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ORIGINAL PAPER

# The ambivalence of ridesharing

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**Abstract** Ridesharing is quite a popular topic of discussion among transport authority personnel. It is perceived to be a viable alternative to classical modes of transportation, and receives a great deal of political support from transport planners. However, not much objective information is available on ridesharing behaviors. We use travel survey data to study the evolution of the ridesharing market in an urban area. Our study is based on data from four large-scale OD surveys conducted in the Greater Montreal Area (1987, 1993, 1998 and 2003).In the latest survey conducted in Montreal, car passengers were asked to identify the driver who gave them the opportunity to travel in this way. Their answers were classified according to the type of driver; for instance, a member of their household, a neighbor or a co-worker. We use this information to calibrate a model matching car passengers and car drivers belonging to the same household. This will be referred to as IHHR (intra-household ridesharing).Preliminary results reveal that approximately 70% of all trips made by car passengers are the result of IHHR. Furthermore, around 15% of those trips are questionable, in that they were exclusively generated for another individual's purposes, consequently generating an additional trip for the journey back home. Moreover, this percentage increased over time. Objective data regarding ridesharing and its evolution in an urban area will undoubtedly help decision makers gain a clearer profile of this means of travel and help to realign attitudes on the issue.

**Keywords** Carsharing · Greater Montreal Area (GMA) · Origin–destination surveys · Ridesharing · Sustainable transportation

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## 1 Introduction

The subject of this paper is ridesharing, and the ambivalence associated with it.

Ridesharing is quite a popular topic of discussion among transport authority personnel. It is perceived to be a viable alternative to classical modes of transportation, and receives a great deal of support from transit suppliers and transport planners. At first glance, ridesharing exists when two or more trips are executed simultaneously, in a single vehicle. Its main anticipated impact is to increase car occupancy, with a consequent reduction in the number of cars traveling on urban roads.

However, not much objective information is available to quantify the real market of ridesharing in an urban area. Our objective is to use travel survey data to construct a clearer profile of the ridesharing market in an urban area. Our study is based on data from large-scale origin–destination (OD) surveys conducted cyclically in the Greater Montreal Area. Four sets of OD data are used: 1987, 1993, 1998 and 2003. As revealed by these data, approximately 14% of the trips made on a typical weekday are made by car passengers.

In the 2003 Origin–Destination Travel Survey conducted in Montreal, car passengers were asked to identify the driver who had given them the opportunity to travel in this way. The answers were classified according to type of driver; for instance, a member of their household, a neighbor or a co-worker. We use this information to calibrate a model aimed at matching car passengers and car drivers belonging to the same household. For each car passenger trip identified in the trip file, the process loops within the car driver trips made by other members of the household in order to capture a possible trip opportunity. Matching can be performed between exclusive car trips and multimodal trips. Various constraints regarding time of departure and spatial location of origin, destination and junction points are specified.

This matching makes it possible to identify intra-households ridesharing (IHHR) and measure its contribution to the overall market of car passenger trips. The ride-matching model is applied similarly to car passenger trips recorded in the four travel surveys in order to observe trends over a 15-year period.

The matching process also makes it possible to discriminate between the various types of ridesharing, not all of which are entirely sustainable. Indeed, from the sustainability standpoint, not all types of ridesharing are even desirable. The increasing number of trips made by car passengers does not necessarily result in a reduction in the number of kilometers traveled. While ridesharing can yield an effective matching of trips with sufficient spatio-temporal coincidence, it can also result in the multiplication of trips by drivers who act as taxi drivers. This occurs particularly frequently in household-based ridesharing, where mothers drive around by car, accompanying their children to various activities, school for instance. The number of such trips reveals an important (and critical) issue, considering that car travel is slowly but surely replacing walking, biking and public transit as the preferred mode of transportation for young people. Obviously, it will be harder for these children to trade car travel for public transit and other sustainable modes of transportation when they are old enough to make the choice.

The objectives of the study are the following:

- Measure the true market for ridesharing, as measured by large-scale travel survey data; the Greater Montreal Area case is used as the case study;

- Develop and apply a ride-matching process based on spatio-temporal coincidence between the drivers and passengers in a single household;
- Study and classify the various types of ridesharing: intra-household versus collective, sustainable versus questionable;
- Describe the socio-demography and behaviors of both drivers and passengers according to the ridesharing class;
- Discuss some perspectives on the market for collective ridesharing.

