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Transportation for
the Elderly and
the Handicapped

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Mobility of Persons Who Need Nursing and Who Live at Home

WERNER BRÖG, FRITZ HÄBERLE, AND KARL RIBBECK

A survey on the mobility of persons who need nursing is used to show that, by integrating and newly processing data from previous surveys, it is possible to fill gaps in research without making new surveys. The most important results of an attempt to thus integrate and newly process data from two different surveys are discussed and interpreted. The special methodological and conceptual problems of doing empirical research on the handicapped are discussed, and the results of empirical surveys designed to overcome these problems are explained. The mobility of persons who need nursing is compared with the average mobility of the population as a whole as well as with a control group that has a similar sociodemographic structure. This method proved to be useful for determining the quantitative characteristics of the mobility deficit in the target group studied. Finally, the study is compared with other surveys, and areas in which research gaps still exist are identified.

In this paper, mobility is defined as the number and quality of times a person moves from one location to another. Mobility is triggered by out-of-home activities and thus necessarily causes a person to change his or her location. This definition is not restricted to the use of any specific modes of transportation; it includes all methods of moving between one location and another and views mobility as a derived demand (1). Transportation planning frequently limits the term mobility so that it refers only to motorized trips; however, this definition is incomplete. When studying mobility, one must include nonmotorized travel as well.

All empirical surveys of mobility depend on a broad base of data that are comparable. However, although many data exist, there are few data available that might be used for comparative purposes. One of the reasons for this is that the needed data can only be obtained in surveys. In surveys, the interviewees are partners and cause the well-known subjective biases of the surveys.

Of course, basic information for planning--such as can be obtained by qualified empirical research--is necessary for continuous service and provisory care (2). This is true in social areas as well as in matters pertaining to architecture and transportation for the integration and rehabilitation of handicapped persons (3,4). The design and implementation of surveys for this purpose must take these problems into consideration. Such a survey is described later in this paper. A detailed discussion of how to solve the methodological and conceptual problems in empirical research on the "mobility limited" (briefly discussed in the following section of this paper) can be found in a paper by Brög and Mettler-Meibom (5).

PROBLEMS CONFRONTED IN EMPIRICAL STUDIES OF THE HANDICAPPED

Target Groups

In research on the handicapped, the definition of the target group is especially problematical since the nature of different types of handicaps is so complex. Depending on the type of research being done, several criteria can be used to define "the handicapped": (a) legal and insurance-oriented definitions, which are frequently more or less abstract; (b) the loss or gradual impairment of vital functions; and (c) the self-estimation of the handicapped person.

Experience has shown that multistep mail-back questionnaires make it possible to collect the complex data needed to study the handicapped. The first of the multistep questionnaires makes it possible to identify all persons in the surveyed households who might be handicapped. The following survey steps concentrate on the group of persons that seem to have handicaps and verify and collect data on the handicap.

Frequently, it is necessary to sort the initial data manually in order to identify persons who are handicapped. The reasons for defining a person as handicapped must be clear; they should not be arbitrary. For purposes of data analysis, the definitions should guarantee that new reflections concerning the composition of the total can be adequately realized.

Collecting Behavioral Data

A survey on mobility cannot limit itself to determining the number of trips made. Trips are not goals in themselves; they are the result of participation in desired and necessary activities, even if the activity is only "to get a breath of fresh air".

In order to study mobility and the reasons for this mobility, optimally realistic data must be collected on the actual behavior of the target persons. Although measured reality will never perfectly correspond with actual reality (no matter what measurement technique is used), empirical measurement techniques must have two basic goals: (a) to ensure that the measurement results are as realistic as possible and (b) to estimate the tendency of the bias and the reasons for this bias (6). The common approach of asking interviewees for information on their "average behavior" is especially dangerous because the resulting data are particularly unrealistic (7).

Sample Size

The number of handicapped persons (no matter how handicapped is defined) represents only a comparatively small percentage of the population. As a group, the mobility limited are not identical with the handicapped. In order to make reliable statements about the mobility limited, it is necessary to design studies so that, in addition to determining a representative proportion of as large a sample as possible for qualitative analysis, some subgroups of the total group are available. The size of the sample (8-10) is a necessary criterion for the validity of the predominantly qualitatively oriented data; the degree to which subgroups built by using a priori methods are relevant to the results of the survey cannot be predicted for such complex variables.

The Sample

Records on the handicapped are available from a variety of organizations that help the handicapped medically, socially, or financially. However, for a number of reasons, the records kept by these organizations are incomplete. They also include differ-

ent categories of the handicapped, depending on the nature of the organization. This is probably so not only in the Federal Republic of Germany but in most other countries as well.

Furthermore, since such data are based on more or less voluntary registries, data on the handicapped are systematically distorted. Random samples selected from the records of such organizations are generally not representative, at least when the structure of the groups and the personal situations of the persons in the groups are not compared with handicapped persons who are not registered. Since such comparisons have rarely been made, representative samples of the handicapped have had to be drawn from the population as a whole, indirectly. (Thus, the special evaluation of currently existing data sources that is described later in this paper is certainly an exception worthy of imitation.) But, when one draws a sample of this sort from the population as a whole, one contacts most of the sample uselessly, since the great majority of the persons contacted do not belong to the special target group. In addition, since funds are usually limited, the samples will usually only be large enough to ensure that the desired representativeness can be obtained within a tolerable fluctuation range.

Survey Method

The pertinent subject literature shows a definite tendency to use personal interviews--the so-called "king's method". The more difficult the object of research, the more pronounced this tendency is. However, we feel that the exclusive use of oral methods is not sufficient for surveys that deal with the mobility limited. The personal interview is inferior to mail-back questionnaires for a variety of reasons:

1. Target persons are very difficult to get in touch with for personal interviews.
2. Psychological problems arise when persons are directly confronted with a stranger asking personal questions.
3. Personal interviews are limited with respect to time and place.

The mail-back questionnaire has considerable advantages for the person questioned:

1. The individual can decide when to fill out the questionnaire.
2. The questionnaire is anonymous and answers are thus more honest.
3. The individual has the chance to discuss the questionnaire with friends and relatives.
4. The individual can refer to his or her records to get precise information on such subjects as medical and maintenance needs.

Control Groups

Finally, a well-grounded analysis of the personal situation and behavior of the mobility limited calls for a comparison of the target group with a control group. For this purpose, control groups must be defined. The control group must have an analogous data set and (depending on the given research topic) must be determined in as differentiated a combination of potential characteristics as possible.

When studying the mobility limited, one can, for example, use suitable demographic data on all handicapped persons to depict a multidimensional matrix and select the analogous number of nonhandicapped persons for each occupied matrix cell (11). When the number of cell occupants varies, weighting can

be used for purposes of comparison. This comparison should be extended to include the other persons living in the same households (as was done in a pilot study discussed briefly later in this paper).

RESULTS FOR CONCEPTION OF EMPIRICAL SURVEYS ON THE MOBILITY LIMITED

Goal of Pilot Study

The pilot study described here attempts to determine representative data. Due to the serious methodological problems confronted in collecting such data and the considerable funds that are needed for a survey of this sort, it was of primary importance to show that a suitable concept makes it possible to collect valid data at a reasonable cost. Thus, the study was to serve as an example, not to collect all of the data that would be needed for a complete analysis of the problem.

Therefore, the research goal was limited to the determination of mobility as defined at the beginning of this paper. Both of the major prerequisites for the collection of valid, representative data for the study of the mobility limited--the reliable determination of the out-of-home activity pattern and the careful identification of the target group--were taken into consideration. The most important problems confronted with respect to both of these requirements were mentioned in the last section of the paper and will not be discussed further here.

Estimation of Mistakes

If one looks at the factors that influence the results of empirical measurement, one can differentiate between random errors and systematic biases. Random errors are usually a result of the statistical significance of the sample; it is expensive to reduce these errors. But these random errors occur within a relatively narrow range even when a comparatively small sample is used. Thus, if the percentage of the handicapped in the population were hypothetically 5 percent, the coincidental range of fluctuation in a sample of 5000 persons is ± 0.6 percent (safety factor of $z = 2$) and can only be halved if the sample is quadrupled.

This is not so for systematic biases. Systematic biases are usually caused by (a) the selection of nonrepresentative samples (e.g., as a result of using the records of various types of organizations), (b) the choice of the survey method (mail-back or personal interviews), (c) the design of the survey instruments, (d) the organizational execution of the survey, (e) the manner in which the data are prepared, and (f) the type of data processing used.

Although the above bias sources--in contrast to the random errors--can be reduced by using comparatively cost-effective measures, there is little critical awareness of the systematic biases. The result is usually a one-dimensional evaluation of the validity of such surveys in view of the survey instrument. The much more important question of the validity of the results is usually ignored.

This is even more unfortunate, since the systematic bias is usually much more important than the random errors and is, moreover, included in the evaluation of mistakes in a squared form. The long-range effects of systematic bias have frequently been proved. Three examples from the pilot study illustrate the problem:

1. In surveys of persons who need nursing care (12,13), only about two-thirds of the persons who claimed to have such a need were identified, in the in-depth interviews, as actually needing nursing.

Table 1. Out-of-home mobility of persons who need nursing on average day of week by method of data measurement.

Measurement Method	Persons Who Need Nursing (%)			
	Total	Confined to Bed	Very Limited Mobility	Basically Mobile
Self-estimation of average behavior	56	17	27	73
Recall measurement	40	3	7	62
Entries in diaries	38	2	15	55

This is an important factor to consider when one uses the records of various types of organizations for the handicapped.

2. In determining the out-of-home activity patterns of those persons who needed nursing care, the different forms of data collection resulted in clearly inconsistent results (see Table 1). The mobility on the day of sampling was underestimated by more than 40 percent for average behavior.

3. In a survey on the mobility of senior citizens (over 65 years of age), the design of the questionnaire layout resulted in an underestimation of out-of-home activities by almost 20 percent.

These sources of error are so important that they clearly indicate what the main goal of pertinent methodological considerations should be, but it seems to be in the nature of applied mobility research to usually neglect these factors.

Methods of Simplification

The above discussion has shown that very large samples might offer a greater statistical significance, but they do not exclude biases per se. In view of the considerable effects of such systematic biases on the results of the surveys, research should concentrate on reducing these biases; it would then be possible to use smaller samples. However, costs are considerable even when this is done.

Another cost-effective simplification can be used in dealing with the mobility limited. Data from the mobility surveys that are available in most countries can be used. These surveys are relatively regular, and the samples are comparatively large. By studying these data sources, it is possible to identify persons suspected of being handicapped and to specifically question these persons (12,13). The necessary separation of both surveys is thus a given methodological prerequisite for valid data bases. Generally, this makes it possible to triple or quadruple the number of "lucky hits" so that a proportionally smaller sample size is sufficient. At the same time, a relatively small control sample makes it possible to identify and, when necessary, correct the bias. Finally, the mobility data for the pertinent control groups are then available so that this sample does not have to be separately drawn. How well a method of this type can be applied is shown in the pilot study discussed in the following sections of this paper.

PILOT STUDY

Foundations

In the years 1975-1977, the Representative Continuous Survey on Transportation Behavior (KONTIV) was done for the Ministry of Transport of the Federal Republic of Germany. For a period of 24 months, data were collected on all out-of-home activities of persons over 10 years of age in the representative

sample households. All of the households were asked to record their activities for a stretch of 2 or 3 days. In the total, German residents and all subgroups including the handicapped and their families were studied. Although no specific questions on handicaps were asked, some persons voluntarily noted that they were handicapped in order to explain their out-of-home activity patterns. When such information was not volunteered, the entire data set of a person sometimes suggested that it was likely that he or she was handicapped.

These facts were used as a basis for a study done for the German Ministry of Youth, Family, and Health (12) to select the target group of "persons living at home who need nursing" from the KONTIV sample. The results are summarized below:

Degree of Mobility Limitation	Percentage	Accumulated Percentage
Very great	3.4	
Great	24.3	27.7
Less great	34.5	62.2
Some	24.2	86.4
None	13.6	100.0

About 86 percent of the selected group proved to be mobility limited. This does not include all mobility-limited persons--for instance, frail older persons who sometimes need help but do not need constant nursing. However, the large percentage of the mobility limited led to the conclusion that the mobility of handicapped persons who participated in out-of-home activities should be studied along with the pilot group of "persons living at home who need nursing". This approach seems to be especially adequate because, in the study mentioned above, it was possible to collect valid representative data for persons who need nursing by using several survey steps and applying a special methodological approach (12,13).

Task

It was the methodological task of the pilot study discussed here to combine both of the data sets mentioned above and to evaluate these data. For this purpose, the available data on mobility were integrated with the data base that was later selected on persons who need nursing. This special manner of evaluating data without doing a new survey was possible because both of the surveys that were used had collected data that guaranteed accuracy. However, in order to combine and integrate the data, a series of intensive and partly manual sorting and coding steps was necessary. These steps were completed by using a weighting and grossing up procedure.

Target Group and Definition of Control Group

The target group of persons living at home (i.e., not in hospitals, nursing homes, or other institutions) who need care is not at all homogeneous. In order to study the mobility of the target persons and the nature of their handicaps, the target group had to be divided into the following subgroups:

1. Persons confined to bed, i.e., those persons who need nursing and spend all day, or most of the day, in bed;
2. Persons with very limited mobility, i.e., those persons who need nursing and are not confined to bed but leave their homes only as an exception to the rule; and
3. Persons who are basically mobile, i.e., per-

sons who need nursing but are generally able to leave their homes (these persons are not differentiated according to the conditions pertaining to their mobility; i.e., this group includes persons who are permanently confined to wheelchairs, but are mobile, as well as persons who need to be accompanied on their trips by other persons).

Since the target group differs considerably from the population as a whole in a number of (predominantly) sociodemographic characteristics, it was necessary to select a control group in which the sociodemographic characteristics of the persons included were similar to those of the target group. The following sociodemographic characteristics were identified as important: age, sex, marital status, occupation, size of household, and size of community. The results would have been particularly distorted had the ages of the target group and the control group not been comparable; while 66 percent of all persons who need nursing are older than 64 years of age, only 16 percent of the entire population is over 64 years of age.

Results of Mobility Survey for Control Group and Persons Living at Home Who Need Nursing

On an average weekday in the Federal Republic of Germany, about three out of four persons leave their homes; on an average, 2.5 trips/day are made. Persons who need nursing make an average number of 1.1 trips/person/day. Persons in the control group make an average of 1.8 trips/day, a number of trips roughly midway between the number made by the population as a whole and the number made by persons who need nursing care. When one considers only the total population and excludes persons who need nursing and the control group, then the average mobility increases to 2.7 trips/person/day. If one considers only those persons who made trips on the sample day--i.e., those persons who were mobile--then the mobility of the persons who need nursing (with an average of 2.8 trips/day/mobile person) is close to the 3.1 trips for the mobile persons in the control group and the average for all mobile persons, which is 3.4 trips/person/day. These differences can be partly explained by the different trip chains (activity patterns). Persons who need nursing, as well as the control group, are apparently forced to combine their activities in one trip; they rarely make four or more trips, which would most likely force them to leave their homes several times. The out-of-home mobility of persons who were mobile on the day of sampling, by the number of trips made, is summarized below:

No. of Trips	Group (%)		
	Total Population	Control Group	Persons Who Need Nursing
1-2	46	55	63
3	7	9	16
>4	47	36	21

It is important to determine which persons are capable of leaving their homes. When persons are able to take part in out-of-home activities, then the mobility rate is comparatively high. However, this has nothing to do with the problems encountered while making these trips. The table below summarizes out-of-home mobility for various groups by the degree to which mobility is limited:

Table 2. Travel time for all trips made on sampling day.

Category	Total Population ^a	Control Group	Persons Who Need Nursing		
			Total	Very Limited Mobility	Basically Mobile
Total travel time for all trips made on sample day (%)					
<10 min		8	10	21	9
11-20 min		14	10	4	10
21-30 min		13	19	12	20
31-40 min		10	4	8	3
41-50 min		9	12	19	11
51-60 min		9	10	2	11
61-80 min		8	4	1	4
81-100 min		7	7	16	5
101-120 min		7	8	8	8
121-180 min		7	6	1	7
>3 h		8	4	1	4
No response (%)		1	8	6	8
Avg travel time for all trips made on random sampling day (min)	76	75	67	51	69
Avg travel time per trip (min)	22	25	28	22	29

Note: Because of the small percentage of out-of-home activities for the group "confined to bed" (2 percent), it was not included.

^aDisaggregate values not available.

