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for the Elderly and
the Handicapped

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NATIONAL RESEARCH COUNCIL

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Contents

HUMAN SERVICE TRANSPORTATION AT THE CROSSROADS Frank W. Davis, Jr., Lawrence F. Cunningham, David A. Burkhalter II, and Steve Le May	1
METHODOLOGICAL ISSUES IN COLLECTING PRIMARY DATA ON THE TRANSPORTATION-HANDICAPPED Lalita Sen, Erskine Walther, Julian Benjamin, and Richard S. Watt	7
USER-SIDE SUBSIDIES: DELIVERING SPECIAL-NEEDS TRANSPORTATION THROUGH PRIVATE PROVIDERS Bruce D. Spear	13
ECONOMIES OF SCALE IN TRANSPORTATION FOR THE ELDERLY AND THE HANDICAPPED Claire McKnight, Anthony M. Pagano, Leonard Robins, and Christine Johnson	18
TWO OPTIONS FOR TRAVEL NEEDS OF MENTALLY RETARDED: IMPLICATIONS FOR PRODUCTIVITY AND COST-EFFECTIVENESS Jane K. Starks	25

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Human Service Transportation at the Crossroads

FRANK W. DAVIS, JR., LAWRENCE F. CUNNINGHAM, DAVID A. BURKHALTER II, AND STEVE LE MAY

Human service transportation is evolving to meet growing social needs. Unfortunately, the legal situation is somewhat confusing because human service transportation, for-hire common carriage public transportation, private transportation, school bus transportation, and volunteers all have different origins under the law. Changing government programs have a tendency to change the legal test that differentiates the liability of each of these legal forms. This paper describes some of the trends that are occurring and the way they affect liability, insurance, and other issues.

Human service transportation needs have evolved from the needs of the young, aged, and poor for access to basic human services such as nutrition, education, and medical care. Both nonprofit and government agencies have instituted transportation programs to meet these needs. Unfortunately, the innovativeness of these responses has generated problems for authorities who regulate transportation, policymakers who administer transportation problems, and insurance firms who insure the vehicles.

This paper addresses several different questions that are important in organizing human service transportation programs:

1. Why are traditional regulatory concepts inadequate to facilitate the growth of specialized transportation?
2. How have these traditional concepts limited the legal and philosophical definitions of transportation options?
3. What have been the legal liabilities imposed on forms of transportation development under the concept?
4. What has been the impact of these legal forms on legal liability and insurance rates?
5. What has been the impact of government actions in shifting legal liabilities of human service transportation programs? and
6. What regulatory and legal issues must be resolved to foster the development of human service transportation programs?

TRADITIONAL REGULATORY CONCEPTS

Transportation has been an instrument of public policy throughout the history of our nation. Public policy has sought to fund, promote, and regulate the transportation industry to meet a wide range of public needs, including economic development, national defense, nondiscriminatory services, and safety (1).

The primary tool for control, the public utility concept, was developed during the late 19th century. This concept was originally used to regulate railroads but was later extended to electrical, telephone, water, and sewer service. With this concept, companies were awarded an exclusive franchise for a geographical area. In return, they agreed to charge reasonable and nondiscriminatory rates and provide a reasonable level of service (2). The exclusive franchise allowed the businesses to raise sufficient capital to replace equipment and provide protection against competitors desiring to serve the most profitable customers.

The regulatory body that oversaw the public utility franchise could control the level of services provided to the public by requiring prior approval for changes in service level if the business wanted to retain the franchise. At the same time, the body could also generally ensure a profitable business environment for the utility (3). The

regulatory body always had the alternative of inviting a competitor to operate the franchise. Consequently, the franchisee's continued operation was dependent on willingness to meet the regulator's service standards and prescribed standards for rate increase.

The public utility concept was initially used to regulate "natural monopolies," e.g., railroads and electrical utilities. However, with the passage of time and increased government involvement in business, the concept was extended to industries perceived as natural monopolies as well as those posing a threat to public utilities.

CHANGE PROCESS

One weakness of the public utility concept was an inability to react to the changing needs of its customers. The very nature of the concept precluded special services for those with special needs. The public utility was prohibited under both the concept and subsequent laws from personal and/or place discrimination (Section 3, Interstate Commerce Act). The regulatory mechanism in pursuing nondiscriminatory pricing precluded the pricing of services based strictly on their cost or competition. In keeping with this regulatory philosophy as well as to control cost, public utilities typically provided a limited range of services, all of which were suited to the largest group of average users rather than to the various needs of the marketplace. The inability to price in accordance with the cost of servicing different customers and competitive forces and the utility's preoccupation with this limited range of services were two important factors that greatly inhibited the development of specialized services by regulated carriage (4).

The public utility model, although based on logical principles, has retarded the design of specialized services to meet the needs of such nonaverage or nonstandard users as young children, the mentally afflicted traveling without escorts, and the nonambulatory rider dependent on wheelchair, crutches, walker, or other assistance devices. Other individuals with special needs, such as the blind, those that were unable to get to the public utility stations or bus stops, and those that lived in very rural areas in which the public utilities did not provide service, found that they did not fit into the mainstream planning of the public utility concept.

A second weakness of the public utility concept was its inability to utilize or compete with new technology (5). After the very rapid growth of railroads, trolleys, and subways prior to World War I, the public discovered the flexibility of the automobile. As a consequence, ridership on traditional public utilities declined rapidly. This decline began in the 1930s, and except for increases in ridership during World War II when gasoline and tires were rationed, ridership has continued to decline. Since the regulatory bodies had no funding authority, they could influence the transportation company to provide a specific level of service if the company remained profitable (the company had no incentive to stay in business without a profit). Thus, the utilities were allowed to abandon service in those areas in which they lost money, such as rural areas and suburban areas. The regulatory bodies, realizing that they could not control ser-

vice levels unless they could protect the revenues of the franchised carriers, sought to prevent the development of either specialized for-hire services for nonstandard users or the use of private transportation to meet these needs. The regulators simply extended regulation to industries that were viewed as "competitive threats," e.g., motor carriers (Motor Carrier Act of 1935).

TRADITIONAL REGULATORY CONCEPTS AND RESULTING LEGAL DEFINITION OF TRANSPORTATION

As a consequence of the conditions discussed above, the transportation of passengers has evolved from two separate and distinct legal, regulatory, and philosophical areas. These two distinctively different areas are as follows:

1. For-hire transportation: For-hire transportation includes those companies that are descendants of the original public utilities, such as the National Railroad Passenger Corporation (Amtrak), inner-city bus companies, mass transit systems, taxicabs and airport limousines, as well as other regulated carriers. The primary legal test for these carriers is that they receive compensation for their services as an inducement to provide transportation (for-hire carriage) and that they hold themselves out to serve the general public (common carrier).

2. Private transportation: Private transportation is the transportation of family, friends, and neighbors in which no money changes hands.