## 2 Ridesharing experiences in the literature

Studies in this field are widespread and numerous papers have focused on the various aspects of the ridesharing issue, for instance:

- *Transportation demand management strategies*: Loukopoulos et al. (2006) examine the response of users with regard to travel demand management strategies; Fellows and Pitfield (2000) use cost–benefit analysis techniques to measure the impacts of car-sharing strategies; Baldassare et al. (1998) measure the likelihood of employees stopping solo driving in response to various disincentives; Higgins and Johnson (1999) emphasize the importance of evaluating the outcomes of transportation programs; Salomon and Mokhtarian (1997) discuss the effectiveness, from the point of view of consumers, of various policies aimed at reducing congestion; Collura (1994) presents the results of an evaluation of programs developed to promote ridesharing in Massachussetts.
- *Activity programming within households*: Miller et al. (2005) present a tour-based choice model in which the car passenger mode is modeled as a joint decision between the driver and the passenger, and directly assess the ridesharing issue; Gliebe and Koppelman (2005) propose a model to predict daily patterns of activity, including joint activities; in 2002, the same authors proposed a model of joint activity between household members and present the incidence of children in the activity structure.
- *Matching tools and programs*: Dailey et al. (1999) present a dynamic ride-matching service on the Internet for the Seattle region; Golob and Giuliano (1996) evaluate the Smart Traveler Ridematching Service implemented in Los Angeles in order to draw lessons for future ATIS (Advanced Traveler Information Systems) initiatives.
- *Car dependency issues and car-sharing systems*: Wright and Curtis (2005) discuss the role of the car in the community; Huwer (2004) measures the benefits of combining transit and car-sharing services; Mackett et al. (2003) study the car dependency of children who are driven to school; Shaheen (2001) presents an overview of a transit feeder system in which users share a fleet of vehicles in order to access the transit network.

This paper is concerned with the urban ride-sharing market, and is aimed at classifying the various types of ridesharing and at measuring trends for a study area.

“*In the eighties, carpooling died*.” This simple statement summarizes the trends observed by Pisarski (1997) in the US. Indeed, the average car occupancy in the US dropped from 1.18 in 1970 to 1.09 in 1990. Carpooling lost share in a period when all the alternatives to the single-occupant vehicle also lost share. Ferguson (1997) offers some hypotheses to explain why carpooling has declined: evolution of urban form (dispersion of trip ends, decline in development densities), family income and automobile availability, participation of women in the labor force, race and ethnicity, as well as age and education.

In Canada, carpooling has also lost market share. It remains very popular in sustainable transportation programs, however. Currently, a great deal of effort is being put into the development of tools to organize and promote the use of public transit and other alternative means of travel. Ridesharing is one of these alternatives, and is aimed at encouraging people to share car seating in order to increase occupancy and reduce the number of vehicle-kilometers traveled. One of the problems is that many organizations, both public and private, are developing ill-assorted ride-matching tools targeting similar areas. The overall profile looks like improvised confusion to promote a means of travel which increasingly runs counter to the current demographics (age, household size), economics (car ownership) and urban trends (sprawl, dispersed population). In the Greater Montreal Area, several matching tools are available to travelers, for instance:

- *Allégo program of the AMT* (Metropolitan Transport Agency of Greater Montreal) offers two ridersharing services: (1) an online matching tool to help travelers find travel partners, (2) an information kit to help people organize ridesharing at their place of work or study (http://www.allego.amt.qc.ca/Covoit_allego.asp).
- *More Montreal ridesharing* (http://www.toutmontreal.com/covoiturage/) gathers offers and requests from travelers. Those interested can browse through these lists to identify compatible trips.
- *CovoiturageMontréal* (http://www.covoituragemontreal.com/) also gathers offers and requests from travelers to facilitate trip-matching.
- *Autoduo* (http://www.autoduo.com/) was a search engine that makes it possible to find travel partners for regular trips (journeys to work or study). The service is now closed due to low popularity.
- *CarpoolTool.com* is a non-profit project that helps travelers find matching commuters in their area. It is a free service offered for Canadians which relies on the geocoding of zip codes, and seeks compatible home-work trip patterns for subscribers in their area (http://www.carpooltool.com).

Even though ridesharing obviously has the theoretical ability to increase car occupancy, it is unpopular for several reasons (Black 1995):

- scheduling and routing are usually rigid;
- the wide distribution of spatial locations (home, work, study) reduces the probability of finding good matches;
- the people who ride with someone else do not have a car available during the day for other trips, for errands and going out to lunch for example;
- personality conflicts make car pools unattractive to some; hence, people who have had a bad experience may not want to try again.

## 3 Key facts regarding travel behaviors in the GMA

In the fall of 2003, the eighth Household Origin–Destination Travel Survey was conducted in the GMA. These surveys are conducted by telephone and gather