No. of Trips	Group (%)			
	Control Group	Total Who Need Nursing	Very Limited Mobility	Basically Mobile
1-2	55	63	67	62
3	9	16	20	14
>4	36	21	13	24

The amount of time spent traveling tells one something about the nature of the trip. The population as a whole spends an average of 22 min on a trip; the control persons need an average of 25 min to make a trip, and the persons who need nursing take an average of 28 min to make a trip (see Table 2). The control group and the group of persons who need nursing make comparatively many pedestrian trips. For the population as a whole and persons with very limited mobility who need nursing, the difference is more than 20 percent. The value of the pedestrian trips for persons who need nursing and the control group is not reduced even if one considers all of the modes used; this shows a predominantly uniform and explainable tendency for the population as a whole in relation to the control group and persons who need nursing. The target group and the control group use fewer bicycles and mopeds (small motorcycles with a maximum speed of 25 km/h) and drive cars less frequently; they increasingly use public transportation or ride in cars as passengers (see Tables 3 and 4).

In Table 2 and subsequent Tables 3, 4, 6, and 7, weightings for all trips made by target persons are as follows:

Category	Trips Weighted
Total population	270.00
Control group	23.370
Persons who need nursing	
Total	3.674
Confined to bed	11
Very limited mobility	435
Basically mobile	3.228

Table 3. Mode of transportation used on sampling day.

Mode	Total Population ^a (%)	Control Group (%)	Persons Who Need Nursing (%)		
			Total	Very Limited Mobility	Basically Mobile
Walking	33.7	47.9	47.1	56.2	45.7
Bicycle or mofa	9.8	7.3	3.2	-	3.6
Moped or motorcycle	0.8	0.2	-	-	-
Car driver	37.1	20.0	13.3	11.1	13.7
Car passenger	10.8	9.7	18.6	10.0	19.8
Taxi	0.2	0.2	2.1	0.2	2.4
Bus	7.4	11.4	14.8	22.1	13.8
Streetcar	2.3	3.1	1.5	-	1.6
Rapid train	0.9	0.5	0.6	-	0.7
Subway	0.7	1.1	0.3	0.3	0.3
Train	1.7	1.6	1.0	-	1.1
Other	0.1	-	-	-	-
No response	0.0	0.1	3.0	0.9	3.3

Note: Because of the small percentage of out-of-home activities for the group "confined to bed" (2 percent), it was not included.

^aDisaggregate values not available.

Table 4. "Classic" and "extended" modal split.

Modal Split	Total Population ^a (%)	Control Group (%)	Persons Who Need Nursing (%)		
			Total	Very Limited Mobility	Basically Mobile
Classic					
Individual transportation	81	72	66	50	68
Public transportation	19	28	34	50	32
Extended					
Walking, bicycle, or mofa	40	48	45	56	44
Individual transportation	49	37	36	22	38
Public transportation	11	15	19	22	18

Note: Because of the small percentage of out-of-home activities for the group "confined to bed" (2 percent), it was not included.

^aDisaggregate values not available.

The percentage of walking trips made in relation to the daily average number of trips is also noteworthy. Whereas the population as a whole makes only about one-third of its trips on foot, the control group and the group of persons who need nursing make almost half of their trips on foot (see Table 5). However, since the population as a whole is generally more mobile, the absolute number of its walking trips (0.8) is higher than that of persons who need nursing (0.5). Thus, it is particularly striking that the control group makes even more walking trips in absolute numbers than the population as a whole, although the former group is less mobile than the latter. The 0.2 trips/day by public transportation made by persons who need nursing is also less than the number of such trips for the control group and the population as a whole (Table 5).

However, besides increased travel as car passengers by persons who need nursing, there is more use made of taxis (Table 3), a sign that at least some of the barriers are broken down by spending (or being forced to spend) more money. Persons who need nursing find it particularly difficult to travel by streetcar, since the stops are spread out and it is difficult for them to get into and out of the vehicle.

If one analyzes the reasons why persons make trips, it is obvious that persons who need nursing,

Table 5. Average number of trips for each mode used.

Mode	Avg No. of Trips per Day		
	All Persons in Population	All Persons in Control Group	All Persons Who Need Nursing
Walking	0.80	0.83	0.48
Public transportation	0.30	0.31	0.20
Taxi	0.00 ^a	0.00 ^a	0.02
Car driver	0.88	0.35	0.14
Car passenger	0.26	0.17	0.19
Other (e.g., bicycle)	0.25	0.13	0.03
Total	2.49	1.79	1.06

^aLess than 0.01 trips/day.

Table 6. Type of activity engaged in at trip destination.

Trip Activity	Total Population ^a (%)	Control Group (%)	Persons Who Need Nursing (%)		
			Total	Very Limited Mobility	Basically Mobile
To work	25	10	8	4	9
While at work	5	2	2	-	3
To school	8	2	3	-	3
While at school	0	0	-	-	-
Shopping, visits to doctor, etc.	28	47	39	56	37
Recreation	32	38	47	39	48
Service (escorting)	2	1	0	1	0

Note: Because of the small percentage of out-of-home activities for the group "confined to bed" (2 percent), it was not included.

^aDisaggregate values not available.

Table 7. Number of trips made on various days of the week.

Day	Total Population ^a (%)	Control Group (%)	Persons Who Need Nursing (%)		
			Total	Very Limited Mobility	Basically Mobile
Monday-Friday	78	73	65	58	65
Saturday and Sunday	22	27	35	42	35

Note: Because of the small percentage of out-of-home activities for the group "confined to bed" (2 percent), it was not included.

^aDisaggregate values not available.

as well as the persons in the control group, make relatively few work or educational trips. This is related to their socioeconomic structure. Most of the out-of-home activities of persons who need nursing revolve about recreation, shopping, and making visits to the doctor (see Table 6). Here, too, it makes sense to compare the average number of trips per activity with the control group. The average number of work trips for persons who need nursing is only half as large as the number for the control group. Even the number of recreational trips is considerably less for persons who need nursing than for the control group.

The given mobility deficit can be analyzed even more precisely when one differentiates between trips made on different days of the week. On each of the first four days of the week (Monday through Thursday), persons who need nursing make 10 percent of their trips--i.e., a total of 40 percent of their trips. Thus, these persons make more than half of their trips on "three-day weekends", a considerably larger percentage than that for the control group and the population as a whole (see Table 7). This can be explained by the fact that persons who need

Table 8. Out-of-home mobility of all target persons on day of random sampling by number of trips made.

Mobility of Persons Interviewed	Total Population (%)	Control Group (%)	Persons Who Need Nursing (%)			
			Total	Confined to Bed ^a	Very Limited Mobility	Basically Mobile
No out-of-home activities on sampling day	27	42	62	98	85	45
No. of out-of-home activities on sampling day (trips)	73	58	38	2	15	55
1	1	1	1	-	-	2
2	33	32	23	2	10	32
3	5	5	6	-	3	8
4	19	12	5	-	2	7
5	4	3	1	-	-	1
6	7	4	2	-	0	4
≥7	4	2	1	-	0	1
Avg no. of trips per day						
All persons	2.49	1.79	1.06	0.04	0.39	1.53
Mobile persons	3.43	3.06	2.77	2.00	2.56	2.80

Note: Random sampling days for target persons weighted as follows: Total population, 108.00; control group, 13.045; total persons who need nursing, 3.451; persons confined to bed, 209; persons with very limited mobility, 1.130; and persons who are basically mobile, 2.112.

^aBecause of the small percentage of this group's out-of-home activities (2 percent), it was not included.

nursing find it easier to get the needed escorts to make their trips on weekends than during the week. These results are reinforced by the analysis of the various target-group subgroups listed earlier in this paper. As expected, there were considerable differences among the subgroups in the number of trips made and the reasons for traveling.

COMPARISON WITH OTHER SURVEYS

Surveys on the mobility of specific target groups (or for the population as a whole) call for specific survey requirements that cannot usually be (totally) fulfilled. Therefore, the previous sections of this paper have attempted to pinpoint some of the most problematical aspects of such surveys: for example, the type of sample (drawing a random sample from the population rather than using the records of various organizations for the handicapped), the research concept (multistage survey), the survey method (mail-back questionnaires or personal interviews), the definition of the target group and its subgroups, and the collection of data on actual behavior (use of diaries to determine behavior on the sampling day instead of directly questioning persons on their "average behavior").

However, this does not suffice to explain the mobility of persons who need nursing and who live at home. Quantitative data do not give one any information about the personal situations of the persons questioned, the circumstances under which trips were made and, most important of all, the mobility deficit. The method described in the previous section of this paper comparing the target group with a comparable control group does explain mobility. Due to the given situation, this was, in fact, the only solution to the problem. Thus, the difference between the mobility of persons who need nursing and that of the control group can be assumed to depict the average extent of the mobility deficit for persons who need nursing. Since the possible mobility deficit of the control group was unknown, it was not taken into consideration. The great importance of empirical know-how and its incorporation in surveys is shown in surveys that measured mobility by using the self-evaluations of interviewees. When this method was used, the persons questioned tended to exaggerate their own mobility. Persons who needed nursing, for instance, estimated their own mobility to be as high as it was actually proved to be for the control group (see Tables 1 and 8). But a comparison of the self-estimated mobility of persons who need nursing with the mobility recorded

in the diaries suggests that the estimated values reflect wishful thinking and not actual mobility. Thus, it proved to be especially useful to use the control group as a comparison with the group of persons who need nursing in order to estimate the mobility deficit.

When a survey strictly adheres to the principles mentioned above, the mobility of persons who need nursing can be determined. In summary, one can say that, in relation to their out-of-home activities, persons who need nursing are a heterogeneous group: The number of their daily trips varies. Persons with radically limited mobility make 20 percent as many trips as the control group, whereas persons who need nursing and are basically mobile make 90 percent as many trips as the control group.

The main reasons for leaving the house are recreational (e.g., taking walks) and for shopping and visiting the doctor. When vehicles are used, the persons who need nursing prefer to ride as passengers in cars: They travel as passengers in cars 100 percent more frequently than the control group. The bus is also a preferred mode. Persons who need nursing use taxis 10 times more frequently than the control group. Transportation planners should realize that persons with very limited mobility do not (cannot) use rail transportation, with the exception of the subway.

FURTHER CONSIDERATIONS

Experience has shown that the realization of adequate research concepts depends, to a large extent, on whether the interested parties--i.e., the handicapped themselves, persons and organizations representing the concerns of the handicapped, and researchers--succeed in making clear the needs of the handicapped to those persons responsible for making political and/or administrative decisions. This is especially true since valid concepts to solve conceptual and methodological problems are already available but are not yet used to the extent that would be desirable. In the long run, further basic (methodological) research will be necessary to stimulate applied research. It should be possible to change the present climate of opinion for the better since the present high costs for research could ultimately be lowered by using increasingly efficient measures. The declaration of 1981 as the United Nations Year of the Handicapped will certainly give a new impetus to these efforts. One aspect of the problem discussed in this paper--the potential increase in the mobility of mobil-

ity-limited (handicapped) persons--was already a topic at the 1980 European Transportation Minister's Conference.

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Comparison of Two Brokerages: Lessons to Be Learned from Houston and Pittsburgh

SANDRA ROSENBLOOM AND DAVID WARREN

An examination is presented of two similar transportation systems that were designed to test two assumptions: (a) that transportation services can be provided to the elderly and the handicapped more effectively and efficiently when coordinated by a single agency than when provided by conventional, fragmented systems and (b) that specialized or paratransit services are the most appropriate way to meet the transportation needs of elderly and handicapped clients. The two communities involved are Houston, Texas, and Pittsburgh, Pennsylvania. Each community developed a brokerage system to deliver services to elderly and handicapped clients in its service area. The experiences of both systems with regard to costs, fares, ridership patterns, operational experiences, and goals and objectives are discussed. An examination of the important differences and similarities in the two systems and an evaluation of the important and transferable findings that follow from that examination are provided.

There are two complementary trends developing in the U.S. transportation planning community. The first is the serious consideration of coordinated approaches to the delivery of transportation services to elderly and handicapped travelers, particularly those who are clients of human- and social-service agencies. A related trend is the growing belief that it is more effective to provide accessible transportation services to the handicapped, not through physical modifications to existing transit fixed-route coaches but through the provision of specialized and responsive paratransit services.

These trends have been recognized by Congress but

in different ways. Some federal agencies, like the Administration on Aging, have specific congressional requirements that mandate coordination of all services provided. On the other hand, the U.S. Department of Transportation (DOT) currently mandates that transit systems must make their programs accessible to the handicapped by providing wheelchair lifts on fixed-route services rather than by providing paratransit services.

Two major regional transit authorities in very different parts of the country have taken remarkably similar actions to test two assumptions that have grown out of these complementary trends. The first assumption being tested is that coordinated approaches to transportation delivery are more efficient and effective than ad hoc, fragmented transportation services. The second assumption is that specialized services rather than accessible, fixed-route services are the most appropriate way to meet the needs of the elderly and the handicapped of a community. Both the Port Authority of Allegheny County (PAT) in Pittsburgh, Pennsylvania, and the Metropolitan Transit Authority (MTA) of Houston, Texas, have developed innovative and comprehensive ways of meeting the objectives embodied in these assumptions.

Of the two efforts, the Pittsburgh experience is by far the better known. The coordinated effort in

Pittsburgh is funded in part by an Urban Mass Transportation Administration (UMTA) Service and Methods Demonstration grant, and project activities are being monitored by the Transportation Systems Center of DOT. Thus, there are reports and published documentation of the experiences in Pittsburgh. However, to this date there has been no widespread documentation of the Houston experience.

We believe that information on the Houston experience will be most useful if it is presented in comparison with the Pittsburgh experience. In this way, the transportation planning community will be able to see what coordination experiences have general applicability and are potentially transferable.

This paper first discusses the operation and service characteristics of the Houston and Pittsburgh systems. It then describes any transferable conclusions that can be made about implementing large-scale coordinated services for the handicapped. Last, the paper describes what the experiences of the two cities tell us about the two basic assumptions underlying recent statutory and regulatory trends.

BASIC BACKGROUND

Description of Transit Service Areas

Pittsburgh is the urban center of Allegheny County. Pittsburgh was a city of 442 139 in 1977, a 15 percent decrease in population since 1970. The population of the county was 1 493 272 in 1971, a 7 percent decrease since 1970. The regional transportation system, PAT, serves the entire county. PAT has no buses equipped with wheelchair lifts. Its last vehicle acquisition is thought to be the last non-wheelchair-equipped purchase by any transit property in the United States. The PAT service area is roughly 734 miles².

Houston is the urban center of Harris County. Houston is one of the largest cities in the United States, and its growth rate is seven times the national average. The 1979 city population is estimated at 1 737 000, and the population of the county is estimated at 2 460 000. The regional transit system serving Harris County and parts of adjoining counties is MTA, which was formed with voter approval in 1978. MTA is financed in part by a \$0.01 sales tax imposed in the region. The MTA service area is more than 1700 miles². It currently operates 355 peak-hour transit coaches, 326 of which have wheelchair lifts. However, no lift-equipped service is provided as a matter of MTA policy.

Brokerages

The coordinated paratransit services provided by both the Pittsburgh and Houston transit properties are "brokerages". Neither system owns or directly operates any of the vehicles that provide specialized services to handicapped individuals. Instead, both systems contract with existing community transportation providers, both profit and nonprofit, to provide services in the vehicles already owned by those agencies (although some agencies in each city have purchased additional vehicles to provide continuing contract services). In Pittsburgh, PAT has contracted with a private firm, ACCESS (a wholly owned subsidiary of Multisystems, Inc.), to act as a third-party broker; all contracts for service are with this organization and not directly with PAT. In Houston, MTA itself acts as the broker for the specialized service, Metrolift.

Both systems were conceived and organized in response to the UMTA Section 16 requirement (Urban Mass Transportation Act of 1964, as amended) that

transit properties make "special efforts", roughly equal to 5 percent of their operating assistance, to provide services to handicapped and elderly travelers. Both transit systems would like to continue the brokerages as their response to the UMTA Section 504 accessibility requirements (Rehabilitation Act of 1973, as amended).

Both agencies purchase service from providers through contracts based largely on a vehicle-hour charge. Both agencies, however, pay some taxi-meter charges occasionally. Each brokerage serves city or regional residents who meet certain eligibility criteria. Both systems also serve the possibly non-eligible clients of social- and human-service agencies that contract with the brokerage (Houston) or make advance billing arrangements (Pittsburgh). Both systems have negotiated varying rates for different agencies that purchase services for their clients. Both systems pay varying rates to the different transportation service providers with whom they contract. Houston never had any Section 13c (Urban Mass Transportation Act of 1964, as amended) labor protection difficulty. Pittsburgh did initially have difficulty.

COMPARATIVE SERVICE CHARACTERISTICS

There are great similarities in the general characteristics of the two systems. The following section compares and contrasts the specific ridership experiences and service and operation characteristics of the two systems.

Level of Service and Fares

The Houston Metrolift provides 24-h advance notice, curb-to-curb service for eligible riders five days per week. Eligible city riders pay a fare of \$0.50 or \$1.00, depending on trip length. Clients provided service because their agency has a contract with Metrolift do not pay any fare; their agencies are billed monthly. The rates charged for agency clients are negotiated separately with each agency; they currently range from \$0.50 to \$5.00/one-way passenger trip.