The limited range of nondiscriminatory service for standard users, the abandonment of nonprofitable routes, and the complete absence of for-hire transportation in many rural and suburban areas left no option for large groups who could neither use the public utility nor transport themselves in their own vehicle. Finding other options illegal, they asked the government for assistance. The first of these groups was school children, whose parents put strong pressures on the school boards to provide extensive school bus transportation. Government, concerned over limiting the use of public funds and the legal protection of the for-hire franchisee, limited the use of school bus services to the transportation of school children, and compensation for hauling school children was avoided. Next, individuals found that their churches could purchase buses and provide Sunday morning rides to church, trips to summer camp, senior citizens' excursions, trips to church conventions, as well as tours for adults. Church buses hauling church members were generally held to be exempt from public service commission or regional transportation authority regulatory practices since any compensation was considered to be a contribution or the state regulatory statutes were modified to specifically exempt church and school buses.

More recently, new funding programs and interest in the needs of the elderly, the handicapped, the young, and the poor have created public and charitable agencies that have become intensely interested in solving the needs of these groups, who have traditionally not been able to participate in the mainstream of American activities. These organizations soon realized that their humanitarian objectives could not be met unless these individuals could be transported to the various human service programs. They realized that these transportation needs could not be served by the traditional for-hire modes nor could the individuals provide private transportation for themselves, so pressure was brought on both government and charities to fund transportation for these special groups. Thus, a

third category of transportation provider has developed in reaction to the limited range of services available from the for-hire transportation provider and the extensive legal restrictions placed on private transportation. This third category is defined as follows:

Human service transportation: Human service transportation is provided by a government, social service, or charitable institution for their program beneficiaries, clients, or members to the activities sponsored by the organization.

Legal Liability of Transportation

The liability of each form of transportation has evolved from very diverse legal philosophies. For-hire and private transportation developed under tort liability law, whereas human service transportation was exempt from lawsuit under the doctrine of governmental and charitable immunity. Under tort liability, for-hire transportation was virtually an insurer of the safety of the passenger with no defense from suit. Private transportation was negligent (and thus liable) only if reasonable care was not exercised. Volunteers (under special legislation) could be held liable only if they did not exercise slight care. In most cases, a volunteer could not receive any benefit from providing the transportation, not even reciprocal driving as in the case of carpooling.

Evolution of Tort Liability in the United States

Automobile liability law in the United States is based on negligence. The tort of negligence establishes a rule for imposing liability for unintentionally caused harm. Negligence establishes a standard of care to which individuals are required to adhere or be rendered liable. The standard of care is often referred to as the reasonable-man standard. The tort of negligence, however, is a recent (1825) development in the field of law (6, p. 140).

American courts have wrestled with the notion of duty. While it is generally held that a common carrier of passengers is not an insurer of the safety of its passengers, it has been said that the duty to protect its passengers stops just short of insuring the passengers against injury. In a few cases, it has been simply stated that common carriers of passengers must exercise "a high degree of care," "a very high degree of care," or "extraordinary care" for the safety of their passengers (14 American Jurisprudence 2d 916 and the cases cited therein).

It was in the evolution of duty that the courts began to establish three levels of duty. If the transportation provider was a for-hire common carrier such as a railroad, the carrier was expected to exercise the highest degree of care since the passenger had little control over the safety practices of operating the vehicle. A private carrier, on the other hand, was expected to act as an ordinary person or use ordinary care to prevent accident or injury. An individual picking up a hitchhiker, however, was only expected to use slight care, that is, to see that injury to the passenger was not caused willfully and wantonly.

As the concept of duty developed, the courts recognized and adopted the theory of negligence per se. Ordinarily the appropriate standard of care is the reasonable-man standard, but when there is a statute, the statute may prescribe the appropriate standard of care. Violation of the statute may therefore constitute negligence per se.

Evolution of Extended-Care Standard

The duty of common carriers with reference to the safety of their passengers is founded on principles of negligence. The origin of the theory of liability dates back to ancient Roman law.

The courts by virtue of several precedents have made the common law affecting common carriers clear (Mann versus Virginia Dane Transportation Company, Inc. 283 N.C. 734, 198 SE2d 558). Although a carrier is not an absolute insurer of the safety of the passengers, the carrier does owe the passengers whom it offers to transport "the highest degree of care for their safety as is consistent with the practical considerations and the conduct of its business."

The fundamental assumption that reduces the risk of the common carrier of passengers from that of being an absolute insurer of the passengers to the highest degree of care was the fact of "the passengers being capable of taking care of themselves." [Governmental immunity has been explained by Justice Holmes in *Kawquankoa versus Polybank* (1907, 205 U.S. 349, 353).] Recognizing this legal principle, the common carriers were reluctant to carry passengers who were limited in their ability to take care of themselves, although there is limited case law to indicate the way the courts would evaluate the carrier's obligation to these individuals. One way the common carriers limited service to special groups was to require an escort or fully capable adult to travel with the person to assume responsibility for taking care of that individual. In this way, the carrier would retain the traditional defense that the passenger or passengers and their escort were fully capable of taking care of themselves. Often the escort was given free passage to perform this duty.

An evolving area of concern to common carriers is the expanding of regulations to specify who the carrier will offer to haul. In return for federal dollars, local transportation systems are required to adhere to all applicable federal regulations or lose federal funds. Since the common carrier is held to the extreme-care standard and injury occurs because a standard is not fully followed, the carrier will have no defense and is subject to punitive damages as well. This is the concept of negligence per se. Therefore, not only is the carrier subject to an extended standard of care, but the legal duty of the carrier to the public is rapidly being expanded by new regulations.

Tort law reform has had a tendency, as shown by the state no-fault statutes, to be concerned about more certain reparations, eliminating small suits, and spreading the cost of the "inevitable" accident among all parties involved. Ironically, however, for-hire carriage has generally been expected to assume the total cost of all passenger injury. Even in no-fault states, where the individual's coverage on the family-owned vehicle makes payment for the injury (follow the family state), the for-hire carrier is expected to provide all coverage (follow-the-vehicle principle) in case of injury.

Evolution of Governmental Immunity

The doctrine of governmental immunity as it was recognized in the United States in the early 19th century evolved out of English common law. The doctrine of governmental immunity was based on the theory that "the King could do no wrong" and that the sovereign could not be sued without its consent.

The doctrine of governmental immunity was authoritatively recognized in the United States in 1821 when the Supreme Court, speaking through Chief Justice Marshall, stated that no suit could be

commenced or prosecuted against the United States without its consent (*Hargrove versus Lawn of Cocoa Beach*, 95 So. 2d 130, and *Baker versus City of Santa Fe*, 47 N.M. 85, 136 p 2d 480).

The doctrine of governmental immunity is no longer an absolute protection from suit. Recent court decisions and the mood of the country favors allowing governmental entities to be sued just as private entities can be sued [8 *American Jurisprudence* 2d, *Automobiles and Highway Traffic* 486 (1963)]. In most instances, either the doctrine has been abolished or modified by the courts or consent to be sued has been given by the legislatures. This is especially true in connection with liability arising out of the operation of a motor vehicle. Even in those instances in which the doctrine is still in force, there is the possibility that a judicial challenge would be successful based on the trend of the case law, and, consequently, liability insurance has been purchased.