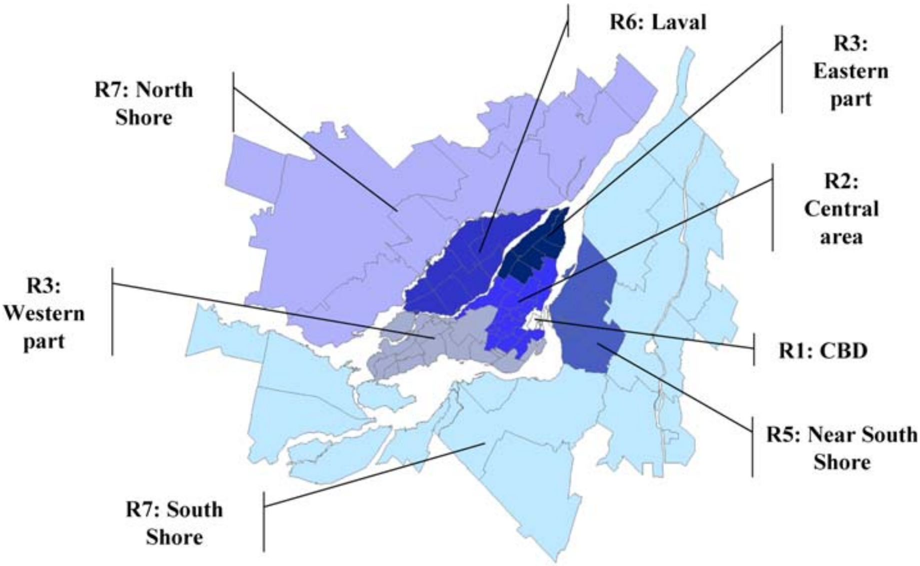


**Fig. 1** The GMA as defined for the 2003 Origin–Destination Travel survey

details regarding the trips made on a weekday by all the people in a household. The sample sizes are quite impressive: 70,000 households, 170,000 people and 370,000 trips for the survey conducted in 2003. This represents approximately 5% of all the households in the GMA (5,500 km$^2$). The GMA, as defined for the 2003 survey, is presented in Fig. 1.

The number of car passenger (CP) trips provides an initial estimate of the modal share of ridesharing in terms of overall mobility. In the GMA, approximately 1,099,000 trips are made daily by car passengers. To these unimodal trips are added the bimodal trips (kiss-and-ride)[1] that number 38,000 trips. Hence, the overall market for car passenger trips (number of CP and KR trips over the total number of trips done during a typical weekday) was estimated at 14.3% in 2003 (13.7% in 1987). This is quite comparable to the US estimate: carpooling there represents approximately 13.4% of weekday commutes (Pisarski 1997). As well documented in Teal (1987), carpooling as a commuting mode for American workers was somehow higher in the late 70s, around 18–20%. Comparable estimates for workers are quite hard to construct for the Montreal Area since OD survey data can only approximate carpooling using the car passenger share. For journey-to-work trips, the share of car passenger is around 7.9% in 1987. Hence, data from the 1996 Canadian Census regarding the primary mode of transportation to work reveal similar car passenger shares of 3.4% and 8.0% for men and women, respectively. These shares are lower than what was observed using the 1977–1978 National Personal Transportation Survey (Teal 1987).

Figure 2 summarizes the make-up of the car passenger and kiss-and-ride share in the daily behaviors of Montrealers according to where they live. From this figure, we can observe several things:

[1] Trips combining car passenger and transit (KR).

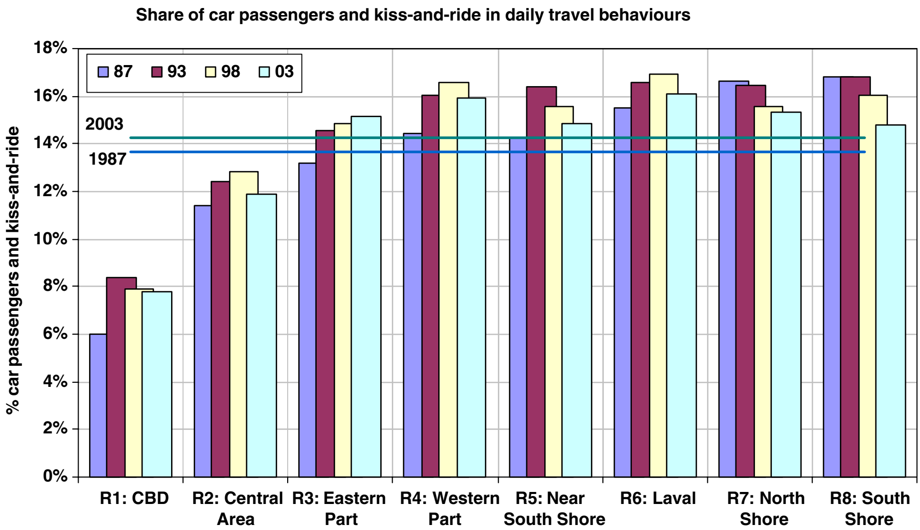


**Fig. 2** Share of car passengers and kiss-and-ride in daily travel behaviors

- The proportion of car passenger trips is lower in the central parts of the area, due to the efficiency of the public transit system (subway), as well as to the demographic attributes of the population (fewer family-type households, more elderly people and people living on their own, less car ownership, higher density living). The impact of socio-demographic distribution will become more obvious from the analysis of the attributes of the ridesharers.
- Except for the two suburban shores, the proportion of car passenger trips increased between 1987 and 2003, but is lower overall than what was observed in 1993 and 1998. Hence, the share of car passenger trips has decreased in the two suburbs furthest from the urban center.

## 4 Identification of IHHR

The study of ridesharing using OD survey data raises certain issues: Until the latest survey was conducted, no information was available for the study of ridesharing trips that did not contain any uncertainty. Also, although it has been possible to study IHHR up to now (when both driver and passenger belong to the same household), no information has been available to validate the matching between travelers.