Metrolift has no formal trip-limitation policy. However, the system is at capacity for the busiest times of the day because routine and recurring trips, such as school, work, and medical (dialysis) trips, have effectively used all available capacity. Thus, occasional and demand-responsive trips often cannot be accommodated at the time originally requested. Users are then asked to reschedule these less routine trips to take advantage of available space. Some survey data indicate that 30 percent of all callers are never served at all because of this capacity problem.

Pittsburgh offers a much higher level of service at a higher user fare and a higher charge to contracting agencies than Houston. As in Houston, Pittsburgh agencies may purchase service for their possibly ineligible clients; these agencies, too, are billed monthly. ACCESS offers a door-to-door service seven days a week. The system has no capacity problem. All requested trips are accommodated--if not in the dedicated contract vehicles, then in full-fare taxis. Although ACCESS has relatively strict criteria for subsidy eligibility (discussed in the next section of this paper), there are no trip limitations once a user is certified as eligible (either subsidized or not).

ACCESS fares are computed from a zone-based fare schedule calculated to produce revenue equivalent to predicted costs. There are 195 zones in the ACCESS service area, and fares are based on the airline distance between the centers of the zones (some ad-

justments are made for geographic barriers, etc.). The minimum fare (even for an intrazone trip) is \$2.00; each additional zone is \$1.50/airline mile.

Those Pittsburgh citizens who qualify for the service but who are not traveling under the sponsorship of an agency are told what their fare will be when they call and describe their origins and destinations. Fares to the rider theoretically can range from \$2.00 to \$43.00/trip for unsubsidized passengers and from \$0.50 to \$10.00 for those subsidized directly by PAT. However, in September 1980 the average trip length was 5.5 miles; the average fare to the nonagency was between \$6.00 and \$7.00.

Service Arrangements

Houston

Metrolift currently contracts with one private transportation provider and three not-for-profit providers. MTA also contracts with the private provider, Yellow Cab, to receive all client calls and to provide dispatching and routing services for all four operators. A provider may be asked to serve any part of the large Houston region. However, all providers are scheduled to take advantage of their starting location.

The size of the vehicle fleet of the various providers differs, ranging from 2 vehicles for the not-for-profit operator to 20 vehicles for the contractor who provides transportation for local congregate meals for the elderly. Not all vehicles are lift-equipped or radio-equipped, which severely limits the way in which Metrolift can use them.

Metrolift currently provides more scheduled and fixed-route trips than demand-responsive trips. In order to accommodate the limitations imposed by non-radio-equipped vans, Metrolift preroutes and preschedules many provider's trips as much as a week in advance. These routes or itineraries can be changed up to the day before service, but the vehicles cannot be "dynamically" rerouted to take advantage of excess capacity while in operation. The inability to respond in "real time" explains in part why the system has to turn riders away or reschedule their trips.

In addition, Metrolift has a very high no-show record. The staff believes this rate could be lowered if all vehicles were equipped with radios. The MTA staff is urging all contractors to buy radios to lower the no-show rate and to increase overall system efficiency.

The large private taxi operator provides service in dedicated lift-equipped vehicles. The nonprofit providers technically only dedicate their vehicles for the time purchased from them by MTA. Earlier attempts to use regular-service taxis for at least semiambulatory passengers were not successful. Most taxi drivers in Houston are independents, not employees; they operate under the franchise given to a large company. Such independents cannot be obliged to serve contracted trips if more attractive trips are available. The only way Yellow Cab or most Houston taxi companies could guarantee service is to hire drivers as employees and use dedicated vehicles.

MTA purchases service from its contract providers on a vehicle-hour basis. Currently, the private operator, Yellow Cab, is paid \$12.36/vehicle-h and no maximum level is specified; backup service can be provided in regular taxis at the meter rate. (This service is provided only when a person with a scheduled trip has been missed, not to provide extra capacity.) The other providers are paid either \$12.00 or \$12.36/h, depending on when their contract was renegotiated; most have a minimum daily guarantee as to whether their vehicles are used or not.

All transportation providers or systems in the region were invited via a request for proposals (RFP) to propose service in the initial round of Metrolift contracting. This first RFP was relatively informal; the MTA staff worked with all interested bidders to assist them in estimating their ability to provide service and the costs they would incur in doing so. MTA was able to accept all interested bidders in its first RFP process. One large social-service system, however, was forced to cancel its contract after a few months of operation.

MTA plans to inaugurate a more vigorous bidding process in its next round of RFPs. In that phase, interested agencies will be required to submit and, if successful, adopt some standardized cost and ridership reporting forms.

Pittsburgh

ACCESS also requested agencies to bid on proposed services but in a different fashion. The county was divided into 31 bid sectors, and operators were requested to indicate interest in one or more of those sectors. Interested profit and nonprofit providers were requested to submit a statement of qualifications (RFQ) and to rank the sectors in which they wished to provide service. Then, finally, ACCESS began negotiations over costs.

This RFQ approach ensured that some of the small but active nonprofit providers would be able to bid for a manageable share of the ACCESS service. Like MTA, ACCESS was required to work with potential bidders before they submitted bids to ensure that those agencies understood their own cost patterns and their potential service capability.

ACCESS currently has seven contract providers or carriers, three taxi operators, and four not-for-profit carriers (this has changed over the past year). The intent was to have two types of carriers, those serving long-distance trips and those serving local trips. Actually, cooperative arrangements have been worked out to optimize the efficiency of the system. These arrangements gave the system the capability to handle a Yellow Cab strike (Yellow Cab carries 40 percent of all passengers) with only a 10 percent decrease in ridership.

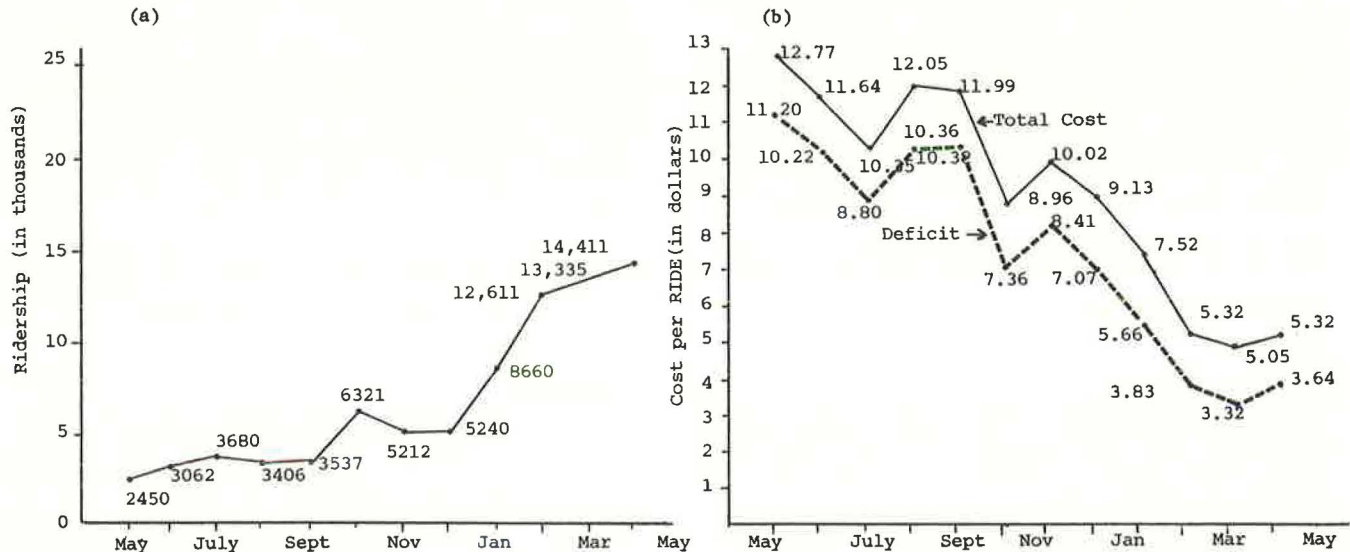
In Pittsburgh, because of the basic geographic breakdown, central dispatching services are not required. Non-agency-sponsored clients simply call the carriers in their respective areas (independent of the destination of their trip). Most individual or nonsponsored trips are directly scheduled by the rider with the appropriate carrier. If the individual does not know how to contact the appropriate provider, he or she can call the ACCESS office and the call will be properly transferred.

When agency-sponsored clients travel, the sponsoring agency calls the central ACCESS office and the ACCESS staff notifies the appropriate carrier. Individuals whose fares are agency-sponsored are not allowed to call ACCESS or any of its carriers directly.

Contract carriers provide service in a mixture of dedicated and nondedicated vehicles. The ACCESS staff has been encouraging carriers to use regular vehicles not dedicated to the ACCESS service, but this is not always possible for lift-equipped providers.

ACCESS is billed by some carriers on a negotiated vehicle-hour basis and by some, but not all, taxi operators on the basis of full taxi-meter fares. Reimbursement rates differ markedly. In September 1980, the taxi contracts ranged from \$11.75 to \$13.50/vehicle-h. Nonprofit operators were charging ACCESS from \$10.08 to \$13.80/vehicle-h.

Figure 1. May 1980 Metrolift monthly progress report: (a) monthly ridership and (b) monthly total cost per ride and monthly deficit per ride.



Eligibility Requirements for Service and Ridership Patterns

Houston

All residents of the MTA service area who cannot use fixed-route transit for physical or functional reasons are eligible for the Metrolift service. They must submit some form of written proof of their disability (a doctor's note is sufficient) and an application to MTA; when their application is approved, they must purchase (at full price) a book of \$0.50/ride coupons. Drivers are not allowed to take money from riders.

Agencies may also purchase service for otherwise ineligible clients from MTA. Many people qualify for these agency-delivered services on the basis of other than physical disabilities; age, residence in certain geographic areas, and low income level are common criteria. But many of these criteria do not make them eligible for the MTA Metrolift service. However, MTA wanted to make it possible for agencies to purchase service for these clients from MTA.

Some agencies also purchase service for clients that are (or might be) eligible for Metrolift service. These agencies are often charged a higher cost per trip than the basic \$0.50 fare. These agencies do so in order to ensure reliable service and to help the brokerage grow. Technically, there is nothing to stop the agency from purchasing the same book of \$0.50 coupons available to all eligible clients and letting their clients ride for \$0.50. MTA has tried to establish its contract rates (at least in part) to encourage agencies to purchase service for clients rather than "dumping" them on the system for \$0.50/ride.

MTA has assumed the burden of subsidizing all transportation services delivered above a certain trip ceiling rate. MTA sales tax set-aside is used for this purpose. The ceiling rates are negotiated with each agency and involve such considerations as trip distance, trip time, trip densities, and client type. The single most important criterion is the available financial resources of the agency. Any trip costs above the ceiling rate are incurred by MTA and not by the provider.

These currently negotiated rates range from \$0.85/one-way trip for the area agency on aging to \$5.00/trip for the regional office of the state Department of Human Resources (DHR). The area agency

on aging requires service to congregate meal sites for its clients; these trips are many-to-one and can easily be scheduled. DHR requires medical trip service for its Medicaid recipients; these are usually demand-responsive, random trips and are not nearly so easy or inexpensive to serve.

The single most unique feature of the MTA "contractual" arrangements with agencies is that the same agency may both sell transportation services to Metrolift and buy transportation service from MTA. MTA is paying some agencies to carry their own clients (plus others) at a contractual charge (ceiling rate) lower than the cost the agency previously incurred in providing direct service! In addition, these agencies generally make money on the additional transportation service provision they sell to Metrolift. This unique arrangement has encouraged several reluctant agencies to participate.

Metrolift ridership has been growing steadily. In May 1979, the Metrolift program carried 2450 one-way passenger trips; by December of 1980, with about half of the congregate meal sites being provided transportation under contract to the area agency on aging, ridership had increased to 5240 one-way trips! Figure 1 shows the rapid increase in total ridership and how that increased ridership has led to a decreased per-passenger deficit.

This rapid growth in ridership has occurred for two reasons. The major reason is that Metrolift has been absorbing other agency programs through service contracts. The largest addition has been all the meal sites of the area agency on aging. The second major reason is that ridership with the various contract programs grew very slowly at first but is growing more rapidly now that system improvements have been made. The net result is an increase in ridership of more than 700 percent in the first year while the cost per rider to MTA has dropped almost 75 percent.

It should be noted that, because of its continued assured funding source and its determination to grow, MTA has made a vigorous effort to involve any potential participants. The MTA strategy has involved willingness to permit hesitant participants to incur a fairly large MTA subsidy per client trip.

Pittsburgh

All elderly and handicapped citizens in the ACCESS

service area are eligible for the service; however, only those citizens so disabled that they cannot use regular PAT service are eligible for the PAT subsidized fare. Individuals who wish to be certified for eligibility for this subsidy make an appointment with the Easter Seal Society, which is under contract to ACCESS to screen applicants. The association uses a mock-up of the front end of a regular transit coach; if an individual cannot mount the first step, he or she is certified as eligible for the subsidized fare. Approximately two-thirds of those so certified are in wheelchairs; the other third use walkers or other devices and are semi-ambulatory (note that certification patterns are not equivalent to ridership patterns). By October 1980, ACCESS had certified more than 1800 persons for the fare subsidy.

Those riders eligible for the PAT subsidy (a directed user-side subsidy) purchase a book of ride tickets or scrip for 25 percent of the face value. They use this discounted scrip to pay the full fare when they purchase a ride with ACCESS. ACCESS carriers and drivers are not permitted to take money from clients.

Some elderly and/or handicapped people are eligible to use ACCESS service without subsidy. The response has not been great. The travel rate of such individuals has been increasing slightly because there are some savings over full meter taxi fare for many trips. In January 1980, 200 unsubsidized, nonagency ACCESS trips were taken; that number grew to a little more than 300 in both the months of June (346) and July (326). (The actual number of individuals is not available.) PAT staff feel that that number is a seasonal high that will drop through the winter months. Preliminary surveys indicate that these riders are elderly travelers who are slightly "better off".

In Pittsburgh, as in Houston, various agencies may purchase service from ACCESS for their own clients. ACCESS is not worried that agencies will "dump" clients onto the system because the eligibility requirements for subsidized fares are so stringent that many clients will not qualify. PAT staff feel that those clients who do qualify should be allowed to use ACCESS in preference to their agency transportation.

ACCESS has tried to be very flexible and responsive to the needs of agencies. An agency may have a formal contract for service (as does the area agency on aging) or simply an oral or written understanding that sets up a monthly charge account. Agency-sponsored trips are generally based on the same fare schedule used to compute all other trips; that schedule was designed to reflect shared-ride service characteristics. However, many trips are not shared-ride simply because demand patterns do not allow such grouping. Several agencies noted this phenomenon and asked for discounts when more than one of their clients rode together. To accommodate the objections of those agencies, discounts were allowed.

ACCESS discounts allow a certain percentage of savings over the computed fare for each agency client who rides with other agency clients. That percentage discount only continues to the point where that figure equals the vehicle-hour charge that ACCESS is paying to its contractor; at that point, the agency is simply charged the vehicle-hour charge as the fare for all clients. The procedure is designed to prove that ACCESS policy is that everyone, including agencies, should pay the full cost of transporting their clients.

Agency-sponsored trips have been growing as a percentage of total trips; as in Houston, the involvement of the area agency on aging substantially

Table 1. ACCESS ridership pattern.

Rider Category	One-Way Trips per Month	Percentage of Total Ridership
Certified ACCESS cardholders		
Wheelchair-bound	1970	27.4
Other	2227	31.0
Noncertified elderly and/or handicapped and agency clients		
Wheelchair-bound	900	12.5
Other	2097	29.1
Total	7197	

increased total ridership. Unlike the Houston agency, however, the Pittsburgh agency did not contract for its group transportation needs but rather for demand-responsive medical trips. Table 1 gives the ridership patterns of ACCESS during May 1980, before 5000 one-way passenger trips by the agency on aging were added. Since very few of these riders are in wheelchairs, the percentage of wheelchair-bound individuals should drop by almost a third. Figure 2 shows the impact of increased agency involvement on total ACCESS ridership but prior to the full involvement of the area agency on aging.

Costs

Both MTA and PAT hoped to make the transportation portion of the service self-sufficient; neither has realized that goal.

Houston

Overall, the Metrolift program currently returns about 25 percent of its direct transportation costs to MTA, although the deficit per passenger has been decreasing rapidly (as Figure 1b shows). In May 1979, the average deficit per one-way passenger trip was \$11.20; by November it had dropped to \$3.84. These costs do not, however, include the value of MTA staff time and resources devoted to the Metrolift service.

From May 1979 to May 1980, approximately \$750 000 was spent on delivery of contract service in the Metrolift program, including routing and scheduling. MTA staff and overhead committed to the program for this period of time cost approximately \$75 000, which brings the total annual cost to approximately \$825 000.