Evolution of Charitable Immunity

Generally, liability has been the rule and immunity from liability the exception, since society has created rules of conduct for individuals interacting with members of the social unit. At one time or another, however, there had evolved over the years the viewpoint that charities and charitable organizations should be immune from their torts because of the nature of the services that they deliver to the public.

Immunity was bestowed on charitable institutions at a time when the public and some private groups who were generally religiously motivated were developing and endowing institutions to care for those unable to care for themselves. Charities were encouraged, and public interest demanded that charities be protected in order to carry out their benevolent work. These fledgling charities did not have the financial support or backing to enable them to pay off tort claims and survive. In many instances, their sole support was a single donor or a single trust fund. The possibility of destruction by a substantial award in a negligence action presented the charity in the latter half of the 19th century with a cost that could not be borne.

Modern-day charitable organizations bear little resemblance to their predecessors. From their humble beginnings as institutions depending on "the humane instincts of individuals or small informal groups" [Freezer, *The Tort Liability of Charities*, 77 U.Pa. L. Rev. 191 (1928)], charities have gradually evolved into a "thing of steel and stone and electricity, of boards and committees, of card indices and filing systems, and rules and regulations" [77 U.Pa. L. Rev. 195 (1928)]. Charities are now more than able to withstand substantial judgments without any termination of activities or any diminishment of donations. Similarly, and very importantly, charities can procure liability insurance, which defeats any argument that donations would be used for the payment of damages to tort victims. The purchase of the liability insurance has become an ordinary and necessary expense.

The demise of the doctrine of charitable immunity was signaled by the landmark decision of President and Directors of *Georgetown College versus Hughes* [130 F 2d 810, 812-813 (D.C. Cir. 1942)]. In that well-reasoned opinion, Justice Rutledge, then sitting on the Court of Appeals for the District of Columbia wrote:

Generally also charity is no defense to tort. For wrong done, it is no answer to say, "He did not pay and was not bound to pay for the service

I gave him." One who undertakes to aid another must do so with due care.

At the time of the Georgetown College decision in 1942, only four states had imposed unqualified liability on charities [130 F 2d 810 (D.C. Cir. 1942)]. However, the doctrine of charitable immunity has now been repudiated in the majority of states. Charities thus no longer have protection from suit.

Development and Decline of Automobile Guest Statutes

Automobile guest statutes, which deny recovery to a nonpaying automobile passenger injured as a result of the host driver's ordinary negligence, have existed at one time or another in the majority of states. The reasons most frequently given as underlying the statutes are the prevention of collusion between host and guest and the encouragement of hospitality on the part of owners and drivers of automobiles. Typically, the guest statutes (and/or authoritative judicial decisions that achieve the same result) eliminate the driver's liability for injuries to guests other than those injuries arising from "gross negligence," "willful and wanton conduct," "disregard of the right of others," "intentional conduct," "intoxication," or a combination of these or similar terms.

The economic conditions of the 1930s gave particular force to the hospitality argument used to justify the guest statutes. The Great Depression created a substantial increase in the number of hitchhikers on the nation's highways. It was feared that these strangers would take advantage of generous but unsuspecting motorists and offend society's sense of fair play without the guest statutes.

From their inception, guest statutes presented abundant definitional problems. What is a guest? Who can be a guest? What if the accident occurs in a private driveway? Can a host be a guest? What if the guest is entering or leaving the car? What if the car has come to a momentary halt? What do "gross negligence," "willful misconduct," and "intoxication" mean? American Jurisprudence (2d) undertakes to answer the problem when it says that none of these terms is susceptible to exact definition.

At present, the status of guest statutes in the United States is declining. In 1939, 27 states had legislatively enacted guest statutes. Forty years later, only 10 of those guest statutes remain.

Effect of Law on Liability on Each Type of Transportation

As a result of these different legal philosophies, each of the three forms of transportation is viewed in a completely different light when injuries occur. The key tests to determine which legal philosophy will apply are well known. These tests and standards are listed below:

1. For-hire transportation (tort liability):
 - a. Test: compensation, holding out to public
 - b. Legal standard of care: extreme care
 - c. Regulation: entry, rates, discrimination, routes, schedules, claims, safety, financial responsibility
 - d. Taxes: traditionally viewed as extensive revenue source
2. Private transportation (tort liability):
 - a. Legal test: ownership of vehicle and items transported, no compensation
 - b. Legal standard of care: ordinary
 - c. Regulation: safety, financial responsibility

- d. Taxes: moderate tax source
3. Human service transportation (immunity from lawsuit):
 - a. Legal test: source of funds, public or private contributions
 - b. Legal standard of care: slight
 - c. Regulations: safety, financial responsibility
 - d. Taxes: exempt from taxes or recipient of taxes

For example, if an organization provides both vehicle and driver to provide transportation for a fee, this was considered to be for-hire transportation. If the service was also offered to the general public, it was called common carriage and the strict legal standard applied.

If, on the other hand, the organization leased a vehicle from a car rental agency and hired a driver from a temporary employment service, this was considered to be private carriage as long as both the driver and the vehicle were not supplied by the same organization. In this case, the driver had a duty to the passenger to use ordinary care to avoid an accident. Government typically regulates private transportation only for levels of safety (vehicle inspection) and financial responsibility that the individual must meet in case of an accident. Typically, the taxes have been limited to gasoline taxes, sales taxes, license fees, and perhaps property taxes.

A carrier was considered to be a human service carrier if its funding came from government sources or private contributions and it had a specific relationship to the passengers. School buses, for example, could only haul school children or teachers. Church buses could only haul church members or visitors. YMCAs could only handle members or persons attending their activities. Traditionally, these forms of transportation benefited from the concept of governmental immunity, and charitable vehicles were exempt from taxes and often received tax-free gasoline and free license plates (state tags) and were exempt from sales tax or property tax. The guest statutes applied whenever someone gave a person a ride and where no compensation was involved.

Effect of Legal Forms of Transportation on Insurance Rates

The Insurance Services Office (ISO) is a statistical and rating organization supported by the insurance industry to collect accident statistics, analyze loss statistics for each type of transportation risk, and indicate the rates that are required for the industry as a whole to earn a target rate of return. Each insurance company then uses these advisory rates as an indicator of loss experience for that specific type of risk. Thus, the ISO advisory rates are the best-known way of comparing actual settlements for each type of transportation activity. Table 1 provides a comparison of advisory rates for a 12-passenger van operating under identical conditions except for legal status.

Part of this difference in advisory insurance rates can be explained by a difference in miles traveled, passengers transported, accident rates, and suit consciousness. The term "suit consciousness" is used to define the general public's expectations as shown by the tendency to pursue claims, the tendency to press suits for larger claims, the tendency of juries to award larger claims, the tendency to pursue litigation, and all other factors that affect the cost of settling the claim. For example, taxicab or bus passengers have a greater

Table 1. Comparison of insurance rates for various types of transportation.