However, a new question was introduced in the latest survey questionnaire regarding the type of driver who gives people the opportunity to travel as car passengers. For every trip made by car as a passenger, the question, "Who was the driver?" was asked. This is highly relevant for the study of ridesharing behaviors. We use it to validate an intra-household matching process applied in precisely the same way to four OD samples.

### 4.1 Methodology

The identification of IHHR in the survey files requires spatio-temporal compatibility between two car trips: a car passenger (CP) or a kiss-and-ride (KR) trip and a car driver (CD) or a park-and-ride[2] (PR) trip. As mentioned earlier, IHHR refers to the matching of two trips made by members of the same household.

According to the accepted instructions regarding data collection during telephone interviews (the same for all four OD surveys used), the CD trips that need to deviate from their final destination in order to generate a travel opportunity for a passenger must be collected in sequence, as two distinct trips. The proposed methodology respects these instructions, and is, consequently, very conservative. It requires spatial coincidence at both ends of the trips and temporal compatibility between departure times.

This methodological choice was made, even though study of the 2003 data shows either a lack of understanding of these instructions or some laxity in applying them. For example, some ridesharing trips made to accompany someone else were not explicitly declared as such. As a result, these trips will not be flagged by the automatic process, and this has been confirmed by the 2003 data. As will be seen in Sect. 4, the proportion of IHHR trips that cannot be recognized by the method represents approximately 20% of the CP trips.

Various types of intra-household matching can be identified from the declared trips. This coupling is the result of a range of possible coincidences. The formalization of these matching types relies on the following variables:

| | |
|---|---|
| • Dependent trips: car passenger (CP) or kiss-and-ride (KR): | • Independent trip: car driver (CD) or park-and-ride (PR): |
| • $O_{CP}$: Origin of CP trip | • $O_{CD}$: Origin of CD trip |
| • $O_{KR}$: Origin of KR trip | • $O_{PR}$: Origin of PR trip |
| • $D_{CP}$: Destination of CP trip | • $D_{CD}$: Destination of CD trip |
| • $D_{KR}$: Destination of KR trip | • $D_{PR}$: Destination of PR trip |
| • $J_{KR}$: Junction of KR trip | • $J_{PR}$: Junction of PR trip |
| • $T_{CP}$: Time of departure of CP trip | • $T_{CD}$: Time of departure of CD trip |
| • $T_{KR}$: Time of departure of KR trip | • $T_{PR}$: Time of departure of PR trip |

A 1,000 m gap between origin points is considered acceptable, since travelers sharing a ride can be at walking distance from one another. This gap also takes into account the imprecision due to the type of declaration made by the travelers when describing their trips (address, trip generator, intersection or zip code). For temporal coincidence, times of departure from compatible points of origin are considered acceptable if the time difference is less than 15 min. Other rules apply for bimodal trips.

The various types of matching describing IHHR are listed below and illustrated in Fig. 3 (plain line: driver, dash line: passenger).

- *Type 1*: Matching of unimodal trips (CP → CD). The perfect coupling between a CD trip and a CP trip involves compatibility between the origin $O_{CP} = O_{CD}$ and the destination $D_{CP} = D_{CD}$ points, as well as between the times of departure ($T_{CP} = T_{CD}$). In this case, the purpose of the CD trip can be either a specific activity at the destination (work or study) or "to give someone a lift." In the latter case, it indicates that the destination is intermediate and probably would not exist if no passenger was to be dropped at this point.
- *Type 2*: Matching between a multimodal passenger trip and a unimodal driver trip (KR → CD). In the first direction (type 2–1), the destination of the CD trip can allow a passenger to access a public transit network in order to reach his final

[2] Trips combining a car drive and public transit (PR).

