023)*

Northern Ireland's unique history means there is more focus on ensuring transport works well with other services, such as health and social care. While this works well, the different transport options in Northern Ireland are less well integrated, because of underinvestment in public transport. This leaves disabled people with fewer options to get around without a car.

Our key insight from the interviews is that transport systems seem to be designed to minimise costs to government, rather than provide maximum benefit for users. Effort is often invested in making services as efficient as possible for the funder. However, when it comes to transport for disabled people, many do not have easy access to existing services, the services do not always meet their needs, and some services are unaffordable. Overall, governments, service providers and disabled people have different perspectives of subsidised mobility, and there are no clear objectives, from the investment side, to bridge these gaps.

### **3.3.6 Disabled people participate less fully in society, because of transport**

A final theme, discussed by Hagan and Egger in their articles (Egger et al., 2022; Hagan, 2020) and in our interviews, is that some disabled people accept a lower level of participation in everyday life, because transport is consistently too difficult or expensive to use. Hagan describes this as 'relational autonomy', which means that disabled people have to negotiate between having autonomy and maintaining their relationships with others (Hagan, 2020; R. J. Hagan, personal communication, July 2023). Rather than seeking the best option for themselves, they may seek the option that takes other paratransit passengers and service providers into account. According to Egger, this results in disabled people having fewer choices about how to live. This is a symptom of transport poverty, which happens when people spend more than they can reasonably afford on transport. The combination of transport disadvantage and social exclusion related to disability means that disabled people cannot participate fully in everyday life.

## 4 Subsidised mobility in Aotearoa New Zealand

To apply the insights from other countries to Aotearoa New Zealand, it is useful to understand our context for subsidised mobility in 2023.

In Aotearoa New Zealand, the Total Mobility scheme provides subsidised taxi services for eligible disabled people, in towns and cities where the scheme is active. Total Mobility provides a subsidy, so passengers travel for 25% of the full fare, up to a ceiling amount. The ceiling amount varies from NZ\$10 in small towns, through to NZ\$80 in large cities.

Previous research on Total Mobility has described its benefits, from the perspective of disabled people, service providers and the transport sector, and identified there is room for improvement (Doran et al., 2022). This research identifies the main benefits of Total Mobility:

- It is sometimes the only option for disabled people to participate in everyday life, so it is highly valued.
- It is more affordable than a full-price taxi fare.
- It is usually more direct and convenient than another means of travel, such as relying on family and friends, walking, cycling or using public transport.

The research also identifies the main challenges related to Total Mobility:

- The ongoing cost is challenging for some customers.
- The ceiling amount makes long trips prohibitively expensive.
- The scheme is not available in every town and city, or in rural areas.
- There are not enough taxis available, especially wheelchair-accessible taxis. This means some people wait a long time for their trip, or need to book their travel well in advance, which reduces their ability to travel spontaneously.
- The scheme operates inconsistently in different parts of the country. There are different ceiling amounts, different numbers of taxis available, and drivers have varying levels of training.

As well as Total Mobility, the government subsidises the cost of public transport for disabled people. These public-transport subsidies have been introduced in the last five years, so there is not yet any published information about their effectiveness or the impact they are having on disabled people's travel.

The government also supports community transport. Te Whatu Ora | Health New Zealand, and some regional authorities and organisations, give grants to community groups that provide transport using volunteer drivers. For example, Waikato Regional Council provides grants to community transport providers, funded through targeted regional rates on property. Waikato Regional Council also hosts a quarterly Community Transport discussion and support forum. The transport and health sectors support community transport in other ways, such as having staff who are dedicated to working with communities on transport solutions, which include community transport. There is no national-level coordination or governance of community transport, so the total extent of government support for community transport is unclear.

We are not aware of any evaluation of community transport in Aotearoa New Zealand. Neither has there been a national stocktake of what exists, and the extent to which community transport meets disabled people's needs to participate in everyday life.

In the next section, we present our recommendations for subsidised mobility in Aotearoa New Zealand.

## 5 Conclusions and recommendations

Internationally, subsidised mobility is delivered in different ways, but there are several variations on a consistent theme. All models:

- provide paratransit because public transport is unlikely to ever be fully accessible for everyone
- have funding limits
- acknowledge that paratransit is not a perfect response to the transport needs of disabled people.

Consistent themes emerge from the literature: there is widespread support for community transport overseas, paratransit continues to be improved, and there are ongoing efforts to make other transport services more accessible.