Classification	Base Rate (\$)	Primary Factor	Secondary Factor	Extended Limits Factor	Nonfleet Rate (\$)
For-hire carrier					
Intercity bus	1597	1.00	-0.25	1.66	1988
Taxi (six-passenger car)	1120	1.00	N.A.	1.66	1859
Urban bus	1597	0.75	-0.25	1.66	1988
Airport limousine	1597	0.60	-0.25	1.66	927
Human service carrier					
Social service agency	1597	0.50	-0.25	1.66	662
Social service contractor	1597	0.50	-0.25	1.66	662
School bus (government owned)	147	0.95	-0.25	1.66	171
School bus (contractor owned)	147	0.95	-0.25	1.66	183
Church bus	147	1.00	-0.25	1.66	183

Notes: The social service agency and contractor rates were set by judgment, since the ISO did not have a separate statistical classification for them until October 1, 1979.
The vehicle used was a 12-passenger van, \$500 000 single limit, in Knoxville, Tennessee, up to a 50-mile radius.

tendency to sue the company than do passengers on a church bus.

The importance of this suit consciousness is a slowly changing variable. If the general population is familiar with the traditional concept of governmental and charitable immunity, it may take decades after states pass laws allowing themselves to be sued (or after court decisions allowing suits) before the change fully becomes the mindset of the general population to the extent that suit consciousness fully reflects the change.

Government Actions Rapidly Changing Transportation Suit Consciousness

During the last 20 years, there have been three major government actions that are rapidly changing the suit consciousness of each form of transportation: (a) government steps to fund the preservation of the traditional transportation public utilities, (b) general erosion of governmental and charitable immunity, and (c) demise of the guest statutes.

Traditionally, public funding was limited to the government transportation providers such as school buses, which were protected by governmental immunity (as well as the laws that required that all other vehicles stop for school buses loading and unloading). In the 1960s, however, government became heavily involved in attempting to preserve public utilities such as Amtrak and mass transit that could no longer remain economically feasible without substantially curtailing routes or receiving an infusion of new equipment and capital. When government preserved these services, it also assumed all the legal and regulatory expectations that had been part of the for-hire transportation industry that government was now replacing. Therefore, the government takeover and/or financial support of mass transit, Amtrak, and Consolidated Rail Corporation (Conrail) and the proposed funding of intercity bus services have tended to move all publicly supported transportation from the area of governmental immunity into the category of for-hire common carrier. This shift is accentuated by the fact that there is very little difference in the way that mass transit and school bus services are provided or funded except that mass transit is administered by a transit authority and school bus service is administered by a school board and that transit is open to the general public.

Since it is legally in the best interest of the injured for the transportation service to be held to the for-hire standard of care, the natural result of governmental involvement in transportation is to have the suit consciousness of school buses and human service transportation become more like the suit consciousness of mass transit. As this occurs,

insurance rates on school buses will surely become closer to urban bus insurance rates.

In addition to increasing suit consciousness toward human service programs, involvement of government in the traditional for-hire transportation area is also bringing additional responsibilities and obligations to human service carriers. For example, there is a well-understood body of labor law that applies to for-hire carriers, as, for example, the New Orleans passenger train case, Section 13(c) of the Urban Mass Transportation Act of 1964, Section 405 of the Rail Passenger Service Act of 1970 (Amtrak Act), and Section 516 of the Railroad Revitalization and Regulatory Reform Act of 1976. Also, for-hire carriage has the traditional regulatory requirements that restrict entry and exit and place other restrictions on the ability of the carrier to modify service without public hearings. Thus, the shift toward identification of all government transportation as for-hire transportation has major ramifications for human service agencies.

The second action of government has been the general erosion of governmental and charitable immunity as well as the abolition of guest statutes. This erosion, whether by statute or court decision, has forced the human service transportation providers to be viewed either as for-hire carriers or as private carriers, since they are the only legal option once the immunity of the human service area is removed.

Federal highway programs such as transportation systems management and ridesharing are focusing on improving the efficiency with which existing vehicles are used. These programs are basically private transportation programs.

Too often, human service transportation planners design their delivery system around funding guidelines, theoretical economies of scale, or a desire to eliminate duplication of services without realizing that slight program variations make major changes in the laws that apply to the programs. For example, these situations may exist:

1. If a human service agency accepts fares from clients who are willing and able to pay for their transportation, the agency's legal and insurance classifications will change and become subject to all the requirements of for-hire carriage.

2. If a federal program such as Section 18 of the Surface Transportation Act of 1978 requires that the general public be served, that transportation program becomes a common carrier, since that is the legal test of a common carrier, even though 98 percent of its passengers may be program beneficiaries of human service agencies.

3. If a church loans or leases its vehicles to a human service agency to transport the elderly, they

will no longer be insured as church buses but as those of a social service agency. If the social service agency charges the senior citizens a fee to cover the cost of operating the buses, compensation is involved and the agency and vehicles legally become for-hire carriers, and suit consciousness and insurance rates again increase.

4. If a human service agency reimburses a volunteer 15¢/mile (or any amount) to help cover the cost of operating the volunteer's vehicle, the agency may be held liable as a for-hire carrier because of the compensation test. (South Dakota's Attorney General ruled that payment of 15¢/mile to volunteers made them public livery, and thus they must be regulated and insured accordingly.)

5. If a public service commission or regional transportation authority attempts to regulate insurance requirements or safety aspects of human service agency transportation, this generally makes the human service transportation for-hire carriage, since the regulatory bodies in most cases only have authority to regulate for-hire carriers.

6. If transportation of the elderly is done by the Office on Aging, it will be viewed as human service transportation. If the same service is performed by the regional transit authority, it will almost certainly be treated as common carriage with all the suit consciousness, labor protection, and public hearings this involves.

7. If a volunteer receives first-aid training and uses it to render first aid to an injured human service passenger, the Good Samaritan statute will probably apply. If a transit authority driver receives the same training and renders the same aid, it will probably be considered part of the driver's job and the extreme-care standard may apply.

CROSSROADS FOR HUMAN SERVICE TRANSPORTATION

Currently, human service transportation is seeking a direction and many different programs are moving in different directions. In general, the U.S. Department of Transportation (DOT) has stressed the public utility philosophy of transportation with its accompanying legal-care standard, its labor protections, and its required public review on any service change. As can be expected, DOT programs have emphasized the systemwide, full-accessibility, public-utility approach.

The Department of Health and Human Services (HHS) has generally retained the mission orientation of the human service program in which transportation is a means to an end rather than the primary purpose. These programs generally fund essential transportation for specific types of program beneficiaries or coordinate volunteers to serve particular needs. In general, HHS programs take a mission orientation to Section 504 guidelines, i.e., does the service meet the need?