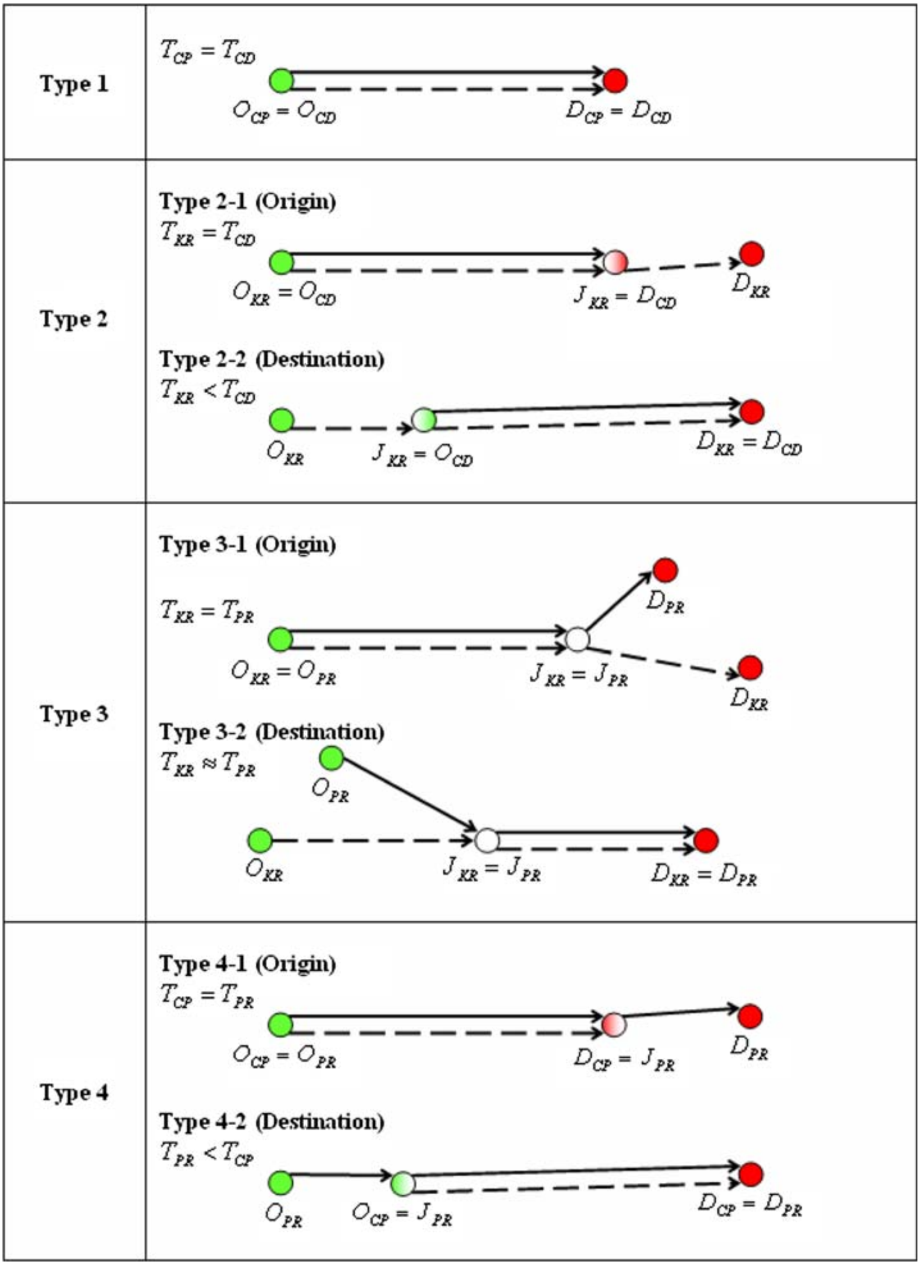


**Fig. 3** Synthesis of the plausible types of matching (plain line: driver, dash line: passenger)

destination. In this case, there is compatibility between the points of origin ($O_{\mathrm{KR}} = O_{\mathrm{CD}}$) and times of departure ($T_{\mathrm{KR}} = T_{\mathrm{CD}}$), and between the destination of the driver and the junction point of the passenger ($J_{\mathrm{KR}} = D_{\mathrm{CD}}$). If the coupling occurs the other way around (type 2–2), there is compatibility between the destinations ($D_{KR} = D_{CD}$), and the times of departure are within a certain interval, set at 1 h for the experiment, and the time of departure of the passenger precedes that of the driver $T_{CD} - T_{KR} < 60$min). Finally, the point of origin of the driver is compatible with the junction point of the passenger ($J_{KR} = O_{CD}$).

- *Type 3*: Matching between two multimodal trips (KR → PR). This type of matching occurs when driver and passenger depart from compatible points of origin ($O_{KR} = O_{PR}$) in order to access the public transit network at a junction point ($J_{KR} = J_{PR}$). In this direction (type 3–1), the departure times are compatible, while a 1-h time gap is acceptable if the matching occurs to reach the destination (type 3–2). In the latter case, no strict temporal sequencing is required, since either of the two travelers can leave first.
- *Type 4*: Matching between a unimodal CP trip and a bimodal CD trip (CD → PR). The destination of the passenger can actually be the junction point of the driver who uses the transit network to reach his final destination. The required compatibilities are between the points of origin ($O_{CP} = O_{PR}$) and the times of departure ($T_{CP} = T_{PR}$), as well as between the destinations of the passenger and the junction point of the driver ($D_{CP} = J_{PR}$). In the reverse direction, the driver begins his trip on the public transit network and then accesses the point of origin of the passenger ($T_{CP} - T_{KR} < 60$min) ($O_{CP} = J_{PR}$); both travelers use the same car to reach their final destination ($D_{CP} = D_{PR}$).

## 4.2 Results of the matching process

The systematic application of the matching process to the four OD samples makes it possible to estimate the proportion of CP trips that belong to the various types of IHHR.

Table 1 summarizes these results: approximately 60% of the CP trips are classified as IHHR. The slight increase of the proportion of IHHR CP trips from 1998 (61.70%) to 2003 (62.81%) nevertheless represents a decrease in terms of trips (– 29,100 trips), explained by the lower share of CP trips in the area (14.25% vs.