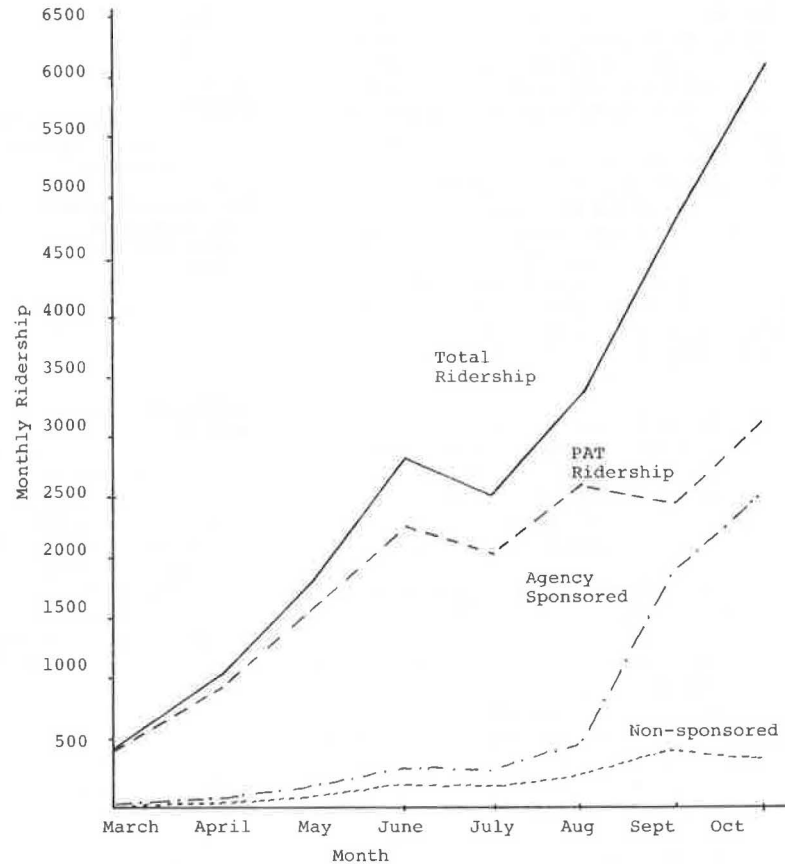
In Metrolift, the average revenue per passenger for the first year was roughly \$1.60. The staff expects that revenue per passenger will drop slightly as additional agencies are brought into the program. In general, most newer programs will pay lower negotiated ceiling rates. MTA will negotiate such rates again in part to encourage additional participation. In addition, as participation grows there will be increased eligibility overlap for any given client. Thus, agencies may start to purchase \$0.50 coupons for their clients if they are not given an advantageous fare.

Total revenues, however, are expected to increase, and costs per passenger are expected to drop as efficiency rises. The staff expects a revenue return to MTA of from 30 to 50 percent in the next stage of the program.

Pittsburgh

In September 1980, ACCESS incurred direct transportation costs of \$110 000 and administration costs (both PAT and ACCESS) of approximately \$23 000. In

Figure 2. ACCESS system ridership by agency.



that month, 12 162 one-way passenger trips were delivered (including 880 escort trips). Overall, ACCESS recovered approximately 60 percent of all direct transportation costs during September or 50 percent of total costs (including administration and overhead).

It is important to keep one point firmly in mind in discussing Pittsburgh's revenues and deficits per passenger. All ACCESS revenue figures include the already subsidized fares paid by PAT clients. Therefore, the kind of data on deficits or subsidy per passenger that would be comparable to Houston's (or any other city's) figures are not immediately available. In short, the full cost of the ACCESS system is not reflected in the system deficit figures presented above.

In September 1980, ACCESS revenue comprised almost \$45 000 in agency-paid fares or billings, \$1100 in unsubsidized (by PAT) redeemed scrip, and \$20 200 in redeemed PAT-subsidized scrip. Of that \$20 200, PAT paid ACCESS 75 percent or approximately \$15 000.

This arrangement was designed (a) to allow the brokerage to work at its highest efficiency without being compromised in the long run by the client-subsidy issue and (b) to allow PAT to give a directed, specific client subsidy without giving a system subsidy.

Like MTA, ACCESS average costs and deficits are dropping. Since September 1979, ACCESS has increased total revenue by an average of \$2.17/passenger trip (which in part reflects a fare increase) and total costs per trip were down \$1.20. In September 1980, average total revenue per passenger was \$5.88 (including PAT subsidies); average total cost per one-way passenger trip was \$11.82.

Operational Differences and Similarities

While there are many significant differences between the operational practices and the ridership experiences of both systems, there are some similarities that are important to note.

Similarities

Both systems made every attempt to involve a wide variety of local transportation providers. Both systems used a bid process to encourage the involvement of all potential transportation providers in the community; this was both a system objective and a sound political move. Both systems had to work with smaller, generally not-for-profit providers to help them see their potential strengths and weaknesses in the brokerage system. Both systems made some allowances for less sophisticated operators. The award of contracts met some nonefficiency criteria. In particular, both systems involved more costly nonprofit providers in order to gain the trust of the community and to prove that the quality of service was important to them.

Both systems were interested initially in the involvement of the area agency on aging; both systems had to wait for that involvement. In both systems, the participation of the agency has made a tremendous difference in the total cost and ridership pattern. The MTA rationale was very different from that of ACCESS, however. MTA wanted the area agency on aging to participate in order to fully and efficiently use the large vehicle fleet of agency subcontractors.

Both systems hoped to eventually break even, al-

though MTA started with a much greater "loss-leader" policy. ACCESS tried to determine its break-even point from the inception of the service.

Because both systems expect to break even eventually, at least for certain services, they both make special efforts to stress to clients what the full costs of transportation are. Although Metrolift invoices to contracting agencies only call for the negotiated ceiling rate, they also list the full costs of providing agency trips so that agencies can see how much subsidy is being provided to them by MTA.

Both systems have a fare policy that allows some predictability for riders and agencies, a very necessary condition for their agency participation. The two systems use different mechanisms to achieve this. MTA sets a flat fare for all trips, whether individual or agency sponsored (although not the same rate for each agency). The ACCESS fare structure allows individuals to know exactly what a trip will cost before the vehicle comes; agencies with recurrent trips can also know what their costs are.

Both systems operate on a noncash basis; both use driver's logs and scheduling manifests to do billing. Both generally pay on a vehicle-hour basis so that any rider payment device (scrip, tickets, etc.) is in essence "funny money" to the carriers or providers (although clearly not to individual clients).

Both systems found that there were difficulties with both private and public providers. Most non-profit providers did not have the experience or expertise to schedule trips, particularly under demand-responsive conditions. On the other hand, private market providers had drawbacks as well. As previously mentioned, Houston was forced to abandon the use of regular taxis because they were too unreliable; ACCESS has used regular-fare taxis, but some dedicated vehicles were required for lift-operated service. In neither community was there any expansion in the number or the solvency of for-profit providers (as some advocates of brokerages contend that there will be).

Both systems found that they had a core of regular riders traveling frequently. Probably more than 90 percent of Houston's ridership is composed of "regulars"; approximately 75 percent of the ACCESS ridership is "core" riders. Certainly such regular ridership alleviates the scheduling problem faced by some providers.

Both systems use the brokerage mechanism to directly and indirectly support the social service community. The Pittsburgh approach is more direct; for example, ACCESS contracts with Easter Seals to do eligibility screening and uses Goodwill, Inc., as printers. Houston permits certain agencies to continue small-scale transportation services by purchasing additional agency transportation services at a profit from those agencies. The profits that these Houston agencies make on contract services to Metrolift are in turn used to maintain the vans, etc., for the kinds of semiemergency or very personal transportation services currently not well provided by Metrolift. In both cases, these activities have helped to convince the agencies of the broker's genuine interest in the human service network and its clients.

Differences Between the Two Systems

The differences between the two systems also have some important implications. Because ACCESS has no capacity limitations, it can easily handle non-routine and random trips. This probably explains why more than 30 agencies have some form of billing arrangement with ACCESS whereas only 7 agencies currently contract with Metrolift. Metrolift is at

capacity; frequently, either nonscheduled trips must be moved to another time or the individual must wait two to three days to get on the system. It is not surprising that many agencies are not able or willing to use Metrolift for their clients with these limitations. Individual riders are similarly disadvantaged.

The two systems have different approaches to the subsidy question. PAT wishes the only subsidy to be the direct 75 percent share of the fare of eligible handicapped riders; PAT staff expects (and hopes) that the system itself will eventually break even in terms of revenue meeting all costs. MTA expects that all agencies purchasing service for noneligible clients will eventually pay the full cost of transporting those clients. However, MTA has more mixed expectations with regard to agency clients who might be eligible for Metrolift as city clients; in this case, MTA is willing to allow some sort of discounted fare. In fact, MTA staff has developed a number of different discount fares to agencies, none of which really reflects the cost of transporting their clients but rather the constraints under which the agencies operate. This approach is supported by the expectation of continuing financial assistance to Metrolift.

The different approaches to the subsidy question are complemented by the two agencies' different approaches to the eligibility question. It is extremely difficult to be certified as eligible for the PAT subsidy for ACCESS. It is extremely easy for an individual to be certified as eligible for Metrolift service, which is itself heavily subsidized. MTA is considering changing its eligibility requirements; if it does, changes may be made in its billing and overall subsidy policies.

TRANSFERABLE LESSONS

Stages of Development

An analysis of ACCESS and Metrolift and their growth and development patterns has implications for other areas. It appears that brokerages grow and develop in stages. The first stage of planned effort can be called the initial consolidation stage. It may be difficult to realize or to accurately measure savings at this stage because many variables are changing at the same time. During this period, program costs can increase for both agencies and individual providers because certain expenses are allocated to transportation provision for the first time.

When ridership levels off and the consolidation of funding programs has been accomplished, a second stage begins. This stage can be characterized by service refinement, in which service operations and accountability are improved. For Metrolift, the second stage consisted of developing computer-assisted routing and scheduling and the total automation of recordkeeping. Such capabilities provide management and evaluation tools that allow better contract monitoring and allow contractors to monitor individual drivers and vehicles. Agencies that purchase service are able to monitor overall service as well as the travel of individual clients.

The final stage in development may well be the further consolidation of providers and contracting agencies. In the first and second stages, contracting agencies are typically public agencies. This third stage of consolidation could involve smaller social but nonpublic agencies. Because these smaller agencies often work very closely with their clients, they must be convinced that a large system will be able to serve client needs as well as they could do it themselves. In the first and second stages, a brokerage effort may not be able to ensure

this. In the third stage, the system should provide a much higher level of service.

Fitting Agencies to Appropriate Development Stages

Since the brokerage system has distinct development stages, certain types of agencies fit better into the system at different stages. In the first stage, a participating agency should have a good knowledge of the cost of transportation services. This knowledge can be gained either through experience in contracting for transportation services or in providing it. Generally, the necessary level of sophistication will be available in agencies that operate more than four vans. Public agencies that have Title XIX (Social Security Act) Medicaid programs sometimes have this experience. Local Easter Seal Societies often are sophisticated enough to recognize the potential benefits, financial and other, of this arrangement.

The size and sophistication of the agency that participates in the first stage are important. First, agencies must expect and be able to weather service problems that will inevitably accompany coordination attempts. The agency must understand and expect problems and work to resolve them. Smaller agencies may not be able to accommodate such disruptions without losing their clients. As a result, they would have to pull out of the effort. Poor service to smaller agencies in the first stage would discredit the effort and possibly hamper consolidation in latter stages.

It is important, therefore, in the first stage to deal with large agencies that can afford some disruption. Ironically enough, those small agencies that complain the loudest about service disruption are often not very consistent at delivering transportation to their clients. But in the brokerage system they have someone else to blame.

Finally, good first-stage agencies are those better-financed programs from which the best financial return can be realized. These will traditionally be large public agencies, although some private agencies have such financial strength.

After service is refined and made more reliable in the second and third stages, more agencies can be accommodated, given some mutual advantages. It should be cautioned that all agency demand cannot be coordinated. Geography is an important consideration. If the agency's need for geographic coverage exceeds that of the brokerage system, that need may negate any benefit from coordination.

In addition to geography, client needs are sometimes incompatible with the service provided by the system. In Metrolift, the system provides essentially curb-to-curb transportation. While currently participating agencies find this acceptable, agencies that provide more personalized or door-to-door service must either modify their service objectives or continue to provide transportation themselves.

The concept of fitting appropriate agencies into the appropriate stage of brokerage development is not a restrictive approach. Certainly, attempts should be made to accommodate any agency that shows an interest in coordination. However, the more sophisticated, larger agencies will adapt more readily to a consolidated delivery system. Smaller agencies whose business practices have traditionally been weak will require more effort by the broker so that they can operate under the system.

Essential Components for Successful Implementation

The Houston and Pittsburgh experiences suggest that four essential components are necessary to develop a transportation brokerage program:

1. A lead agency to serve as a broker and "bankroll" the developmental costs,
2. An agency that assumes the broad responsibility for serving the transportation disadvantaged,
3. Highly motivated staff to "sell" the concept to selected appropriate agencies, and
4. Time.

The key role of the lead agency--(a) to bankroll the development of the brokerage and (b) during the first stage, when it may incur large deficits--is obvious from both the Pittsburgh and Houston experiences. Less obvious is how critical are the last two components--motivated staff and time.

Initially, there may be negative reactions to coordination and consolidation and it takes a great deal of staff time to "sell" the concept. The staff must plant the seeds of the concept and let the idea be internalized by the agency leaders on whom the effort depends. The staff must maintain high visibility through meetings, participation on committees, transportation brokerage seminars, etc.

The staff must also educate small, nonprofit providers in basic aspects of transportation such as cost accounting, preventive maintenance, insurance, purchasing, and training. Some of this can be accomplished by developing an information-sharing network to take advantage of the expertise already available in the community. It has been the experience of both ACCESS and MTA that the best way to develop a coordinated system is to work individually with potential participant agencies. This allows the agency and the system to define their needs and build a relationship based on trust. Again, such efforts require a considerable commitment of time and resources.

The successful development of a brokerage program requires strong community participation, especially by public and private human service agencies. The human service sector is a complex network of agencies interconnected through an array of funding programs, personal relations, and a common desire to help people. Overcoming initial resistance also requires the commitment of personnel resources and perhaps an initial "loss-leader" fare policy.

HOW WELL THE TWO SYSTEMS MET THEIR OBJECTIVES

Both Houston and Pittsburgh were in part testing two different and important assumptions currently held in the transportation planning community. To what extent does the experience of either system uphold those assumptions?

Cost-Effectiveness of Coordination

An examination of both cities shows that coordinated transportation systems can provide better, and in some cases cheaper, services than the ad hoc systems in existence previously. Almost all of the agencies that buy transportation services from either ACCESS or Metrolift incur lower costs than they incurred or would have incurred without these systems. On the other hand, in both cases lowered costs may be the result of sizable subsidies from state, local, and federal sources to cover any system deficits. It is not clear that the actual coordination efforts undertaken by both systems are currently bringing down operating costs. In addition, the "extra" overhead generated by special project staff and consultants is considerable. This may be because both systems are only in the first stage of development, where losses are natural.

"Breaking even", however, is not necessarily a measure of cost-effectiveness. It may be that certain types of transportation for the elderly and the

handicapped simply cannot be provided so that total system costs are equivalent to revenues. The more important question, which has yet to be answered, is whether a coordination mechanism, which itself initially requires the expenditure of additional resources, in the long run either lowers the cost or increases the quality of most transportation services delivered in a community. The staffs of both Metrolift and ACCESS believe this question will eventually be answered in the affirmative.

It does appear that most agencies in both cities are receiving better service for their clients than they did before. In addition, many agencies find it easier to deal with the broker than to deal with local transportation providers directly or to own vans and provide services themselves. However, there is some self-selection involved; in both communities, agencies that already provided or received high levels or even satisfactory levels of transportation services were far less likely to purchase service from the broker. Both systems may well have attracted those agencies that were already very unhappy with their current arrangements.

Appropriateness of Specialized Services as Response to Needs of Handicapped and Elderly

Neither Pittsburgh nor Houston has provided fixed-route, accessible bus service with which to compare the specialized services provided. Yet both cities have experienced fairly high ridership among a variety of both the handicapped and the elderly. In general, the handicapped groups in both cities are pleased enough with this service not to expect fixed-route, accessible service; in Houston there has been little demand that the city actually

operate the lifts on its 326 lift-equipped buses. In addition to meeting the needs each week of a larger number of travelers than have ever been accommodated by the accessibility features on any fixed-route, accessible service, both of these specialized services, delivered through a brokerage, are meeting the needs of ever more financially strapped social- and human-welfare agencies.