The carrier-management philosophy of DOT follows the public-utility concept of consolidating all human services transportation under a single provider to eliminate duplication of service. The mission orientation of HHS suggests the coordinating of all possible transportation options by someone who is primarily responsible for seeing that the human service agencies get the service that they need but has little desire to operate vehicles. Ironically, most human service planners give little or no attention to the legal form of transportation they propose and wonder why contractors, transit authorities, and others are reluctant to provide various types of service.

Until these legal philosophies are changed by statute, the legal form of the transportation is probably more important for the success of the

transportation mission than any other variable. Ridesharing could not progress until legal barriers were changed. Now there is a model ridesharing law (7) and model human service law (8) for introduction into each state.

Until such steps can be taken, however, a key component of every transportation plan should be an impact analysis of the legal form of transportation selected. The impact analysis should include insurance cost, liability issues such as Good Samaritan laws, operating flexibility, labor issues, public hearing requirement for each type of change, suit consciousness, and resource availability such as borrowed or leased vehicles. Unfortunately, many planners dismiss these considerations as a necessary cost of protecting the passenger. Ironically, many if not most passengers in human service transportation programs are already receiving medical protection from Medicare, Medicaid, the Veterans' Administration, developmental disabilities, or other government programs. Also, many are not working, so they would not collect for lost wages. Since Medicare, for example, must pay hospital costs anyway, the main benefit supplied by the expensive common carrier insurance coverage may be for the right of the insured to collect more than once for the same injury and the ability to collect sizeable settlements for pain and suffering.

CONCLUSIONS

Traditional regulatory concepts have proved inadequate to facilitate the growth of specialized transportation. Traditional concepts have limited the legal and philosophical definitions of transportation to the detriment of special groups. Recent court decisions have weakened or removed guest statutes and governmental and charitable immunity. Human service transportation is thus left without legal protection and is forced to obtain liability insurance at often excessive rates.

The erosion of governmental and charitable immunity tells us what human service transportation will no longer be, but there is little to indicate whether the legal philosophy of for-hire common carriage or private transportation will ultimately be adopted. The insurance industry must know and cannot guess, so to be on the safe side they usually predict that the philosophy will become more like that of for-hire carriers. Thus, rates will be very high in many cases.

Human service transportation has arrived at a point when key issues need to be addressed. The uncertain legal status of human service transportation needs to be resolved so that human service agencies can continue to provide a vitally needed service at a reasonable cost. By eliminating the legal uncertainties, insurance companies can then develop rates and collect statistics without being overly conservative, and the beneficiaries of human service transportation can be assured of continued service and adequate coverage.

REFERENCES

1. D.V. Harper. *Transportation in America*. Prentice-Hall, Englewood Cliffs, NJ, 1978.
2. A.E. Kahn. *Economics of Regulation: Principles and Institutions*. Wiley, New York, NY, 1979.
3. D.P. Locklin. *Economics of Transportation*. Richard D. Irwin, Inc., Homewood, IL, 1972.
4. H. Mertins, Jr. *National Transportation Policy in Transition*. D.C. Heath and Co., Lexington, MA, 1972.
5. G. Eads. *Railroad Diversification: Where Lies*

- the Public Interest. Bell Journal of Economics and Management Science, 1974.
6. W.L. Prosser. Law of Torts. 4th ed., West Publishing Co., St. Paul, MN, 1971.
 7. Model State Law to Remove Legal Impediments to Ridesharing Arrangements. National Committee on

- Uniform Traffic Laws and Ordinances, Washington, DC, Sept. 4, 1979.
8. The Rural Transportation Insurance Initiative. National Governor's Association, Washington, DC, 1979.

Methodological Issues in Collecting Primary Data on the Transportation-Handicapped

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Issues of definition and identification of the transportation-handicapped and methodological questions of sample-frame selection, formulation of questionnaires, and survey administration techniques in studies of the transportation-handicapped are explored by using data from a survey conducted in Greensboro, North Carolina. The Greensboro study used four different sample frames that represented different methods of sampling and eligibility screening of respondents. Respondents captured by the alternative sample frames varied in meaningful ways on socioeconomic variables, number and types of handicaps, mode choice and travel frequency, and degree of cooperation with interviewers. The impacts of alternative questionnaire formats and survey administration techniques on respondents with various physical handicaps are explored. Specific applications of observed sample-frame biases to accomplish research objectives are suggested.

The study of the transportation-handicapped poses numerous methodological issues. Of major concern are the issue of how to identify the transportation-handicapped and the related issue of data-collection methods.

Identification of the transportation-handicapped is a problem because, although some handicapped individuals may be highly visible in public, the group is not homogeneous, and individuals rarely work in or are affiliated with one specific organization that can be helpful in identifying those who are transportation-handicapped.

Underlying the problem of identification is the more fundamental problem of definition. Who are the transportation-handicapped? When does an individual become transportation-handicapped or cease to be handicapped for transportation purposes? These questions have perplexed many researchers in the past. The resolution ultimately reached has been determined by specific research objectives, available literature, and available descriptive data. These items have been particularly important in determining procedures for the selection of survey respondents.

Methods used to identify the transportation-handicapped have ranged from the approach taken by the U.S. National Health Survey (1), which was based on the respondents' perceptions as well as their physical disabilities, to the 1974 study by Michaels and Weiler (2) in which medical conditions, mobility limitations, and functional requirements were used in combination to identify three levels of transportation-related handicaps. Many alternative methods for identifying the transportation-handicapped are discussed in detail in the study Elderly and Handicapped Data Collection (3) conducted by Peat, Marwick, Mitchell and Company. Although this study does examine previous studies as well as information and opinions solicited from panels of experts, there

is no hard data base to enable comparisons between techniques or to support the conclusions drawn in the study.

In this paper, data collected in Greensboro, North Carolina, will be used to analyze differences between samples collected by different techniques as well as any special problems or difficulties encountered in any of the four alternative sample frames used for the data collection. It is important to note that alternative sample frames are being compared and not alternative sampling methods, which apply within a given sample frame.

SAMPLING TECHNIQUES AND PROBLEMS

In theory, the most desirable sampling method for a general study of the transportation-handicapped is a random sample. However, the prediction equations developed in the Grey Advertising study (4) conducted at the national level showed that only 4 percent of the population in a typical urban area is transportation-handicapped.

To obtain 200 usable completed interviews for a study of the transportation-handicapped in Greensboro, North Carolina, this 4 percent figure required the screening of 5000 members of the general public. This was done by telephone; 5000 telephone numbers were selected at random from the telephone directory. This method of course introduced the bias that only those with listed numbers would fall into the sample. It was observed that this screening was time-consuming and expensive and that some of those identified as handicapped were not willing to be interviewed. As a result of both these factors, three other sample frames were used to ensure the sample population desired for the Greensboro study: a 100 percent sample from client lists provided by social service agencies; self-identification through response to advertisements or publicity in newspapers, radio, and television; and a sample from a list of current users of the Greensboro Agency Transportation Express (GATE), the special transportation service for the elderly and the handicapped in Greensboro. Of the four techniques, random sampling of the general public took the most time, followed by sampling from agency lists. These approaches therefore showed the highest costs for the initial identification of transportation-handicapped individuals.