**Table 1** Proportion of car passenger trips classified as IHHR

| Proportion of car passenger trips attributable to IHHR | | 1987 | 1993 | 1998 | 2003 |
|---|---|---|---|---|---|
| IHHR | | 532,200 | 694,700 | 743,300 | 714,200 |
| % IHHR/car pass. trips | | 61.36% | 56.66% | 61.70% | 62.81% |
| Car occupancy | | 2.01 | 2.14 | 2.16 | 2.17 |
| *% of trips according to the various matching types* | | | | | |
| 1 | CP+CD | 97.30% | 97.63% | 97.42% | 97.52% |
| 2–1 | KR+CD | 1.21% | 1.00% | 1.25% | 1.10% |
| 2–2 | KR+CD | 0.88% | 0.83% | 0.82% | 0.74% |
| 3–1 | KR+PR | 0.46% | 0.38% | 0.33% | 0.41% |
| 3–2 | KR+PR | 0.05% | 0.04% | 0.07% | 0.12% |
| 4–1 | CP+PR | 0.06% | 0.06% | 0.06% | 0.05% |
| 4–2 | CP+PR | 0.05% | 0.05% | 0.06% | 0.07% |

14.93%). Of these IHHR CP trips, more than 97% are the result of a perfect matching between two unimodal trips. It is worth noting that the CD trip matched to a CP trip can be a segment of a journey to a main activity. We observe that car occupancy is greater than 2.00 and that it increases over time. In 2003, the average car occupancy is 2.17; data also reveal that 11.9% of the drivers carry two passengers and 2.8% carry more than two passengers.

As Pisarski said, "*Today carpooling has become a household activity, with the past notion of carpooling as a voluntary arrangement of unrelated individuals an unlikely event*." The current figures on the Montreal experience support this.

## 5 Description of ridesharing according to the 2003 OD survey

As was mentioned earlier, a new question regarding the type of driver who gives a passenger the opportunity to travel was added to the 2003 OD survey questionnaire. The information collected is summarized in Table 2.

According to these figures, the proportion of declared IHHR trips is larger than that estimated with the matching process (71.3% vs. 62.8%). However, this figure needs to be discussed. Comparison of the matching by program and the declarations collected during the 2003 OD survey at the trip level is presented in Table 3. This table shows the proportion of CP (and KR) trips that were matched by the program for each declaration type. At this point, it is worth recalling that the declared

**Table 2** Summary of 2003 statements regarding the type of driver who gave passengers the opportunity to travel

| Type of driver who gave passengers the opportunity OD 2003 | | |
|---|---|---|
| Member of the household | 810,600 | 71.29% |
| Neighbor | 35,900 | 3.16% |
| Co-worker | 65,700 | 5.78% |
| Family member | 120,700 | 10.61% |
| Other | 103,000 | 9.06% |
| Does not know | 1,000 | 0.09% |
| Refusal to answer | 200 | 0.02% |
| Total | 1,137,100 | |

**Table 3** Comparison between declared matching and matching by program (for IHHR)—based on car passenger and kiss-and-ride trips—2003 Origin–Destination Travel Survey

| Statements by the respondents | Matched: 1: yes 0: no | % Passenger trips |
|---|---|---|
| Member of the household | 1 | 80.12% |
| | 0 | 19.88% |
| Neighbor | 1 | 3.23% |
| | 0 | 96.76% |
| Co-worker | 1 | 1.07% |
| | 0 | 98.87% |
| Family member | 1 | 38.08% |
| | 0 | 61.96% |
| Other | 1 | 1.78% |
| | 0 | 98.26% |
| Does not know | 1 | 3.30% |
| | 0 | 94.63% |
| Refusal to answer | 1 | 15.02% |
| | 0 | 92.40% |

information was not processed by the program (all the CP trips were handled equally). Consistent with the definition of IHHR, all the trips belonging to the type *Member of the household* should be matched, while no matching should occur within the other types of driver. What Table 3 reveals is that 80.12% of these trips were matched by the process, but also that a significant proportion of the trips belonging to the type *Family member* were also matched (38.08%). This can be the result of a misunderstanding of the classes by either the respondent (when declaring the information) or the interviewer (when coding the answer) since many people can belong to both groups (both member of the household and family member).

The study of unmatched CP trips which were labeled *Member of the household declared* helped determine the typical reasons why the process could not identify a CD trip within a particular household:

- The gap between the declared times of departure of the CP trip and those of the CD trip that obviously constituted the opportunity to travel. A loosening of the temporal constraint could prevent the exclusion of these trips, but could also match trips that were not really shared;
- Departure time non-response for one of the trips;
- The driver of the CD trip giving a passenger the opportunity to travel forgetting to state that the journey would be divided into two distinct trips: the first to the dropping point of the passenger and the second from this point to the final destination;
- No CD trips were made by any of the other members of the household.

This study has led us to make various recommendations to the OD technical committee regarding the simultaneous validation of ridesharing trips while conducting the interviews.