It is not clear whether the specialized systems in Houston and Pittsburgh are a more appropriate response; it is clear that they are meeting the real transportation needs of a large number of citizens. There are some complaints, difficulties, and problems, but the citizens of each community seem relatively committed to the idea of specialized transit service delivered to the elderly and the handicapped through a broker. That community support seems to be the ultimate test of the appropriateness of a service.

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Charging Human Service Agencies for Public Transportation Services in Rural Areas

JOHN COLLURA, JAPHET H. NKONGE, DALE F. COPE, AND AYODELE MOBOLURIN

Seven procedures that could be used to charge human service agencies for public transportation services in rural areas are presented and evaluated. These procedures consist of two general types: (a) population based and (b) use based. A population-based procedure charges each agency on the basis of the number of clients, whereas use-based procedures charge agencies according to the amount of service consumed in terms of passenger trips, passenger miles, vehicle hours, and/or vehicle miles. The procedures are evaluated in terms of their ability to satisfy objectives of simplicity, cost, efficiency, and equity as well as their applicability to different types of public transportation services (i.e., shared-ride versus exclusive-ride services). In addition, the constraints of funding sources, the demands of accountability, and costing methods are examined. This presentation of the procedures will be of importance to public transportation providers and administrators of human service agencies who are negotiating contracts for the provision of public transportation services to agency clients. The evaluation of the procedures will be useful in determining the most appropriate procedure for use in particular circumstances. Finally, it is expected that the presentation and evaluation of procedures will aid in the task of simplifying and standardizing accounting, reporting, and billing methods for use in rural public transportation programs as mandated in the White House Rural Development Initiatives of June 1979.

One of the major actions to improve local rural public transportation outlined in the White House Rural

Development Initiatives of June 1979 was to "improve the delivery and effectiveness of local transportation programs through better coordination and simplification of administrative procedures" (1). Under the terms of this mandate, a task force composed of representatives from the then U.S. Department of Health, Education, and Welfare; the U.S. Department of Transportation; the Office of Management and Budget; and seven of the states was to be established to develop simplified and standardized accounting, reporting, and billing procedures for use in social service/public transportation programs (1). These directives, together with the impetus toward coordination of social-service-agency transportation services embodied in Federal Highway Administration (FHWA) Section 18 guidelines (Urban Mass Transportation Act of 1964, as amended), have increased the incentive for agencies to ensure that the transportation provided to their clients is efficient and service effective.

Administrators of human service agencies who are interested in purchasing transportation services

from a provider are faced with a myriad of billing, accounting, and reporting procedures for which they are responsible (2). In addition, in the process of seeking the optimum coordination scheme among agencies and providers, the agency administrator will be concerned with the charges made by the transportation provider for services delivered to clients.

This paper presents and evaluates seven procedures that can be used to arrive at charges for services made available to agency clients on a demand-responsive basis, either under a shared-ride system or an exclusive-use arrangement. The constraints of funding sources, accountability, simplicity, cost of use, and equity of the various procedures are examined and discussed. It is hoped that the delineation of specific variables to be incorporated in such allocation procedures will aid in the effort to simplify billing and accounting methods as well as demonstrate to agency administrators the possibility for encouraging efficient and cost-effective service under the application of a particular charging procedure.

ALTERNATIVE PROCEDURES

Regardless of the source of revenues, or the presence of user-side or provider-side subsidies, costs incurred by the transportation provider in the delivery of service to clients of human service agencies will be charged in some fashion to the agency. The question that must be addressed by the provider and the agency administrator during negotiations is how to determine these charges and on what basis. Accountability requirements dictate conditions that must be discussed by the agency administrator and the provider during planning for service. The number of eligible clients involved, allowable trip purposes, methods for identifying the sponsorship of the client and/or the trip, and the potential costs for service must be delineated. Simplified billing procedures, under which the transportation provider will be able to receive payment for a specific amount of service delivered to an agency over a specified time period, will also be aided by the procedures discussed here.

The procedures presented in this paper are of two types. One type of charging method is based simply on the number of clients to be served and uses client population as the base variable in the procedure. The other type of procedure uses variables that measure the amount of service consumed. Examples of such variables include passenger trips, passenger miles, and vehicle hours.

Charging Agencies on Basis of Number of Clients

A client-based procedure will charge each agency served by the transportation provider on the basis of the number of clients affiliated with each. The procedure will be simple and easy to understand and requires no ridership data for implementation. It is appropriate for use in a shared-ride service that operates on a demand-responsive basis because each client of each agency has equal access to the transportation services that are available.

In order to determine charges to agencies under a client-based procedure, the following calculations will be made (3):

1. Calculate the percentage of all clients affiliated with agency A,
2. Determine the total costs of service provided to all clients, and
3. Multiply the total costs of service by the percentage of agency A clients.

The formulation of this single-variable procedure is

$$C_A = (CL_A/CL_T) \times TC \quad (1)$$

where

C_A = charge to agency A,
 CL_A = number of clients affiliated with agency A,
 CL_T = total number of clients in all agencies, and
 TC = total costs of service.

Thus, if 10 percent of the total regional client population is affiliated with Agency A, then agency A will be charged for 10 percent of the total costs of service. It is recognized that an agency might have more than one funding source and that there will be a need to distinguish between clients eligible under each funding source. If such a situation exists, it is likely that a use-based procedure will be employed.

In cases where another level of government is partly subsidizing the transportation services, the allocation of costs obtained above would be multiplied by the percentage of costs that must be covered by the human service agencies. The formulation would incorporate this percentage as follows:

$$C_A = (d/100)(CL_A/CL_T) \times TC \quad (2)$$

where d is the percentage of total costs to be charged to agencies.

It may also be the case that an amount of revenue is obtained by the provider either directly or indirectly in support of clients' transportation. In that instance, the procedure would be modified to subtract those revenues from an agency's charges so that the agency is credited with the revenues generated for its support. The formula would then be

$$C_A = (d/100) \{ [(CL_A/CL_T) \times TC] - R_A \} \quad (3)$$

where R_A is revenues received in support of transportation for clients of agency A.

Equation 3 would be used, for example, if Section 18 funds and state assistance were available and the agency had "restricted funds" available, which could only be applied as a revenue (R_A). If $R_A < (CL_A/CL_T) \times TC$, then a charge to agency A would result. If $R_A \geq (CL_A/CL_T) \times TC$, then no additional charge would be made to agency A.

Charging Agencies on Basis of Use

Client-based procedures will often be rejected when charges to human service agencies are determined in favor of procedures that embody (a) a use variable and (b) an operating cost factor, or unit cost, to which all or part of the use can be attributed. Within this format, a wide range of possibilities, from simple to complex, still exists. In fact, innumerable formulas can be created by recombining use variables and the methods of attributing costs to them. For the purposes of this paper, six sample use-based procedures are presented and evaluated to provide guidance to agency administrators and transportation providers.

The six example procedures use the following use variables and combinations of variables: (a) passenger trips, (b) passenger miles, (c) passenger trips and passenger miles, (d) vehicle miles, (e) vehicle hours, and (f) vehicle miles and vehicle hours. Each procedure is described in terms of the use measures incorporated in it, and the application of each procedure to a particular service type is examined.

procedure may require the recording of "on and off" odometer readings by the driver of the vehicle; the processing of these data would increase the cost of using this procedure. However, in a demand-responsive system, the "shortest distance" between various typical origins and destinations can be predetermined from a trip matrix and recorded by the dispatcher, which eliminates the need to process odometer readings.

If it is decided to charge agencies on the basis of passenger miles, then the procedure would be formulated as follows:

$$C_A = PM_A(TC/PM_T) \quad (5)$$

where PM_A is passenger miles traveled by clients of agency A and PM_T is total passenger miles traveled by clients of all agencies.

As in the case of the passenger-trips-based procedure, revenues may be deducted and/or percentages of total costs allocated to agencies modified by the use of R_A and/or $d/100$. It should be noted here that deadhead mileage (that time when a vehicle is running without passengers) is accounted for in these procedures through the calculation of the average systemwide unit cost per passenger trip or mile. The disadvantage to using passenger miles as the sole variable is the converse of that noted under passenger trips; i.e., a miles-based procedure will tend to impose a penalty on agencies whose clients are located on the periphery of a service area.

Passenger Trips and Passenger Miles

The combination of the use variables, passenger trips and passenger miles, in one procedure presents some complications in terms of cost accounting and data collection but would probably be deemed more equitable by agencies that are charged because of the lack of penalties associated with the use of either passenger trips or passenger miles as the sole variable. The use of this two-variable procedure requires a preliminary breakdown of total system costs into two categories: (a) costs associated with passenger trips and (b) those costs directly attributable to trip length. The issues of identification of passenger affiliation, collection of necessary data, and the method of breaking down the total costs into the two categories should be addressed by the agency administrator and the transportation provider at the time of negotiation.

The procedure is formulated as follows:

$$C_A = [\alpha_1(PT_A/PT_T) + \alpha_2(PM_A/PM_T)] \quad (6)$$

where

- α_1 = costs associated with trip volume,
- α_2 = costs associated with trip length, and
- $\alpha_1 + \alpha_2$ = total costs of service.

The determination of those costs that should be associated with trip volume (number of trips), represented as α_1 , and those costs that should be attributed to trip length, represented as α_2 , will be made by participants. Usually, fuel and oil expenses, along with maintenance costs, are charged to passenger miles. Driver wages and the costs of dispatching, office personnel, expenses, and supervisory personnel are assigned to passenger trips. A sample breakdown of the two cost categories is given below:

Cost Element	Cost Assignment	
	Trips	Miles
Wages		
Driver	X	
Dispatcher	X	
Fringe benefits	X	
Fuel and oil		X
Tubes and tires		X
Vehicle		
Insurance	X	
Lease	X	
Licenses and registration	X	
Storage	X	
Maintenance		X
Utilities	X	
Salary		
Administrator/manager	X	
Secretary/bookkeeper	X	
Materials and supplies	X	
Telephone	X	
Office rental and equipment	X	

By using this two-variable procedure, systemwide unit costs per passenger trip and per passenger mile are calculated and agencies are charged on the basis of the percentages of passenger trips and miles delivered to their clients. Once again, revenues may be deducted from the charge to the agency, and other government subsidies may be accounted for.

Vehicle Miles

Whereas the previous three procedures are most useful in a shared-ride arrangement because of the fact that passenger use is identified by agency affiliation when clients of several agencies are sharing a vehicle, the use of vehicle-related variables is more appropriate in the exclusive-use arrangement, where a particular vehicle or vehicles are "dedicated" to serving a specific agency for a specified period of time. The following three procedures assign all costs of service to a variable or combination of variables that examine vehicle availability and/or use by the particular agency during the time of dedication.

The use of the single variable, vehicle miles, assigns all costs of service to that measure. A systemwide unit cost per vehicle mile is established by dividing the total costs of service by the total vehicle miles delivered, and each agency is charged on the basis of the number of vehicle miles consumed by its clients. In the case where a particular agency receives exclusive use of a vehicle for a specified period, odometer readings taken at the beginning and the end of the period will reveal the number of agency vehicle miles to be charged.

The vehicle-miles-based procedure would be formulated as follows:

$$C_A = VM_A(TC/VM_T) \quad (7)$$

where VM_A is vehicle miles traveled in service to agency A and VM_T is total vehicle miles traveled in service to all agencies.

It should be noted that it is possible to use a vehicle-miles-based procedure to allocate the costs of service among the agencies participating in a shared-ride service. Data requirements would include identification of clients by agency and vehicle miles traveled by each rider. Therefore, a record would have to be kept of the "on and off" odometer readings at the time of boarding and disembarking for each passenger. The processing of these data would be expensive. For example, if seven passengers are on a bus that travels 1 mile and four of the passengers are affiliated with

agency A, then agency A would be charged for four-sevenths of a vehicle mile. The complications are obvious. However, the use of a vehicle-miles-based procedure would have the advantage of encouraging group ridership in a shared-ride system, since any single agency will pay only once for each vehicle mile delivered to one or more of its clients. This encouragement toward group riding is also operative under the application of the vehicle-miles-based procedure in a dedicated service. It will be to the agency's advantage to encourage several of its clients to ride together.

Vehicle Hours

The procedure for charging agencies based on vehicle hours of service available to clients on an exclusive-use basis differs from the use of vehicle miles in that the procedure may not measure actual use but the potential for use. For example, if agency A has one vehicle dedicated to the exclusive use of its clients from 11:00 a.m. to 1:00 p.m. every weekday, then agency A will pay for 10 vehicle-h of service each week.

The vehicle-hours-based procedure may be formulated as follows:

$$C_A = V H_A (TC / V H_T) \quad (8)$$

where $V H_A$ is vehicle hours of service available to clients of agency A and $V H_T$ is total vehicle hours of service available to all agencies.

As in the case of other single-variable procedures, all costs of service are assigned to the variable and a unit cost per vehicle hour is established by dividing total costs of service by total vehicle hours. Then each agency is charged on the basis of the number of vehicle hours available to its clients.

Vehicle Miles and Vehicle Hours

The procedure that combines vehicle miles and vehicle hours incorporates measures of actual use and availability into one formula. A cost breakdown is required. The total systemwide costs of service will be broken down into two categories: (a) costs that vary with the number of vehicle miles traveled and (b) costs associated with mere availability of service. Fixed costs of service will often be assigned to vehicle hours whereas variable costs of service are assigned to vehicle miles.

The formulation of this two-variable procedure would be

$$C_A = \{ [\alpha_1 (V M_A / V M_T)] + [\alpha_2 (V H_A / V H_T)] \} \quad (9)$$

where

- α_1 = costs associated with vehicle miles,
- α_2 = costs associated with vehicle hours, and
- $\alpha_1 + \alpha_2$ = total cost of service.

This two-variable procedure is most appropriate when service is provided on an exclusive-use basis. The complexity and costs of data collection and processing for the use of vehicle miles and vehicle hours are high when the service is provided on a shared-ride basis; however, this procedure does provide an incentive for agencies to encourage their clients to group ride, since the agency will be charged for the same number of miles and hours regardless of the number of clients riding the vehicle at the same time.

COMPARATIVE EVALUATION OF PROCEDURES

The single client-based procedure and the six service-related procedures described in this paper can be evaluated in terms of the criteria of simplicity, cost of use, and equity. In addition, the suitability of particular procedures for specific types of service provided on a demand-responsive basis to human service agencies can be analyzed. Procedures may also be evaluated on the basis of their ability to satisfy objectives of cost-efficiency and service-effectiveness, including the incentive provided for group ridership.

The criteria of simplicity, cost of use, and equity are often cited as major issues of concern in the design and selection of a procedure to charge human service agencies for service. Simplicity refers to both the formulation of the procedure and its ease of application and is closely related to cost of use. Generally, the more complex the formulation of a procedure, the more data its implementation requires. Collection and processing costs will rise with the data requirements inherent in the component variables. A simple procedure will usually be inexpensive to use because minimal data are required and computer processing is not necessary. However, a simple procedure, such as that based on number of clients, may be inappropriate when the overriding concern is to institute a charging method that measures relative use by clients of different agencies.

Use-based procedures, which charge agencies on the basis of amounts of service available and/or delivered to clients, will often be deemed more equitable in terms of having each agency pay for the service it receives. Generally, the transportation provider and the agency administrator will be searching for the procedure that, considering the constraints of funding sources, accountability demands, and needs of clients, will be the simplest, least costly, and most equitable method of charging agencies for service.

It should be noted here that the requirements of some funding sources specify collection of some data that may also be used in a charging procedure. For example, if a particular funding source requires an annual report from the provider that includes the total number of passenger trips provided during the year, then the inclusion of the variable, passenger trips, in the charging procedure will not cost any more than the inclusion of the simple variable, number of clients.

The procedures are evaluated here as they were presented earlier in the paper. The client-based procedure may be most appropriate in a service area that has a small number of participating agencies, where the service provided is on a shared-ride arrangement, and where the total costs to be charged to all agencies are relatively low. The procedure does not require any data regarding actual use of the service or a determination of the relative amounts of operating costs incurred by each agency. The lack of relationship to levels of use does, however, provide possible reasons for the rejection of the simple, client-based procedure by some agency administrators.

The two single-variable procedures, based on either passenger miles or passenger trips, have the advantage of relating charges directly to the amount of service consumed by agency clients. However, as this paper has shown, the use of either variable alone has the disadvantage of penalizing agencies whose clients are either centrally located or geographically dispersed. The combination of passenger miles and passenger trips satisfies those objections

Table 1. Methods and costs of processing data to use procedures in selected areas that serve a large rural population.