Due to the limited number of personnel available for the project, there was sometimes a lag between the initial contact and the follow-up home interview. As a result, a number of potential interviews

were lost from a waning of interest, changes in schedules, changes in health, and even the death of potential respondents. In addition, the failure of many individuals to keep scheduled interview appointments and the reluctance of some potential respondents, especially the elderly living alone, to be interviewed at home made it impossible to ensure an even distribution of completed interviews across the four samples. Although the unequal size of the subgroups makes comparisons statistically less accurate, some valid general statements can be made about the differences between the samples as well as the characteristics and biases of each sample.

SAMPLING METHODS

Random Sample

The random sample identified elderly and handicapped individuals from the Greensboro telephone directory. A set of random numbers, generated by computer, identified a directory page number, a column on the identified page, and a line within the identified column. The telephone numbers thus identified were then classified as residential or commercial. All identified commercial numbers were replaced by an adjacent residential number. All identified residential telephone numbers were then contacted (up to three call-backs were allowed) and screened for eligibility. Eligible individuals were asked to participate in the survey, and if they were willing, an interview time was arranged and an interview conducted. A total of 54 interviews (22.9 percent of all responses) was completed by using this sampling method.

Agency Sample

For this sampling procedure, public and private agencies serving elderly and handicapped clients were identified and the agency director or supervisor was contacted. Cooperating agencies were requested to provide a listing of potential survey respondents. All identified individuals were then contacted, screened for eligibility if necessary, and, if eligible, asked to participate in the survey. A total of 96 interviews (40.7 percent of all responses) was obtained by using this sampling method.

GATE Sample

The GATE sample is classified separately from the agency sample above due to its size and to a different method of respondent identification. The GATE sample was made up of approximately 200 individuals who were more than 18 years of age and who rode GATE during the week of June 23-27, 1980. Although GATE specializes in providing transportation to the handicapped, the nonhandicapped elderly also use GATE's services. Thus, identified GATE riders were first screened for eligibility and, when eligible, for willingness to participate. Individuals interested in participating were then interviewed. A total of 64 interviews (27.1 percent of all responses) was obtained through this sampling procedure.

Self-Identified Sample

Respondents classified as self-identified fell into three classes:

1. Those suggested by other survey respondents or by project staff members,
2. Those who learned of the survey by word of mouth or media coverage and contacted the research

staff and asked to participate, and

3. Those "discovered" at an interview site where the original respondents had been identified in advance (by any of the other sampling methods).

The first class left the initial contact and eligibility screening to the initiative of the project staff. The potential respondents, however, were originally identified by previous survey respondents or by project staff members. This group was composed of friends and neighbors of the referring individuals. Identification of the second class relied on the initiative of the potential respondent. The nature and objectives of the survey project reached the community through the local media and by word of mouth. Interested individuals were requested to contact the research staff. Persons making this contact were screened for eligibility and, where appropriate, interviewed.

Identification of the third class entailed the chance discovery of individuals in the process of interviewing a preidentified respondent. These "discovered" respondents were normally other household members or visitors who happened to be present during the interview. In group-living situations, the identification of potential respondents in this manner was not unusual. All respondents identified in this manner were checked for eligibility and, if eligible, were interviewed either on the spot or at a later time of their choosing. A total of 22 interviews (9.3 percent of all respondents) was located by these methods.

VARIANCES AMONG SAMPLES AND RESPONDENTS

Cooperation With Interviewers

In general, cooperation was high for all sampling methods (Table 1). Respondents in the self-identified sample and the agency sample tended to be somewhat more cooperative than respondents in the other samples. However, the differences among samples were slight. Cooperation from GATE respondents was adversely affected by the worry that critical comments could result in termination or reduction of the service. This concern has been reported by other researchers of special-service client populations.

When viewed as a function of handicap, regardless of sampling frame, cooperation is found to be highest among the wheelchair-confined and lowest among those individuals with hearing difficulties. When allowance is made for sampling techniques, this general observation is borne out. For example, among the agency sample respondents who were wheelchair-confined, 78.6 percent scored very high on the cooperation index, whereas 42.9 percent of the non-wheelchair-confined respondents from this sample obtained the same rating. For the hearing-impaired, the same pattern is found within each sampling frame as for all samples combined. Cooperation was rated as very high for 35.3 percent of the hearing-impaired respondents in the agency sample, whereas

Table 1. Cooperation scores: percentage by sample.

Sample	Very High	High	Moderate	Very Low
Random	46.3	35.2	16.7	1.9
Agency	52.7	29.0	18.3	-
Self-identified	68.4	26.3	5.3	-
GATE	49.1	41.5	9.4	-

Notes: Cooperation was measured by the interviewer on a 5-point scale. No scores of low cooperation were recorded.

56.0 percent of the agency respondents without hearing impairment received that rating. This basic pattern repeats for other handicaps and is consistent across samples. Thus, respondents whose handicaps complicate the interview process, such as the hearing-impaired for interviewer-completed questionnaires or tactile-impaired respondents to self-administered questionnaires or questionnaires that require the respondent to hold and/or manipulate flash cards or the like, tend to be rated by interviewers as somewhat less cooperative than respondents without such impairments. This result was found in all four samples.

An interesting exception to the above finding is the cooperation scores of blind or visually impaired persons. The percentage of visually impaired individuals in the random and in the agency sample who received high or very high cooperation ratings was somewhat higher than that for respondents without visual impairments, whereas for the GATE sample, the cooperation ratings for these two subgroups were virtually identical.

Sociodemographic Variances

The majority of respondents in each sample reported annual incomes of less than \$5000 (Table 2). The agency sample, however, showed slightly fewer individuals in the group whose incomes were less than \$5000 and a somewhat higher percentage of respondents in the other income categories. Reported annual income for the agency sample ranged from zero to between \$25 000 and \$35 000. Only the random sample captured any respondents with incomes of \$35 000 or more. Very few respondents refused or otherwise failed to report an annual income value.

The agency sample and the self-identified respondents were also more likely to be currently employed. Of the employed respondents in all samples, 47.6 percent were captured by the agency sample; 13.6 percent of the self-identified sample and 10.4 percent of the agency sample were currently employed;

Employment Status (% of sample)

Sample	Not		
	Employed	Employed	Retired
Random	9.3	25.9	64.8
Agency	10.4	29.2	60.4
Self-identified	13.6	31.8	54.5
GATE	4.8	20.6	74.6

The notable difference among samples with respect to age variance of respondents is the capturing of more of the younger handicapped by the agency sample and the self-identified sample (Table 3). Only 3.7 percent of respondents captured by the random sample lived in group quarters, whereas 30.2 percent of the agency sample, 22.7 percent of the self-identified sample, and 15.6 percent of the GATE sample lived in group quarters. Group-living arrangements tend to increase access to private automobiles.