## 6 Features of IHHR

Ridesharing is not an exemplary endeavor in and of itself, as two types of IHHR can be identified: sustainable ridesharing and questionable ridesharing. This division is made in order to measure the proportion of CD trips that are exclusively generated to create an opportunity for a passenger to travel. This is the questionable type of IHHR. It is the diametric opposite of the sustainable type of IHHR, where two trips (people) are combined in a single trip (car), sometimes requiring a deviation by the driver (before he reaches his final destination), sometimes resulting in the sharing of an activity at the destination (and this is true even if the activity is more or less desired by one of the people). Questionable IHHR is recognizable through the existence of a symmetrical solo driver trip (same trip-ends) taken immediately before or after the shared trip. It is the case when, for instance, a mother drives his child to school (shared trip) and then comes back home driving alone (origin and destination points of share trip become destination and origin points of a solo driver trip).

This type of ‘‘family taxi’’ actually multiplies the number of car trips, each CP trip generating two CD trips that would not be taken if there were no passenger. This is far from the sustainable transportation concept.

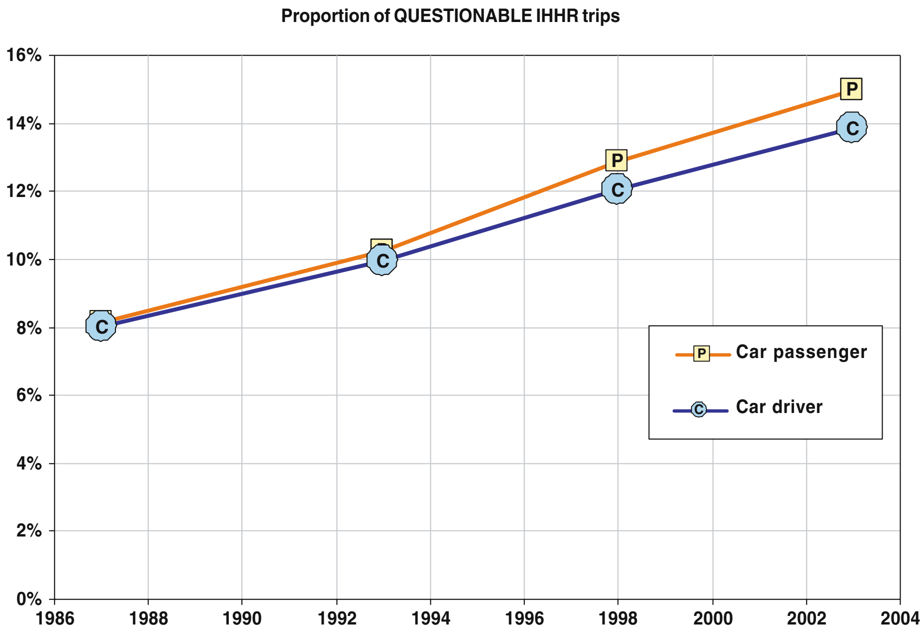


**Fig. 4** Proportion of CP and CD trips made as questionable IHHR trips (Origin–Destination Travel Surveys 1987,1993,1998 and 2003)

Figure 4 presents the proportion of IHHR matched trips that are of the questionable type. It shows that the questionable ridesharing accounted for 15.0% of the IHHR CP trips in 2003, while the proportion was only 8.2% in 1987. The number of trips of this type (questionable IHHR) has also increased during this time period: +55,300 CP trips (104.7%). The study of the related CD trips in 2003 confirms that their main purpose was to facilitate a passenger (drop-offs: 49% and pick-ups: 46%).

The features of the trips differ according to the type of IHHR. Table 4 presents the car occupancy of shared trips, as well as the average length of a passenger trip for the two types of IHHR:

- Questionable ridesharing shows higher car occupancy than sustainable ridesharing: in 2003, 2.25 people per car versus 2.18 in 1987;
- The average length of a questionable CP trip is half that estimated for sustainable CP trips. However, since each questionable CP trip generates a solo CD trip, the cost in terms of vehicle-kilometers is the same. Actually, it should be noted that

**Table 4** Features of IHHR: questionable versus sustainable: car occupancy and average length of a trip

| | 1987 | 1993 | 1998 | 2003 |
|---|---|---|---|---|
| Features of IHHR: questionable versus sustainable | | | | |
| *Car occupancy* | | | | |
| Questionable | 2.23 | 2.14 | 2.22 | 2.25 |
| Sustainable | 2.25 | 2.14 | 2.18 | 2.18 |
| *Average length of a car passenger trip* | | | | |
| Questionable | 3.33 | 3.66 | 3.68 | 3.81 |
| Sustainable | 7.61 | 8.43 | 7.88 | 8.10 |

the current method does not take into account trip chains when identifying questionable trips. Consequently, there is perfect spatial symmetry between the share trip and the solo driver trip.

The following two figures present the demographic structure of the IHHR market.