Transportation Provider	Variable in Procedure	Processing of Data		Approximate No. of Passenger Trips per Month	Source of Funds
		Method	Cost (\$)		
Eastern Task Force on Aging, Bangor, ME	Passenger miles	Computer	13 126 ^{a,b}	4 737	Title III and local funds
Mount Grace Regional Transportation Corporation, Erving, MA	On-board vehicle miles	Computer	8200 ^{a,b}	6 500	Titles III, VII, XIX, XX, and local funds
Regional Transportation Program, Inc., Portland, ME	Passenger miles	Manual	8000-9000 ^c	3 500	Title III and local funds
DAST, Dover, DE	Trip length based on zonal system	Manual	18 000 ^{c,d}	13 000	Titles XIX and XX
Cape Cod Regional Transit Authority, Barnstable, MA	Passenger miles, passenger trips	Computer	18 300 ^e	11 000	Titles III and XX and local funds

^aIncludes only recurring costs and excludes initial programming costs. In the case of Mount Grace, initial programming costs were approximately \$2300.

^b1979.

^cOne full-time person.

^dOne full-time person, two half-time.

^eIncludes recurring and initial costs annualized over a five-year period, after which only recurring costs will be charged.

and also divides total costs of service into those costs related to passenger trips and those related to trip length. The procedure that combines passenger trips and passenger miles is most appropriate for implementation in a shared-ride, demand-responsive system where clients from several agencies may be riding on the same vehicle at the same time. In the application of this two-variable procedure, agencies are charged for the services actually consumed by their clients, plus a certain percentage of the total deadhead mileage costs, covered by the assignment of total system costs to the two variables. There is not, however, any incentive for group ridership inherent in the application of this procedure.

The two procedures that incorporate the single variables, vehicle miles and vehicle hours, may be most suitable for application to a demand-responsive system that provides dedicated, or exclusive, service to particular agencies at specified times. Vehicle hours represents the potential for use by clients of the specific agency being serviced at that time, whereas vehicle miles represents the actualization of that potential and provides a measurement of actual use by the clients served. The use of the single variable, vehicle miles, is most suitable when long wait times are not incurred during the provision of exclusive-use service. For example, when long wait times are incurred by a vehicle that transports clients to a site where meals are provided and remains stationary while the clients have their meals, a procedure that uses vehicle hours alone or in combination with vehicle miles will be more appropriate.

The data collection and processing required for the use of vehicle miles in a procedure to charge agencies that share a vehicle are complicated, time consuming, and more expensive than the use of passenger miles in a shared-ride allocation procedure but do provide an incentive for agencies to group their riders on a particular vehicle. In view of the existence of this incentive, the use of vehicle miles for application to shared-ride systems should not be dismissed.

The procedure based on the two variables, vehicle miles and vehicle hours, with its corresponding cost breakdown, is simple, inexpensive, and equitable for implementation in an exclusive-ride arrangement. Agencies will be encouraged to group their clients on vehicles, which will increase the efficient use of the service. Each agency served will pay a charge in proportion to the amount of service consumed by its clients. It should be noted, however, that the procedure that incorporates vehicle miles and vehicle hours will not reflect total vehicle use

unless deadhead is also accounted for in some way. The calculation of deadhead miles and hours is not complicated, but the apportionment of these amounts among the agencies receiving service is a complex issue, since no agency clients are using the vehicle during deadhead miles or hours. In the procedures presented here, deadhead has been allocated among agencies as though it were a fixed cost of service by assigning all costs to the specific variables under consideration. Deadhead mileage may also be allocated among agencies by assigning those miles to the rider(s) before or after a deadhead segment or by assigning those miles among the riders on the bus during a vehicle trip.

Of the three major criteria of simplicity, cost of use, and equity, the issue of cost of use often appears to be the main concern of agency administrators and transportation providers. Table 1 gives a summary of the methods and costs of processing data for use in various cost allocation procedures. All transportation services listed in Table 1 are provided on a shared-ride, demand-responsive basis. The processing methods are either computerized or manual. In the case of the Eastern Task Force on Aging and the Mount Grace Regional Transportation Corporation, the processing is done by outside computer firms; the costs shown include only the recurring costs such as keypunching, computer time, and storage and supplies and exclude initial programming costs. The Cape Cod Regional Transit Authority has an in-house computer system that is also used for scheduling and dispatching. It has been estimated that this system will cost \$18 000 annually for a five-year period, starting in 1979. This annual cost includes programming, hardware components, monthly maintenance, insurance, computer time, and interest charges. It should also be noted that a number of funding sources are billed for these services, including federal Title III (Older Americans Act) and Titles XIX and XX (Social Security Act) as well as local governments.

CONCLUSIONS

As the variables used in procedures to charge human service agencies for transportation services provided to their clients become more complex, data requirements and cost of implementation may increase. However, the information obtained is likely to lead to more accurate and equitable cost-based allocations and, at the same time, may be necessary, or merely useful, for satisfying other objectives, such as billing and accounting, monitoring and evaluating system performance, and encouraging group ridership.

The pressing need for uniform data reporting and accounting procedures has been noted by officials at many levels of government. In order to serve more than one agency, a transportation provider must frequently comply with distinct accounting and record-keeping procedures for each agency. In addition, billing structures and methods of billing for transportation vary from program to program and agency to agency. These variations may lead to confusion on the part of clients, providers, and agency administrators (5).

Several demonstration programs are currently under way to address these billing and accounting issues (1,5). The presentation of the seven charging procedures described in this paper should aid in the design of model administrative structures that, under the mandate of the demonstration programs "...should be flexible enough to allow transportation providers to report information in formats familiar to the transportation industry, and yet consistent with the mandated regulatory requirements of human service programs" (5).

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Mobility Training for the Retarded: An Issue of Public Transit Accessibility

JANE KAMMERER STARKS

The ability of the retarded to travel independently by public transit, particularly buses, has been demonstrated to have two positive results: (a) Institutions that provide services or custodial care for the retarded can reduce or eliminate the expense of providing special transit services for their clients, and (b) retarded individuals who can travel independently are thereby able to work in the community and become self-supporting, which furthers the national goal of deinstitutionalization. Travel training significantly improves the accessibility of public transit to the retarded. Travel training for the retarded is examined within the context of federal mandates for program and vehicle accessibility with respect to public bus transit. Local transit authorities have not recognized their responsibility to provide travel training in order to remove the barriers to accessibility experienced by the retarded because the retarded have not been recognized at the federal level as a distinct transportation-handicapped group.

The American Association on Mental Deficiency defines retardation as the expression of "significantly subaverage general intellectual functioning existing concurrently with deficits in adaptive behavior and manifested during the developmental period" (1). Retardation is etiologically diverse: More than 200 causes have been identified, although 75 percent of all cases cannot be explained. Retardation can be engendered in the individual by trauma, infectious disease, exposure to toxins, poor maternal and infantile nutrition, chromosomal abnormalities, hereditary and spontaneous metabolic disorders, and emotional deprivation (2). Genetic, metabolic, and environmental factors may function singly or in combination to induce retardation dur-

ing the gestation, infancy, or early-childhood phases of life.

Persons afflicted with retardation comprise approximately 6 million individuals, or 3 percent of the total population of the United States. Yet, despite their handicap, 5.4 million, or approximately 89 percent, of all the retarded should successfully respond to mobility training (3, p. 14). But current federal policy overlooks the transportation needs of the educable mentally retarded in this country, who constitute a large portion of the travel handicapped.

This paper examines means of addressing the needs of these citizens. First, the paper identifies the cognitive travel barriers experienced by the retarded and explains how mobility training can be a solution to overcoming them. The paper then identifies the system barriers of bus transit modes and explains how appropriate solutions can be fashioned. Finally, the paper discusses the institutional barriers that have prevented federal recognition of the retarded as a transportation-handicapped group.

Congress has sought to rectify the inequalities experienced by the transportation handicapped in the provision of transportation services and facilities by enacting several major statutes. The legislation produced by Congress that has resulted in the most controversy is Section 504 of the Rehabilitation Act of 1973. The Section 504 regulations are designed

to implement vehicle and program accessibility for the transportation handicapped.

The extremely high costs, incurred and projected, of compliance with Section 504 have inspired a congressional reappraisal of accessibility requirements. Currently, Congress is investigating altering the status of U.S. Department of Transportation (DOT) and U.S. Department of Health and Human Services (HHS)--formerly Health, Education, and Welfare--legislation. There is interest in transportation solutions to the needs of the handicapped that emphasize gains in mobility (i.e., improved efficiency in terms of expenditures) rather than accessibility. Recognition is growing, among the handicapped as well as legislators, that Section 504 legislation may have been hastily formulated without the benefit of adequate information about the actual travel behavior of the handicapped (4). An influential member of the activist handicapped movement attests the following: "There are...compelling physical reasons why subway and bus accessibility is an impractical concept. More importantly, in terms of equity it is an unjust concept" (5).

More sophisticated knowledge concerning the scope and varying degrees of severity of mental, as well as physical, handicaps is necessary to better inform federal and state policy. It is timely, therefore, to introduce into the current reevaluation a subject that has been consistently overlooked at the federal policy level: the transportation needs and abilities of the retarded. Independent travel for the retarded is a conjunct of both DOT accessibility requirements and the collateral goal of national deinstitutionalization of the retarded.

This paper focuses on the abilities and needs of the educable retarded because they constitute 89 percent of the total population of retarded individuals and because the retarded form the largest component of the developmentally disabled. The focus is on bus travel because it is the form of public transportation that the retarded are most likely to use in an independent fashion.

The acquisition of independent travel ability by the retarded is intrinsic to the national goal promulgated by President Nixon on November 16, 1971: "to enable one-third of the more than 200 000 retarded persons in public institutions to return to useful lives in the community."

VALUE OF TRAVEL TRAINING

A public awareness has emerged within the past decade that many individuals are institutionalized because the educational and social service resources that would assist their participation in normal community life have not been made available. Indeed, few of the retarded truly need or benefit from residential care (6). The American Association on Mental Deficiency estimates that 75 percent, or 150 000, of the institutionalized retarded are capable of independent or semi-independent work and living in the community.

The goals of deinstitutionalization are (a) to prevent the unnecessary admission of the retarded into residential-care facilities and (b) to return residents to the community accompanied by the minimum feasible amount of supervision and programming. The philosophy of deinstitutionalization "pertains to the right of an individual to receive treatment and programming in the least restrictive environment" (6, p. 126).

In 1972, the President's Committee on Retardation (3) conducted a study of the transportation needs of the retarded. They established that the ability to travel independently in the community is an essential corollary to deinstitutionalization.

Institutional and special-education professionals commonly classify the mentally retarded on the basis of both tested intelligence and social competence (6). The levels of classification include mild, moderate, severe, and profound retardation.

Mildly retarded individuals who score in the 50-70 point range of IQ tests are considered to be educable and capable of independence. They comprise 89 percent, or 5.4 million, of the national population of retarded individuals. They are good candidates for travel training.

Moderately retarded individuals fall into the 35-50 point range of IQ scores and are generally self-caring. They do require some degree of supervision in their work and living arrangements throughout their lives. However, they too are candidates for travel training.

Severely retarded individuals, those who score between 20 and 30 points in IQ tests, require residential care. Although not completely dependent, they are not candidates for travel training. The profoundly retarded score 20 points or less on IQ tests and are considered to be uniformly ineligible for travel training (3).

Although transportation is not suitable for the 3 percent of the retarded who are classified as severely or profoundly retarded, the applicability of mobility training is far more extensive than is known or practiced; the President's Committee on Retardation suggests that potentially 98.5 percent of the retarded (including both mildly and moderately retarded) would benefit from training in the use of both dependent and independent travel modes (3). Moderately retarded individuals with IQs greater than 35 respond successfully to travel training. If travel training were undertaken only for the 75 percent of the institutionalized retarded who are capable of benefiting from it, 150 000 individuals could be returned to community living.

The benefits of increased travel ability by the retarded would be fourfold:

1. Increased mobility would reduce institutional and social service costs by permitting a decrease in the expenditure required to provide alternative transportation for those individuals untrained in the use of fixed-route transit but who would respond to such training.

2. Increased independent travel by the retarded would allow more productive employment of retarded individuals in the community than is possible in cost-intensive sheltered workshops.

3. Independent travel ability would enable the retarded individual to make use of the recreational and educational resources available in the greater community.

4. A less tangible but equally important benefit is the significant increase in the retarded individual's self-esteem that results from sharing with normal citizens the ability to travel freely throughout the community.

The solution strongly recommended by the President's Committee--travel training--is endorsed by professionals who provide residential services for the retarded. These professionals give travel training equal priority with finding work and housing for the retarded. Unfortunately, most institutions cannot spare the personnel necessary to undertake a travel-training program for their residents.

TRAVEL BARRIERS FOR MENTALLY RETARDED

Before this paper examines how travel training can be provided, an understanding of retardation and the

travel barriers experienced by the retarded is needed. A study by the Urban Mass Transportation Administration (UMTA) noted that "the combined effect of various travel barriers is to keep people from using public transit when they might desire to do so if they could" (7, p. 15). This concept of "travel barrier" will be used throughout the rest of this paper.

The retarded individual is confronted by a unique configuration of travel barriers in his or her attempts to independently use mass transit. To ensure clarity, these travel barriers will be differentiated and defined as cognitive, system (bus-related mode), and institutional barriers. Because the three barriers fall into a natural progression from the particular to the general, cognitive barriers are dealt with first and institutional barriers are considered last. Pertinent solutions are included in the discussion of each barrier.

Cognitive Barriers to Independent Travel

Cognitive travel barriers experienced by the retarded arise from the intellectual limitations on travel ability imposed by mental deficiency. Examples are numerous.

Poor retention reduces the individual's ability to memorize routes, make transfers, and recognize disembarkment points. Poor visual acuity creates difficulties in distinguishing bus numbers, route names, and color codes. Conceptual problems involve the abstract notions of time and distance and create difficulties in comprehending fixed routes, schedules, fares, and transfers. Inadequate verbal skills, including poor speech ability and a lack of transit-related vocabulary, reduce the retarded individual's ability to request information or assistance.

Social incompetence results in the inability of the retarded to comport themselves in public because of a lack of knowledge about what constitutes appropriate behavior. In addition, being under a time pressure to make decisions can cause a retarded individual to disintegrate in a social situation, such as that occasioned by riding public buses. Diminished self-esteem, based on the retarded individual's unwillingness to expose his or her handicap in public, can cause a lack of the assertiveness necessary to seek assistance when required.

Spatial difficulties include a lack of geographic awareness. Geographers Davies and Carley (8) undertook a study of retarded residents of a state institution. They reported that these residents' incomplete awareness of the immediate environs of the institution and other urban areas served by transit effectively reduced their capacity to travel independently by any mode--bus, walking, or taxi. They concluded that increased familiarity with the urban landscape was an essential prerequisite to effective travel training.

Although equipment modifications to overcome some of the travel barriers experienced by the retarded are available, the President's Committee on Mental Retardation (3) recommends training passengers rather than modifying transit equipment. They point out that the modification of hardware would benefit only the small percentage of clients who are physically as well as mentally handicapped.

Travel-Training Programs as Response to Cognitive Barriers

Laus, the author of a unique text that deals specifically with mobility training for the educable retarded, stresses that the "message...is that when many of these cognitively impaired persons are pro-

vided with an appropriate training program, they are able to learn independent travel; many have already learned independent travel skills, and now we ought to expect many more to travel independently" (9, p. xi).

Travel-training programs for the retarded are generally adopted from earlier programs designed to provide mobility instruction for the blind. Laus (9) describes several programs that have reported success in training the retarded: the Tobias program, Cortazzo and Sansone, Kubat, and Laus. These programs share a curriculum that includes developing skills in fact identification, pedestrian techniques, handling money, and becoming familiar with the travel route.

Davies and Carley (8) stress training in the collateral areas of community orientation and pedestrian mobility as well as intracity transportation use. They also recommend on-site training as much as possible in order to develop experience with real situations, frequency of trips to reinforce previous lessons, a one-to-one ratio between instructor and pupil, and the granting of complimentary bus passes to instructors and their pupils.

Candidates for mobility training can be selected from among the educable retarded. Within this population, there are many individuals who have dual or multiple handicaps--e.g., brain injury, deafness, emotional disturbance, and speech impediments--that further complicate training endeavors. Interestingly, intelligence as it is represented by IQ scores is not a relevant criterion in selecting individuals who will respond successfully to travel training.

Laus (9) describes four requisites of candidacy:

1. The candidate should possess social competence. This means not only the ability to behave properly in public but also the ability to deal with unanticipated contingencies such as delays in departures and arrivals, detours, disorientation, unsolicited contacts with other passengers, and changing features in the landscape.
2. The candidate should demonstrate the capacity to learn basic routines, recognize the landmarks that signify disembarkment, and be able to tell time and exercise punctuality.
3. The candidate must be able to distinguish one particular bus from among many, whether by number, name, or color.
4. The last characteristic required of a candidate is imperative--the ability to behave assertively. The candidate must be emotionally able to seek assistance from the driver or from other passengers when necessary and to make decisions and then be able to act on them.