A majority of respondents in each sample reported having more than one physical handicap. Multiple handicaps tend to complicate use of public transit.

Table 2. Annual income: percentage by sample.

Sample	Less Than \$5000	\$5000-9999	\$10 000-19 999	\$20 000-34 999	\$35 000 and More
Random	57.4	23.4	10.6	4.2	4.2
Agency	51.7	31.4	11.3	5.6	-
Self-identified	61.9	9.6	23.8	4.8	-
GATE	61.9	25.4	11.1	1.6	-

Variances by Handicap

When the populations captured by each sampling method are viewed in terms of respondents' handicaps, several meaningful differences are noted (Table 4). The random-sample respondents included very few wheelchair-confined (3.8 percent of the random sample). However, more of the respondents in this sample reported speech impairment (15.1 percent) or hearing impairment (32.1 percent) than did respondents in other samples. All samples reported high percentages of respondents who had difficulty walking. The self-identified sample captured more visually impaired respondents (57.1 percent of the sample), whereas the agency sample included more respondents with tactile impairments (42.7 percent of the sample). A majority of respondents in each sample reported multiple handicaps.

With respect to handicaps captured, only the agency-sampling method permits directed alteration in the distribution of the handicaps of respondents. This flexibility arises from the ability of the researcher to select agencies serving particular groups of the handicapped. In order to increase the number of respondents with hearing impairment, for example, the researcher who uses an agency-sampling method has only to select a greater proportion of agencies serving the hearing-impaired or to sample more intensely from the listing provided from such agencies. This option is not available with the other sample frames considered.

Trip-Mode and Trip-Purpose Variances

On these variables, the agency sample respondents differed from the other sample frame respondents in several important ways. Agency sample respondents tended to report a wider range of trip frequencies; they took more trips for social and recreational purposes and more shopping trips, more work trips, and more trips to social service agencies than respondents captured by other sampling methods. Agency sample respondents also reported greater use of respondent-driven private automobiles.

Respondents captured by the GATE sample took somewhat more medical trips than other respondents. One of the primary functions of GATE is to facilitate medical trips for the elderly and the handicapped.

The distribution of responses for total trips presents differing cluster patterns for each sample

Table 3. Age distribution: percentage by sample.

Sample	18-32	33-45	46-59	60+
Random	5.8	5.8	23.1	65.4
Agency	10.4	19.8	22.9	46.9
Self-identified	14.3	14.3	19.0	52.4
GATE	9.4	6.3	6.3	78.1

Table 4. Types of handicaps: percentage by sample.

Sample	Handicap ^a						Multiple Handicaps
	WC	DW	HI	VI	TI	SI	
Random	3.8	79.6	32.1	46.2	38.9	15.1	64.8
Agency	14.6	64.2	18.9	38.5	42.7	8.4	52.1
Self-identified	38.1	81.8	14.3	57.1	36.4	10.0	68.2
GATE	9.4	79.7	23.4	40.6	35.9	9.4	50.0

Note: Percentages will add to more than 100 percent due to multiple responses.
^aWC = wheelchair-confined; DW = difficulty in walking; HI = hearing impairment; VI = visual impairment; TI = tactile impairment; SI = speech impairment.

Figure 1. Alternative sample frames for demand and marketing study.

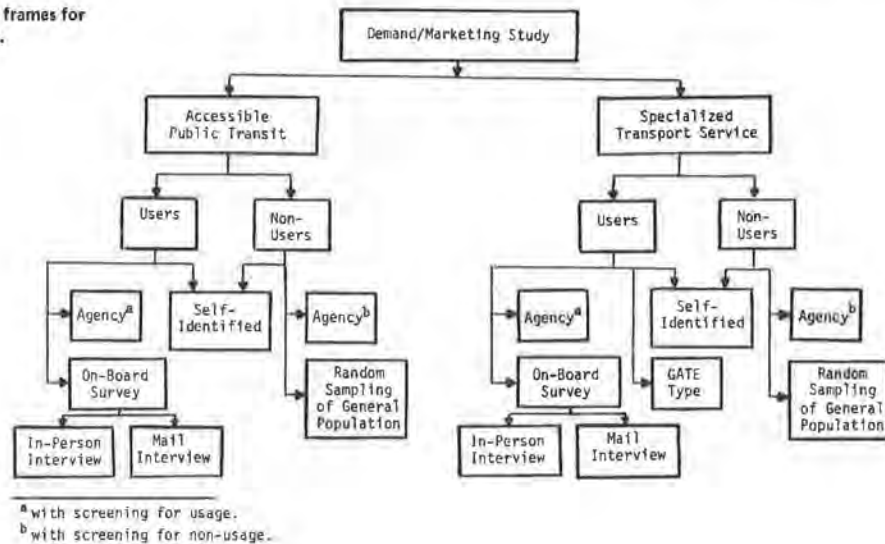
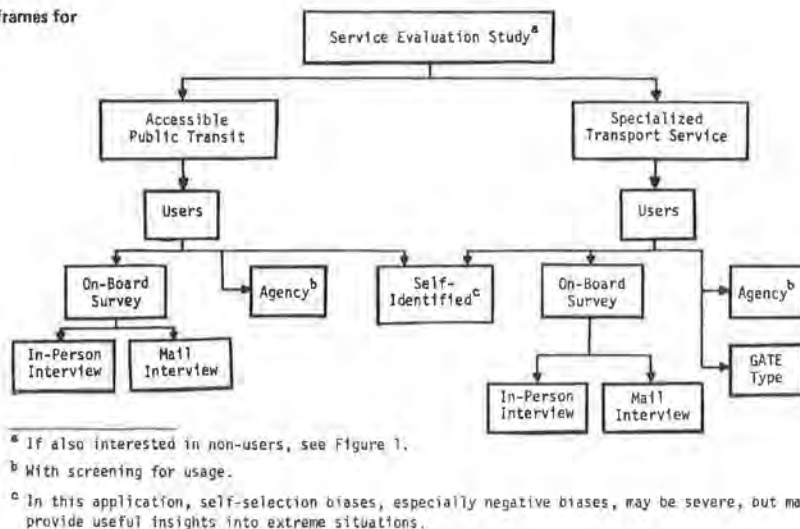


Figure 2. Alternative sample frames for service evaluation study.



frame. Of the random sample, 48.2 percent of respondents cluster in the lower-frequency ranges (1-104 trips a year), whereas 65.6 percent of the GATE respondents cluster between 53 and 156 trips a year; 84.4 percent of the GATE sample make between 1 and 156 annual trips. The self-identified sample reveals a bimodal pattern, with a cluster (45.4 percent of respondents) at the lower frequency range (1-104 annual trips) and another (40.9 percent of respondents) at the upper frequency range (157 and more). Of the agency sample, 47.9 percent cluster in the higher frequency range, indicating 157 or more annual trips. The above distributions are computed by trip mode. When computed by trip purpose, the percentage values change slightly, but the cluster patterns remain the same.