- Figure 5 presents the demographic structure of the trips (CP and CD) made that constitute questionable ridesharing. The passengers are mainly young people (in 2003, almost 73% of the trips were made by people under 20 years old, compared to 59% in 1987). Women 30–44 years old are the dominant group of drivers. The ratio of male to female drivers went from 1.05 in 1987 to 0.90 in 2003 for this type of IHHR. This type of travel is basically linked to the transportation needs of young people who are being driven by their mothers.
- Figure 6 presents the demographic structure of the trips made that constitute sustainable ridesharing. The passengers are young people (in 2003, 40% of the passengers were under 20 years old) and they were women. The ratio of male to female drivers went from 2.25 in 1987 to 1.83 in 2003, while that of the passengers went from 0.32 to 0.51 during the same period. This type of ridesharing seems to be declining with time, women becoming more autonomous in their travel habits (especially those 25–39 years old).

## 7 Conclusion

People were at one time more inclined (or forced) to share car seating. However, our urban development planning, as well as economic growth, have given people more freedom to travel as they wish. Being a car passenger has become increasingly unnecessary and less acceptable as a means of transportation.

"*If carpooling is a study in the probability of having someone near you, going where you're going, it is clear that those probabilities are declining*" (Pisarski 1997).

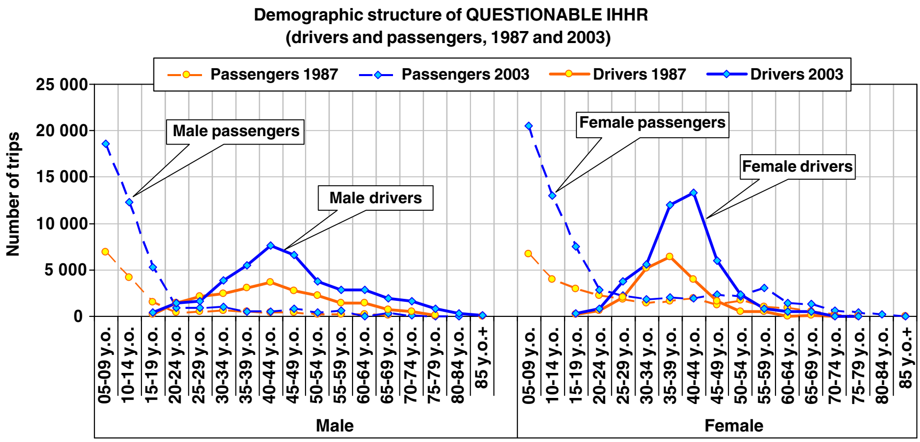


**Fig. 5** Demographic structure of passengers and drivers engaged in QUESTIONABLE IHHR—1987 and 2003 Origin–Destination Travel Surveys

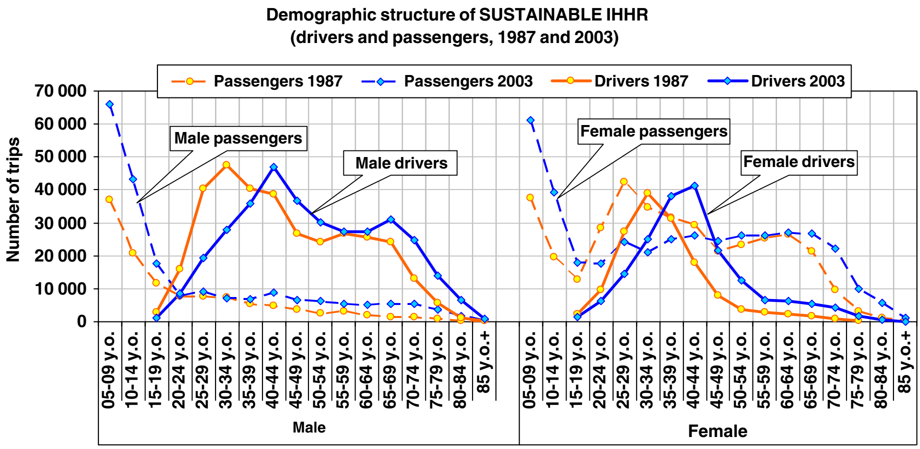


**Fig. 6** Demographic structure of passengers and drivers engaged in SUSTAINABLE IHHR—1987 and 2003 Origin–Destination Travel Surveys

Even though ridesharing forms part of most strategies for sustainable transportation, it appears that its share of the overall market in an urban area is declining. This is what data from four OD surveys have shown for the Greater Montreal Area. Moreover, ridesharing is increasingly becoming a family activity, even though families are getting smaller. The increasing participation of women in the workforce, combined with their increasing mobility, is probably one of the explanations for this. Actually, the proportion of working women increased from 30.7% to 33.7% between 1987 and 2003, while the proportion of them owning a car increased from 28.58% to 43.14%. Finally, the average number of cars per household has increased from 1.06 in 1987 to 1.23 in 2003, while the average household size declined from 2.57 to 2.42 people per household. During the same period, the proportion of households with no car has declined from 25.12% in 1987 to 21.13% in 2003.

It appears, therefore, that access to a car for households and household members has become easier and that the activity rhythms of adults are less flexible (they are participating in more constrained activities, such as work). Policies aimed at reducing car use will have to be rethought.

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