The selection of qualified candidates is critical to the overall success reported by travel-training programs. However, as the following example illustrates, cognitive limitations will always complicate in unforeseen ways the travel difficulties experienced by the retarded.

The Center for the Retarded in Houston, Texas, provides a mobility-training program specifically designed for those of their clients who use the public bus system to commute to their jobs in the community. One staff person is assigned exclusively to this program. The training procedure includes taking photographs of route landmarks to enable the client to recognize points of disembarkment and practice in riding the bus accompanied by the instructor. Finally, the client travels on the bus unaccompanied and the instructor follows by car to ensure that he or she has mastered the procedure.

In one instance, a client was so successful in

the training program that the last step--following the bus by car--was omitted. One of the landmarks (a billboard) that the client had been using to keep himself oriented to the route was changed on the day he took his first solo trip. He became disoriented and panicked, left the bus without taking along his identification or medication to control seizures, and was found by the police many hours later huddled in a ditch. Such failures, however, have been rare.

System Barriers

System barriers relate to the operations and equipment of a particular transit mode--in this instance, public buses. They include inadequate facilities, poorly designed information delivery systems that do not take into account the comprehension difficulties of the retarded (e.g., automated flashing bus signs in the case of Houston Metro), and a lack of driver training. Solutions could include having the driver call out the name of every stop, training drivers to recognize the retarded and to respond to their needs, and providing the retarded with travel passes.

The President's Committee on Mental Retardation does suggest ideas for equipment additions that would simplify the delivery of information and thereby improve accessibility for all passengers, not only the retarded. They specifically recommend the installation of public "bus phones" at major stops, which would provide bus service information and would be staffed by an operator trained to deal with the retarded. They also recommend the placement of symbolic city maps with color-coded routes at major stops. Buses would be designated by color, name, and number. The location of the viewer, as well as major landmarks, would be indicated. The benefits would not be limited to the retarded; such modifications would assist all passengers (3). However, as noted by the President's Committee, mobility training is the paramount need and should be given priority over the correction of bus-system deficiencies.

Institutional Barriers

The reason why cognitive and system barriers have both gone unchallenged is the existence of the third, more overwhelming class of barriers--institutional barriers. Institutional barriers that obstruct the independent use of transit by the retarded are derived from societal attitudes, or "agreements", that either ignore or misconstrue the travel needs and abilities of the retarded. These attitudes have been translated into policies that have an impact on the provision of services for the retarded. An example of one such barrier is the low expectations held by parents and educators concerning the ability of the retarded to respond to travel training (9, p. 52): "Most parents as well as professionals assumed that independent travel was beyond the realm of the mentally retarded person's capability. The success of past programs had not reached the attention of others." I also suspect that parents become concerned because they (correctly) perceive independent travel ability as a way for the retarded child to move freely about in society, beyond the protection offered by the custodial environment.

Another example of an institutional barrier arises from the definitions of retardation. The American Association on Mental Deficiency adjusted the numerical parameters (IQ) of mild retardation downward from 80 to 69 points when the purpose was to elevate a portion of the retarded into the "normal" range in order to erase the stigma of retardation. However, the result has been that those

individuals whose IQ falls into the 69-80 point range have lost their eligibility to be provided with services from any school or program that is a recipient of state or federal funds. This restriction affects precisely that portion of the retarded population who are most likely to benefit from travel training, the educable mentally retarded.

Reduced expectations about the abilities of the retarded are demonstrated by federal officials as well as by parents and educators. Thus, mobility training has never been investigated or promoted as a significant alternative to the provision of special transportation services for the retarded. The lack of mobility training becomes a self-perpetuating barrier because these widely accepted but misinformed attitudes about the abilities of the retarded preclude the widespread adoption of travel-training programs.

RESPONSIBILITY FOR TRAVEL TRAINING

Who, then, is charged with the responsibility of providing system accessibility for the retarded? Quite simply, any transit authority that is a recipient of federal transportation funds and is therefore subject to DOT and HHS accessibility directives.

Section 16a of the Urban Mass Transportation Act of 1964 (as amended) mandates as national policy that "special efforts shall be made in the planning and design of mass transportation facilities and services so that the availability to elderly and handicapped persons of mass transportation which they can effectively utilize, will be assured". The eligibility of the retarded for these "special efforts" is established by Section 16d2, which states that "for the purposes of this act the term 'handicapped person' means any individual who, by reason of illness, injury, age, congenital malfunction, or other permanent or temporary incapacity or disability, is unable without special facilities or special planning or design to utilize mass transportation facilities as effectively as persons who are not so affected." Although the retarded are not mentioned per se, Section 7 of Section 504 of the Rehabilitation Act of 1973 states that "the term 'handicapped individual' means any individual who (A) has a physical or mental disability which for such individual constitutes or results in a substantial handicap to employment...." Section 504 also specifies as a qualifying disability "mental impairments which substantially limit one or more such person's major life activities."

The responsibility of transit authorities for providing an accessible system of services, i.e., travel training for the retarded, is established by Section 504 (as amended), which states that "No otherwise qualified handicapped individual...shall, solely by reason of his handicap,...be excluded from the participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance...." Furthermore, explanatory material that supplements the Section 504 regulations stipulates that all recipients of federal funds must provide a transition plan to provide interim accessible transportation until all systems are accessible and "the planning process must involve public participation, including that of elderly and handicapped persons." In fact, my experience has been that the retarded have not contributed to the planning process nor have the professionals responsible for their care been consulted on their behalf. Travel training as a solution to the travel needs of the educable retarded has not been adopted with any degree of significance because of this lack of the explication

of the particular needs of the retarded at the federal policymaking level.

WHY PROGRAM ACCESSIBILITY FOR THE RETARDED HAS NOT BEEN ACKNOWLEDGED

The educable retarded, although strongly deserving of recognition, have not been analyzed as a distinct transportation-handicapped group by policymakers in DOT. A study commissioned by the state of New Jersey (10, p. 51) noted that, for transportation planning purposes, the retarded need to be considered separately from the other transportation handicapped and that "identifying the level of disability is crucial to determining the usefulness of transportation systems to the developmentally disabled and handicapped." However, as has been noted by Davies and Carley (8), reference to the retarded as a special dysfunction group has in the past been uniformly omitted from literature dealing with the transportation handicapped. This situation has persisted: Reports recently issued from DOT and the Congressional Budget Office, with one exception, are devoid of reference to the retarded.

DOT conducted a national survey of the transportation handicapped that included travel behavior, transportation barriers, latent travel demand, and transportation solutions. The survey is purported to be comprehensive, "since it establishes a firm base of knowledge on the transportation handicapped on a national basis, which until now did not exist" (11, p. 1). Respondents to the survey included the transportation handicapped who were institutionalized as well as those who were home-based. However, in the appendix the authors note that, of the transportation handicapped who resided in institutions, the mentally retarded, without qualification, were specifically exempted from consideration or participation in the survey (11, p. A-1). This is the only specific reference to the retarded I have located in literature issued by DOT.

By allowing the exclusion of the retarded from participation in this survey, DOT has in effect implied that the retarded are, ipso facto, incapable of using public transit. This institutional "agreement" by which DOT excludes the educable retarded from being considered among the transportation handicapped constitutes a formidable institutional barrier. When the independent travel needs of the educable retarded are not affirmed at the national level, it is not surprising that local transit authorities, who are dependent on policy directives and accessibility data issued from Washington, have not addressed an unidentified need by providing system accessibility for the retarded through travel training.

CONCLUSIONS

The fact that travel training is not provided is tragic simply because it could so easily be implemented: A variety of travel-training programs are in existence, and volunteer organizations devoted to the retarded are able to supply teachers. Transit authorities that do not want to directly undertake travel training could hire on a contract basis people or organizations that are experienced in conducting travel training (e.g., the Center for the Retarded, Easter Seals, and the Cerebral Palsy Foundation).

Travel training, administered by transit authorities contracting with relevant community organiza-

tions, might thus be implemented on a scale that would result in a significant increase in the ability of the retarded to independently use public transit. All that is required is that transit authorities recognize that federal mandates require accessibility for the retarded and that the resources exist to provide it.

Travel-training programs have been quite successful, both in reducing costs and in achieving independent travel ability for their students (9). Travel training, not wheelchair lifts, represents the most effective way of implementing program accessibility for the retarded. Federal policymakers and transit authorities must accord the mentally retarded recognition as a unique transportation-handicapped group; they must recognize that the needs of the wheelchair handicapped and the retarded are not reconcilable in one set of solutions.

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Special-Needs Transportation in Portland: Implementation and Dismantling of the LIFT Project

PAMELA BLOOMFIELD, TOM COOPER, AND SYDWELL FLYNN

The Portland, Oregon, special-needs transportation demonstration project—the LIFT—provided advance-reservation, door-to-door transportation services to elderly and handicapped persons unable to use the regular transit system. The Tri-County Metropolitan Transit District (Tri-Met), the local transit district, operated a fleet of 15 lift-equipped buses, supplemented by transportation furnished by local private providers under contract to Tri-Met. The LIFT project, which was funded from December 1976 through June 1979 by a Service and Methods Demonstration grant from the Urban Mass Transportation Administration, was designed to test a transit operator's ability to provide special-needs transportation service in coordination with social service agencies. The Transportation Systems Center was responsible for evaluating the demonstration, and contracted with Crain and Associates for this purpose. Although the project did have a significant positive impact on the travel behavior of regular users, penetration of the transportation-handicapped market was not dramatic. More important, the demonstration clearly revealed that the LIFT was not a cost-effective means of providing special-needs transportation to the elderly and the handicapped, primarily because of high union wages paid to LIFT drivers and controllers. A year after the demonstration ended, the LIFT ceased operations. The service was transferred to one of the private transportation providers under contract to Tri-Met. Thus, the long-range design of special-needs transportation service in the tri-county area remains an unresolved issue.

The Portland, Oregon, special-needs transportation (SNT) demonstration project—the LIFT—provided door-to-door transportation services to elderly and/or handicapped persons living within the Portland city limits who were unable to use the regular transit system and lacked access to alternative means of private transportation. From the start of the project in December 1976 through June 1979, the LIFT project was funded by a Service and Methods Demonstration grant from the Urban Mass Transportation Administration (UMTA). Thereafter, the Tri-County Metropolitan Transit District (Tri-Met) funded the LIFT from June 1979 until the service discontinued operations on June 27, 1980.

The specific purposes of the LIFT demonstration were as follows:

1. To test a transit operator's ability to provide special service to a special group and coordinate this service with the social service agencies involved,
2. To test the cost-effectiveness and value to social service agencies and users of automated fare-collection equipment,
3. To determine the impact of the demonstration on the target group, and
4. To assess the impact of the service on the social service agencies that contracted with Tri-Met for LIFT service for their clients.

The funding of the demonstration grant was as follows:

Source	Amount (\$)
Federal	916 768
Local	
Tri-Met	510 000
City of Portland, agency contracts, and state of Oregon	349 848
Total	1 776 616

This paper documents the circumstances leading to the implementation and subsequent dismantling of the LIFT project, evaluates the cost-effectiveness of the LIFT system in comparison with alternative types of SNT delivery systems, and offers some conclusions regarding the transferability of Portland's four-year experience with this project.

PROJECT HISTORY

Providing service to the handicapped and the elderly of Portland had been a concern of the city for some time. In 1972, the Portland City Council approved funds to study the problems of the mobility disadvantaged. Based on the results of the study, the City Council appropriated \$20 000, which was combined with a grant from the state of Oregon early in 1974; this grant became the basis for a Special Transportation Unit within the Portland Bureau of Human Resources. The unit aimed at coordinating the efforts of 40 agencies that had been identified as providing transportation to the handicapped and the elderly. Initially, only 9 agencies were involved in the consortium; this number eventually increased to 15.

However, in October 1974, in keeping with its policy to operate as few programs as possible, the Bureau of Human Resources made the decision to contract out services then being provided by the city's Special Transportation Unit. The contract was awarded to Special Mobility Services (SMS), a private, nonprofit transportation program. SMS was not able to provide all of the necessary transportation; thus, another transportation provider, Metro Mobility, came into being. It was within this context of fragmented and overlapping transportation services to the elderly and the handicapped that Tri-Met, with the cooperation of the Portland Bureau of Human Resources, stated in a proposal to UMTA the intention to "demonstrate the viability of transit company operated, demand-responsive special transportation...combining the resources and transit expertise of Tri-Met with the resources and social service expertise of the Bureau of Human Resources of the City of Portland." The proposal was submitted to UMTA in March 1976; the following July, Tri-Met was awarded the federal grant to operate the LIFT system. The LIFT service began operations in December 1976.

PROJECT DESCRIPTION

The LIFT vehicles consisted of a fleet of 15 Mercedes-Benz diesel buses equipped with wheelchair lifts, tie-downs, and a retractable lower step. Twelve of the vehicles accommodated eight passengers and two wheelchairs; three vehicles accommodated six passengers and four wheelchairs. All of the buses were equipped with two-way radios. Supplemental services were furnished by two taxi companies and a private wheelchair transportation firm. LIFT operators were Tri-Met drivers who volunteered for the

LIFT and were selected, in part, on the basis of their safety records and their desire to work, and/or special experience in working, with the handicapped and the elderly. Drivers were given a special training course before service began.

The LIFT service carried three types of passengers:

1. Agency-sponsored passengers were sponsored by a public agency that agreed to contract with Tri-Met for LIFT service. Agencies were charged \$3 per one-way trip. No fare was required from the passenger.

2. Affiliated passengers were those affiliated with a nonprofit organization that also contracted with Tri-Met for LIFT service. These organizations were billed \$2/ride; Tri-Met provided the additional \$1/ride as a partial subsidy. No fare was required from the passenger.

3. General passengers were those neither affiliated with an organization nor sponsored by a public agency. General passengers paid a cash fare of \$0.50 per one-way trip on the LIFT. The cash fare was deposited in a farebox similar to those used on regular Tri-Met buses.

Agency-sponsored and affiliated clients were registered for LIFT service by their contracting agencies; general passengers completed the registration application themselves, and each application was verified by a doctor, a case worker, a representative of a social service agency, or some other qualified individual. Each registered client received a special-needs bus pass, a plastic card similar to a credit card. The cards were designed for insertion in the automatic fare identification recorders (AFIRs) that were installed on the LIFT buses. This equipment, a major demonstration innovation, was intended to eliminate the need for manual record keeping. However, because of repeated mechanical and electrical failures, the AFIR equipment was never fully operational. In November 1978, the automated fareboxes were dismantled.

LIFT service was provided to eligible city residents from 7:00 a.m. to 7:00 p.m., Monday through Friday, and operated principally within the Portland city limits. All rides were scheduled in advance. To arrange for service, agency-sponsored and affiliated passengers called their sponsoring agencies, which then called the LIFT in accordance with Tri-Met scheduling procedures. General passengers called Tri-Met directly to arrange for service. Passengers were supplied with the telephone number (on the reverse side of the special-needs bus pass) and instructions on how to call for their return trips. Return trips were provided on both a pre-scheduled and demand-responsive basis. A staff of four dispatchers manually scheduled and dispatched all rides from the control room, which was furnished with a large wall map of the service area, a radio console, and the required data-collection and scheduling equipment.

As an innovation of the project, service design was to be based on market research. Thus, in early 1976, a comprehensive "before" household survey was conducted to determine the number of transportation-handicapped people (those who could not use regular bus service), their predemonstration transportation behavior, and their attitudes, perceptions, and problems regarding travel within Portland. The survey revealed that approximately 22 000 people in Portland had difficulty using or were unable to use regular bus service. The unconstrained trip demand of this group could not possibly have been met by the LIFT. Data from the predemonstration survey showed that transportation-

handicapped people make 1.4 trips/day. If one applies this trip rate to the transportation-handicapped population and assumes that 10 percent of all their trips could be diverted to the LIFT, the unconstrained daily demand of 1.4 trips/day x 22 000 - 10 would be 3080 trips/day. Operating personnel optimistically estimated that the 15 LIFT buses could serve 850 trips/day. Analysis by Crain and Associates revealed a more realistic daily capacity of about 400 trips. Therefore, potential demand for the service was as much as six times the available capacity.

Thus, Tri-Met took three measures to ration the anticipated demand for service:

1. A two-day advance-reservation policy was developed. This was reduced to one day in September 1978 and then changed back to two days in June 1979.

2. Eligibility criteria were formulated.

3. A ride-rationing or priority scheme based on trip purpose or need, length of trip, number of persons served, and destination location was established.