From the literature and our interviews it is evident that paratransit and community-transport services are highly valued by passengers. Most people who use them express their gratitude and experience few problems getting where they want and need to go. Paratransit has many benefits for passengers, including:

- physical health benefits, through the act of getting out and about, and through access to health services
- mental health and wellbeing benefits, through social interaction with the driver and in some cases other passengers
- reduction in anxiety, where paratransit provides a reliable transport mode for both essential and discretionary travel
- the benefits of participation in whatever activity the transport connects a passenger to
- broader benefits to the passenger's family because of its support for their health and wellbeing

However, passengers who report problems with the services suffer major consequences, as they do not have many other ways to get around and access what they need. We found that some disabled people accept a lower level of participation in everyday life, because transport is consistently too difficult or expensive to use. Despite widespread qualitative evidence of unmet need for transport, we did not find any examples of routine, ongoing monitoring of disabled people's experiences of paratransit or satisfaction with services. We are also not aware of any studies that have measured latent demand for paratransit trips. This is a large gap because without understanding more about disabled people's access, it remains difficult to define return on investment in paratransit services. It is also difficult to know how much to invest, because needs are undefined.

Some new insights from this research could be useful in Aotearoa New Zealand, if they are adapted to our context:

- **Travel training:** Supporting disabled people to use public transport can reduce pressure on taxis, while making good use of existing buses and trains. Travel training also provides a way for disabled people to give feedback to transport authorities about how they could better meet their needs.
- **Support for community transport:** In addition to funding community transport, some countries (eg, the UK) have legal recognition for community-transport providers and provide them with a wide range of government support.
- **Trip prioritisation processes:** In Barcelona, trips are oversubscribed. Portell et al. recommend prioritising trips based on a combination of measures that include disability type, trip purpose, trip frequency, and the existence of other accessible-transport options (Portell et al., 2022).
- **Technology can improve paratransit:** Particularly in terms of logistics for organisations managing a lot of paratransit vehicles, and to increase the awareness of paratransit options, technological advances can be helpful. An advantage is that technology can be adapted and improved regularly, and more quickly than for example a fleet of vehicles could be upgraded.

Despite the lack of measures to quantify the value of subsidised mobility, evidence from passengers suggests that it is good to provide paratransit *and* community transport for disabled people. We therefore recommend that Aotearoa New Zealand:

- increases its support for community transport
- continues to improve paratransit, including using measures that demonstrate a return on investment
- continues to make mainstream public-transport services more inclusive, including using measures that demonstrate continuous improvement.
- draws on the benefits of technology to govern, operate and understand paratransit, particularly concerning trip logistics, feedback from customers, and to improve awareness and accessibility of information about it, for the public.

We also emphasise that these recommendations from our previous research (Doran et al., 2020) are still relevant:

- Define a vision for investment in transport that values inclusion.
- Measure accessible journeys.
- Promote the voices of marginalised people.
- Connect across government.

The key to progressing these recommendations is defining a vision for investment, so that inclusion is valued in policies and then valued in an economic sense. Once an investment objective is clearly identified, the government can more confidently invest in subsidised mobility as part of an inclusive transport system.

This research has been limited by the narrow scope of the literature; there are few studies of the costs and benefits of paratransit, and very few that give the perspectives of disabled people themselves. Further research into these services could inform how Aotearoa New Zealand approaches subsidised mobility, in terms of who receives subsidies, and for what reasons.

Important next steps would therefore be to measure both the impacts that community transport, paratransit and mainstream public transport have on disabled people and the return on investment in subsidised mobility, so that any changes in investment can be appropriately targeted.



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## Appendix A: Shortlisted case studies

Reference	Our summary of the work
<p>Ashour, L. A., &amp; Shen, Q. (2022). Incorporating ride-sourcing services into paratransit for people with disabilities: Opportunities and barriers. <i>Transport Policy</i>, 126, 355–363. (Seattle, USA)</p>	<p>This paper looks at shifting people from taking paratransit trips to using services that are like public transport, and which are operated by transport network companies. The study examines several considerations, which are all relevant to Aotearoa New Zealand. These include trip length, level of service (this includes whether passengers need assistance, and the type of assistance they need) and efficiency of conventional paratransit. The paper argues that between 11% and 18% of paratransit trips could be provided by the transport network companies.</p>
<p>Egger, S. M., Gemperli, A., Filippo, M., Liechti, R., &amp; Gantschnig, B. E. (2022). The experiences and needs of persons with disabilities in using paratransit services. <i>Disability and Health Journal</i>, 15(4), 101365. (Switzerland)</p>	<p>This paper investigates paratransit in Switzerland. It discusses many of the trade-offs that people make when they choose to use paratransit or scheduled public-transport services. This a useful paper for Aotearoa New Zealand. Because Switzerland has high-quality public transport, any limitations with public transport that disabled people face there are likely to exist here to an even greater degree. Therefore, this paper gives us the opportunity to investigate perceptions of paratransit in a country that has high-quality mainstream public transport.</p>
<p>Garnier, C., Trépanier, M., &amp; Morency, C. (2022). Criteria to prioritize opportunities to shift paratransit trips to regular transit network –Montreal case study. <i>Journal of Transport &amp; Health</i>, 24, 101338. (Montreal, Canada)</p>	<p>This paper investigates the potential to replace paratransit trips with public-transport trips, in Montreal, Canada. It discusses four criteria:</p> <ol style="list-style-type: none"> <li>1. The ability of an individual to switch to public transport.</li> <li>2. The universal design/accessibility of local public-transport stops and vehicles.</li> <li>3. The first/last mile between the trip origin, destination and public-transport stops.</li> <li>4. The individual's desired trip frequency.</li> </ol> <p>The study estimates that approximately 15% of paratransit trips could be converted to public-transport trips. We think this paper could help us understand how to measure, and potentially map, the accessibility of Aotearoa New Zealand's public-transport networks, to analyse their overlap with, and potentially their ability to replace, Total Mobility trips.</p>
<p>Hagan, R. J. (2020). Getting out of the house: The use of community transport as a third place for rural-dwelling older adults. <i>Ageing &amp; Society</i>, 40(11), 25192539. (Derry/Londonderry, Northern Ireland)</p>	<p>This paper investigates the social value of community transport in terms of the wellbeing benefits that passengers derive. The research is relevant to a discussion about the relative value that people gain from using Total Mobility, community transport and conventional public transport. The model of a community-transport rural bus service is interesting, given that the social and geographic context for this study (rural Northern Ireland) is similar to Aotearoa New Zealand.</p>