Eligibility criteria for LIFT passengers were established as follows. Registration was to be limited to those mobility-disadvantaged persons of all ages who met both of the criteria below:

1. Those in one or more of the following categories: (a) unable to get on or off a regular public transit bus; (b) unable to walk from home to the nearest bus stop; (c) unable to wait standing for more than 10 min; (d) unable to move in crowds (difficulty keeping balance in a regular transit bus is not considered a transit disadvantage since federal regulations require seats for the handicapped near the entrance of all buses); (e) unable to read information signs (this does not include foreign language problems); (f) unable to grasp coins, tickets, or handles; (g) unable to understand and follow transit directions; and (h) unable to use a regular public transit bus in the performance of life-sustaining activities; and

2. Those unable to drive a car or who do not have access to a vehicle for transportation.

The word "unable" here means that performing the function is absolutely impossible or causes severe and continuing pain; it does not mean discomfort or occasional pain. Persons who needed a wheelchair, a walker, or crutches in order to travel were automatically eligible.

DEMONSTRATION FINDINGS

After two years of operations, the LIFT demonstration had yielded the following results.

Demand

The LIFT did not have a dramatic impact on the travel patterns of the estimated 22 000 transportation-handicapped persons in Portland. Although the LIFT registered 5914 people, about 27 percent of the transportation-handicapped market, only one-fourth of those registered actually used the service. The average rider used the service for one round trip per week. The LIFT system was providing a total of 370 trips/day, 18 percent of which were furnished by LIFT-sponsored taxis.

The LIFT did have a significant impact on the travel behavior of regular users. On-board surveys indicated that the LIFT provided two-thirds of the trips made by the regular users. One-fourth of those surveyed stated that without LIFT service they

would have been forced to forgo the trips they were making, and those who had the option of switching to alternative modes viewed them as more costly and less convenient than the LIFT service.

The main reason the majority of eligible users did not use the LIFT was that they did not need this specialized type of service; they had alternative means of transportation, mainly the automobile, to serve their trip needs. Lack of awareness of the service and defects in LIFT service were not significant reasons for nonuse of the LIFT.

Overall, Tri-Met was satisfied with the performance of the Mercedes-Benz buses, despite problems with maintenance, the jerkiness of the ride, and the noise made by the diesel engines. The AFIRs, a technological innovation of the project, were not given a complete test in Portland due to mechanical failure of the fareboxes.

The reliability of LIFT service varied, depending on the time of day and the vehicle coverage. Overall, the buses were an average of 12 min late for pickup during 1977; in 1978, reliability improved somewhat. This improvement was caused by increased efficiency in the dispatch and scheduling functions and the increased use of taxis to relieve peak-period pressures. Average lateness was 9 min for the periods sampled in 1978.

By and large, LIFT users were enthusiastic about the LIFT and particularly pleased with the Tri-Met drivers. There was some dissatisfaction about the noise and the jerky ride; in general, however, clients seemed pleased with the service. They seemed to understand and accept the reliability problems reported earlier as necessary by-products of the SNT system. The taxi component of the LIFT SNT system also received favorable ratings from users. By most objective level-of-service measures, the taxi provided better service than the LIFT: Taxis were more reliable in picking up people on time; because they traveled direct routes, travel times in taxis were less than half the time required on the LIFT; the comfort of the ride was greater; and passengers reported that taxi rides were less noisy than LIFT rides. However, for most passengers taxis were not heavily preferred to the LIFT mode. The LIFT drivers contributed to that mode's image as the service that "understands the needs of the handicapped"; consequently, the LIFT was very popular among its transportation-handicapped clientele.

Cost-Effectiveness

Perhaps the most significant finding to emerge from the LIFT demonstration concerned the cost-effectiveness of that system. In fact, the demonstration clearly revealed that the LIFT was not a cost-effective means of providing SNT to the handicapped and the elderly and that alternatives were available in Portland that could provide equivalent or better service at lower cost. This conclusion was reported in an interim evaluation report after the first year of experience with the LIFT system; at that time, there was hope that recommended operational improvements could significantly lower costs. During 1978, most of these recommended changes were implemented: Efficiency improved and trip costs decreased slightly, despite the rise in labor and materials costs. The LIFT was operating as efficiently as could be expected given the nature of the clientele it was serving. Nevertheless, the total LIFT trip cost was still about \$2 more than the private-sector rate for similar service. The factors that contributed to the high cost of LIFT service made it clear that the LIFT would never be competitive with alternative modes of privately financed and privately operated SNT service.

The primary reasons for high LIFT costs were two: (a) The service was very labor intensive, and (b) union wage rates were high. Labor costs, including payroll and payroll-related overhead expenses, accounted for 86 percent of LIFT operating cost (72 percent of total cost). The wage rates for drivers as of the end of 1978 (excluding benefits) were \$8.61/h; controllers earned \$9.11/h. These rates were more than 60 percent above the market rate in the private sector. Furthermore, there was reason to believe that the differential between the Tri-Met and private-sector wage rates would grow: Between 1977 and 1978, LIFT driver wage rates increased more than 8 percent whereas taxi fares, an indirect measure of private-sector wage rates, remained stable.

Other reasons for the relatively high LIFT costs were as follows:

1. Restricted nature of the market--Because the LIFT only served the transportation handicapped, it consumed considerable time deadheading to reach a widely dispersed clientele.

2. Relatively high capital and finance costs--Capital and finance costs ran at about \$1.55/trip (17 percent of total trip cost) at 1978 operating levels. These costs were about \$1.20/trip greater than the taxi cost, which was estimated at \$0.35 for a 5-mile trip.

3. Inflexible union work rules--Union work rules made it difficult to match service supply with demand. Drivers and controllers were guaranteed a fixed schedule and a 40-h workweek, regardless of demand. Therefore, Tri-Met incurred labor costs even when demand was slack. By contrast, taxi companies do not incur labor costs when demand is down; the drivers simply do not get paid for dead time.

4. High level of dispatch effort--It appears that the dispatch level of effort was about 6 min/trip compared with the estimated taxi labor cost of 1.5 min/trip.

5. Budgetary cutbacks--Tri-Met agencywide budgetary cutbacks in the second year of the demonstration resulted in a higher LIFT operating cost per trip than would have been incurred if system capacity had been fully used. In 1978, only 11 of the 15 buses were used regularly. Analysis performed in 1978 showed that, as the number of trips per day increased, the daily costs per trip of the LIFT system decreased when the fixed costs (e.g., controller salaries) were spread over a higher volume of trips. Conversely, the decrease in capacity and demand in 1978 served to raise unit trip costs.

Effectiveness of Coordinated Paratransit

The LIFT demonstration showed that a coordinated paratransit system can serve the needs of the transportation-handicapped population. The LIFT, supplemented by taxi and local nonprofit provider service, scheduled and delivered more than 200 000 trips from 1976 to 1978. About half of these trips were delivered to unsponsored passengers who heretofore had not had access to publicly provided transportation.

The LIFT demonstration raised reservations about the feasibility of using a fixed-capacity paratransit fleet to serve the varied demands of agency clients. The LIFT penetrated only a small percentage of the social-service-agency trip market, and the number of trips provided to agency clients declined during the second year. Those agencies that did use the service were pleased with LIFT performance but registered complaints about reliability. Those agencies that did not use the service reported that service reliability was the major

reason. Thus, it appeared that the LIFT did not meet the reliability demands of the agencies as well as other modes did--e.g., the agencies' own vehicles and taxis. Ironically, the analysis showed that LIFT reliability was as good as could be expected, given the nature of the clientele served and the peaks in demand that occur throughout the service day (lateness closely paralleled demand); furthermore, reliability improved in the second year of the demonstration. It is not clear that reliability could have improved enough to meet agency expectations. These findings suggested that a coordination strategy that used a variety of paratransit modes on an as-needed basis--i.e., that established a reserve capacity--would be more successful in penetrating the agency trip market than a fixed-capacity paratransit fleet, which had inherent limitations that affected service reliability.

A key lesson yielded by the LIFT demonstration is that short-term demand for SNT service is very difficult to predict: LIFT use by both agency and general passengers fell below original estimates drawn from extensive market research. In the face of this highly uncertain demand, a flexible strategy that allowed expansion or contraction of service in response to demand was likely to be more cost effective than a strategy that required a high front-end capital investment.

Throughout the demonstration, any economies of scale that might have been realized through consolidation of transportation resources within Tri-Met were more than outweighed by the high union wage rates. That large organizations tend to attract union organizing efforts is well documented. Conversely, the small-scale nature of coordinated paratransit--i.e., several different small providers serving several markets--tends to make that mode less vulnerable to union organizing and thus to union wage rates. Therefore, a decentralized but coordinated arrangement with a number of paratransit providers appeared to constitute a more cost-effective system of providing SNT service than the LIFT system operated by Tri-Met.

Role of Transit Operator

The LIFT demonstration indicated that, in the long run, the transit operator should not provide SNT service; less expensive, equal-quality transportation services available to address the needs of the transportation handicapped usually exist. The primary reason a transit operator should not provide this service is that the costs resulting from higher-than-market wage rates that must be paid to union drivers outweigh any economies that can be achieved through larger-scale operation or greater expertise. In the short run, provision of SNT service by a transit operator may prove valuable as a means of establishing a leadership role in coordinating SNT and as a way of attracting additional resources to this critical area of need. Once these roles and the funding channels have been established, however, the transit operator's role as service provider should be phased out in favor of less expensive, private paratransit options.

The LIFT project was instrumental in establishing Tri-Met as a legitimate coordinator of SNT services in Portland. In addition, the LIFT was a visible reminder to the community of their responsibility toward and commitment to the transportation handicapped. However, Tri-Met's coordination efforts did not result in increased efficiency of the SNT system. Instead, the SNT cost per trip rose during the demonstration period.

Finally, the Portland experience indicated that, when a transit operator serves as both SNT operator

and SNT coordinator, a conflict in goals may arise. As SNT operator, the transit operator may be subject to organizational pressures to maintain the service in its existing form; as SNT coordinator, however, the transit operator is responsible for maximizing the cost-effectiveness of the SNT system. When the transit-operator-provided SNT service is not cost effective, as was the case in Portland, there may be organizational barriers or resistance to service cutbacks or elimination; the commitment of the organization to the service may impede objective assessment of its cost-effectiveness.

POST-DEMONSTRATION EVENTS

Cutback in LIFT Operations

When the demonstration funds for the LIFT ran out in June 1979, a number of changes to the existing system were made:

1. The size of the LIFT fleet was cut back to six vehicles.
2. The LIFT service area was considerably reduced. The LIFT continued to serve north and northeast Portland; service in south and southeast Multnomah County was transferred to the Multnomah County Community Action Agency (MCCAA), which operated a small transportation program; and service in West Multnomah County was transferred to SMS. Both MCCAA and SMS were already receiving operating funds from Tri-Met, under the Suburban Agency Support Program, to provide special transportation service to elderly and/or handicapped residents of those areas of the Tri-Met service district surrounding the city of Portland. Under this program, MCCAA provided service in the outlying areas of Multnomah County, SMS in Washington County, and a third provider, Clackamas County Community Action Agency, in Clackamas County.
3. The advance-reservation policy was changed back from one to two days in advance.
4. Due to the reduced capacity of the LIFT system, only medical, work, and school trips were served by the LIFT after June.
5. The LIFT Citizens Advisory Committee, an 11-person committee that met throughout the LIFT demonstration to monitor service operations and suggest improvements, was disbanded.
6. Finally, the amount of Tri-Met funding allocated to SNT was substantially increased.

SNT Policy Advisory Committee

The following September, Tri-Met convened a new advisory committee: the SNT Policy Advisory Committee (SNTPAC). Tri-Met faced a budget crisis, and the number of trips served by the LIFT had declined more than anticipated as a result of the June changes; thus, Tri-Met convened the SNTPAC to solicit public input regarding the future of SNT in the tri-county area. Specifically, the committee was charged by the Tri-Met Board with the responsibility "to determine the best ways to provide the most service and identify the financial resources to support it, and define the appropriate role for Tri-Met." Subsequently, SNTPAC was also granted the responsibility to review elements of Tri-Met's transition plan to implement Section 504 regulations (Rehabilitation Act of 1973) requiring "...access for elderly and handicapped persons to public mass transportation facilities, equipment and services."

SNTPAC, which met regularly for five months, presented a number of recommendations to the Tri-Met Board in February 1980, including the following:

1. Tri-Met should be responsible for special transportation service in the tri-county area. Specifically, Tri-Met should serve as coordinator, broker, planner, and contract manager. An ongoing policy advisory committee should be appointed to aid the Tri-Met Board and staff in formulating policies and decisions that would affect mobility-impaired persons.

2. In the interest of cost-effectiveness, the LIFT operations should be phased out and eventually replaced by service provision by subcontractors in a manner that ensures continuity in frequency and quality of service. For FY 1981, the subcontracting service providers should continue to perform their own dispatch functions; however, Tri-Met staff and SNT-PAC should investigate the feasibility of a central dispatch system.

3. Tri-Met should fund special transportation service only for those clients who are physically or mentally handicapped (elderly, nonhandicapped clients would therefore be ineligible).

4. Tri-Met should increase the operations budget for special transportation by 25 percent, to \$825 000, in FY 1981.

5. Door-to-door special transportation services should be integrated with the fixed-route system as soon as that system becomes accessible.

LIFT Shutdown

The SNT-PAC recommendations had stressed the need for a gradual phase-out of LIFT operations, due to the time required for existing special transportation contractors with Tri-Met to "gear up" for the additional service to be transferred to them: approximately 150-200 rides/day. However, in the spring of 1980 the general manager of Tri-Met decided, over the objections of some Tri-Met staff, that the LIFT should cease operations on June 30, at the end of that fiscal year. Two major risks were associated with this strategy. First, there was a strong possibility that special transportation service to former LIFT users would be severely disrupted when the LIFT service was replaced by subcontracted service. Moreover, some advocates of the handicapped community threatened to organize massive wheelchair demonstrations outside Tri-Met in the event of a service disruption. Second, the Amalgamated Transit Union (ATU), Tri-Met's union, threatened to file suit against Tri-Met management on the grounds that the Tri-Met plan to lease the LIFT vehicles (purchased with demonstration funds) to one or more private providers violated the existing union contract as well as the Section 13c (Urban Mass Transportation Act of 1964, as amended) agreement negotiated in 1976 prior to the LIFT demonstration. Tri-Met management was aware of these risks but was unwilling to extend the July 1 deadline unless the transition problems proved insurmountable.

Tri-Met took a number of steps in response to the risks outlined above. First, the outside consultant hired in response to the SNT-PAC recommendations to investigate the feasibility of a centralized dispatch facility in the tri-county area began to devote a substantial amount of effort to providing technical assistance to SMS, the only provider capable of assuming responsibility for the LIFT vehicles and service by June 30. Second, the Tri-Met labor relations staff began negotiations with the union in an attempt to avoid a confrontation

over the LIFT shutdown. It was planned that the six LIFT drivers would return to regular Tri-Met service; they were unlikely to file a grievance. However, satisfactory job spots had to be found for the four controllers and one clerk working on the LIFT service.

New, Decentralized LIFT System

On June 30, SMS began to furnish service to former LIFT riders, using SMS' own vans and several LIFT buses. One by one, the LIFT buses were repainted with a new color scheme and logo. The five LIFT staff members were relocated in new positions within Tri-Met at identical wage rates, and the ATU agreed not to file suit against Tri-Met. By August 1, 1980, the LIFT operation had been completely dismantled with the exception of the computerized billing system, which was revised to accommodate the needs of the new arrangements with the providers and client agencies. Tri-Met had originally planned to rename the SNT system, but it was decided that "the LIFT" was preferable to other names under consideration; the new, decentralized SNT system of service provision was therefore referred to as the LIFT in all subsequent informational materials prepared by Tri-Met.

The post-transition LIFT system had incorporated the following changes:

1. Tri-Met continued to serve as service coordinator, broker, planner, and contract manager, as SNT-PAC had recommended.

2. The service was operated by four special transportation providers under subcontract to Tri-Met: SMS, the private, nonprofit organization cited above; two county-operated programs cited earlier in this paper, MCCA and the Clackamas County Community Action Agency; and a local taxi company, Broadway Cab Company.

3. The eligibility criteria applied to new registrants for LIFT service were altered somewhat from those listed earlier in this paper. The new criteria placed a greater emphasis on the applicant's physical and mental disability; in addition, they made no mention of the applicant's ability to drive, or access to, an automobile.

4. Based on the recommendations of the outside consultant, Tri-Met decided for the time being not to attempt centralization of the four subcontractor dispatch operations. However, Tri-Met staff, aided by the consultant, began work on the design of a standardized record-keeping and billing system that would allow the trip data reported to Tri-Met by the providers to be keypunched directly from each provider's data-collection forms and computerized at Tri-Met. This measure was intended to reduce the end-of-month reporting burden on the service providers and to improve the accuracy of the LIFT system records.

As of January 1981, no major problems with the decentralized service arrangements were reported by riders, client agencies, providers, or Tri-Met staff. The short-term risks of dismantling LIFT operations at Tri-Met and subcontracting with outside providers for service appeared to have been overcome; however, the longer-range design and operation of SNT service in the tri-county area remained an unresolved issue.