Reference	Our summary of the work
<p>NSW Government. (2020). <i>Transport disability incentives and subsidies review: Findings</i>. (New South Wales, Australia)</p>	<p>This is a review of subsidised taxi services for disabled people, conducted by the New South Wales Government. It investigates the objectives of subsidised mobility, by engaging with disabled people and transport-sector representatives. It examines eligibility criteria; adequacy of the subsidy; and regulatory and administrative matters, such as fare calculations and per-trip or bulk-funding arrangements.</p>
<p>Portell, L., Morera, S., &amp; Ramalhinho, H. (2022). Door-to-door transportation services for reduced mobility population: A descriptive analytics of the city of Barcelona. <i>International Journal of Environmental Research and Public Health</i>, 19(8), 4536. (Barcelona, Spain)</p>	<p>This paper describes Barcelona’s approach to paratransit, which is called the Special Municipal Transport Service (SMTS). The paper investigates the option of sharing trips, given that demand for SMTS is exceeding supply and affordability. It offers some useful insights for Aotearoa New Zealand on issues such as the nature of paratransit-like trips; origin–destination modelling; the feasibility of sharing trips; and the different ways to prioritise trips, besides the current first-come, first-served method.</p>

## Appendix B: Interview questions

1. Please describe your background in paratransit (or subsidised mobility).
2. Please explain how transport subsidies work in your country:
  - a. Subsidised taxis.
  - b. Public transport.
  - c. Community transport.
  - d. Parking.
  - e. Any other subsidies.
3. Do you know how these approaches to subsidised mobility came about?
4. Were there any political or bureaucratic barriers to implementing subsidised mobility?
5. How is technology a part of transport for disabled people specifically, in your country?
6. How does on-demand transit feature in your country?
7. Do you know how inclusive access is *measured* in your country? What are the success indicators?
8. If you were to create a policy for subsidised mobility for your country, what would it include that is not included now?
  - a. Disability sector representation.
  - b. Amount of subsidy.
  - c. Assessment for subsidy.
  - d. Mechanism for subsidy, in-vehicle.
  - e. Funding – national, regional and local.
9. Is there anything else about subsidised paratransit that you'd like to mention?



## Glossary

Autonomous vehicle	A motor vehicle that does not require a human driver (also known as a Level 4 autonomous vehicle)
Brokerage model (paratransit)	Paratransit services that are contracted (brokered) by a government and operated by a private company
Centralised model (paratransit)	Paratransit services that are operated by a government
Combination model (paratransit)	Paratransit services that are operated by a government and a private company
Community transport	Paratransit services that are organised and delivered by not-for-profit community groups
Dial-a-ride problem	The challenge of using efficient routes for paratransit services when managing multiple vehicles, passengers, trip origins and destinations, and operating within time, budget, geographic and other constraints
Mainstream public transport	Transport services available to the public that run on fixed routes at fixed times
On-demand public transport	Transport services available to the public that run when a passenger requests them. This service offers more flexible journey origins and destinations than mainstream public transport
Paratransit	Subsidised public or private transport services available on-demand for people who cannot easily access mainstream public transport
Rideshare	Private door-to-door transport, available on demand for passengers who book it online or using a mobile phone application
Subsidised mobility	Transport services whose operating costs (this includes staff, vehicle running costs and other out-of-pocket expenses) are partly or fully subsidised by the government
Total Mobility	A paratransit scheme in Aotearoa New Zealand that provides government-subsidised taxi fares for eligible disabled people
Transport poverty	Poverty that is caused by people paying more than they can afford for transport
Travel training	One-to-one training provided to a person for a journey they need or want to take, to help them navigate an unfamiliar route, information, vehicle or infrastructure