Observations and Applications to Alternative Survey Objectives

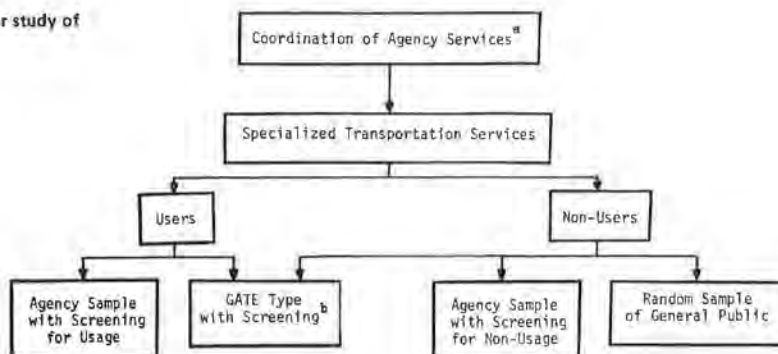
The respondents captured by the four sample frames examined tend to vary in meaningful ways. The agency sample displays the most consistent differences across questions. This observation implies

that sample frames are not completely interchangeable. Each sample captured a set of respondents displaying variances in trip mode, trip purpose, cooperation with the interviewer, and other meaningful sociodemographic variables. The careful researcher will be aware of these variances and either guard against unanticipated distortions in the data or make the sample frames' biases work for the accomplishment of the research objectives.

Figures 1-3 display various applications of the four sample frames for fulfilling particular research objectives. The flow charts were developed with the assumption that random sampling can always be undertaken given an appropriate sample frame. However, random samples of the general population are more expensive than the other sample frames and do not present notable advantages over the other techniques in several important applications. Thus the random-sample frame is noted in the figures only for those cases in which it holds definite advantages over alternative methods.

The self-identified approach can also be used in most cases. This approach has potentially powerful self-selection biases and is only mentioned in cases

Figure 3. Alternative sample frames for study of coordination of agency services.



^a If accessible public transit is involved, see Figure 2 for alternatives.

^b Where this service is independent of social service agencies.

in which it may be a useful supplement to another technique or as an alternative to, though not a substitute for, a more expensive sampling approach.

The alternatives noted in Figures 1-3 often presume the existence of a sample frame of sufficient narrowness. In the absence of such a frame, a random sample of the general population may be the only alternative. Naturally, a random sampling within a narrow specialized sample frame is always an option. Thus one might use a sample frame of GATE riders and randomly select potential respondents from within that frame. This technique was not used in the Greensboro study due to the limited size of the three nonrandom sample frames.

Figures 1-3 suggest numerous uses of the agency-sampling method. In the Greensboro study the respondents captured by the agency sample tended to display a wider range of responses, reflecting a wider range of activities. This presents the researcher with the advantage of capturing a greater variety of transportation-related experiences. Although the initial collection of the sample frame for this method may be somewhat more expensive than that for other methods, the reduced screening costs and the high level of cooperation, which reduces the number of call-backs required, tend to offset the relatively higher cost of obtaining the sample frame.

The agency-sampling approach presents an additional advantage in terms of obtaining narrow sample frames. Since many agencies specialize in service to one particular group of handicapped individuals, the sampling process may be focused on such groups by careful selection of agencies. For example, if the research objective calls for particular attention to the transportation needs of the blind and others with visual impairments, sampling costs may be reduced by selection of agencies specializing in services for the visually impaired. Thus, the agency-sampling process may be viewed as a two-stage sample, in which the first stage is the selection of the agencies and the second stage is the selection of respondents from the agency lists.

ADMINISTRATION OF SURVEY

In considering how to administer a survey, in addition to the type of questions that must be asked to fulfill the study objectives, the cost, the time, and the probable response rates must be taken into account. Studying the transportation-handicapped introduces other problems, such as special difficulties a physical handicap may pose in responding to certain types of survey formats. For example, the

blind cannot easily respond to a mail questionnaire. Given the options of a mail questionnaire, a telephone interview, or a home interview, it was decided in the Greensboro study to proceed with the last two. The first option was abandoned due to anticipated low response rates, which would have further reduced the already small number of those who consented to be interviewed. Thus, attempts were made to contact all potential respondents and proceed with a home interview. When setting up a home interview proved to be difficult (for various reasons, including a reluctance on the part of some potential respondents to permit a home visit), a telephone interview was completed and proved to be no more difficult to administer than the home interview. Of course, no one with a hearing impairment was interviewed over the telephone, but the method was particularly successful for those respondents with visual impairments.

In general, low response rates and failures to keep scheduled appointments were a problem primarily with the random sample, in which many individuals identified as transportation-handicapped appeared to be impossible to contact or, when contacted, were reluctant to be interviewed at home.

FORMAT OF QUESTIONNAIRE

Administration techniques and research objectives are the primary determinants of questionnaire design. The in-person interview approach provides the greatest design flexibility, whereas telephone and mail interviews present several important design limitations. The Greensboro study used a highly structured questionnaire design that worked well in both telephone and personal-interview situations. The structured design also facilitated computerization of the collected responses.

During the pretesting of the questionnaire, several difficulties were encountered that related to the physical handicaps of the respondents. For example, flash cards listing transportation alternatives were at best of very limited use with the visually handicapped and of no use in a telephone interview. Flash cards also presented problems for respondents who had difficulty grasping and holding objects. Thus, instead of reducing interview costs by speeding up interview completion, the use of flash cards actually increased completion time for particular subgroups of the handicapped population. Therefore, the final questionnaire design incorporated alternative administration procedures for use with respondents with these handicaps.

CONCLUSIONS AND RECOMMENDATIONS

Of the four samples, the agency-sample respondents displayed the greatest range of differences in population attributes. This fact presents several self-evident advantages for the user of the research. It is interesting to note that the random sample did not capture so broad a cross section of the handicapped population as did the agency sample. However, random sampling does permit the application of a greater variety of statistical manipulations to the data, which cannot be correctly applied to data derived from nonrandom sampling methods. Probably of greater importance is the ability to generalize the results to a wider population when random sampling is used. Although this fact is a real consideration, most of the advantages of random sampling may be obtained with any of the discussed sample frames by random sampling from within the frame, even though the frame selection process is nonrandom. This two-stage process was not used in the Greensboro study because available resources limited the size of the available sample frames. With adequate advance planning and sufficient resources, a sufficiently large sample frame should be available in most situations.

Respondents whose physical handicaps increase the difficulty of completing the interview tend to be less cooperative than other respondents. Thus questionnaires and survey administration techniques should be so designed as to minimize the difficulties experienced by persons with particular physical handicaps, such as tactile, hearing, and visual impairment.

Respondents identified by agency listings and GATE-type listings, if properly introduced to the survey, can be more highly motivated because a fairly direct link can be established between the survey and improvements in their personal situation. Self-selected respondents naturally tend to be highly motivated.

Although users of specialized services, such as the GATE sample, may be more highly motivated due to a reasonably concrete connection between survey response and service improvement, this connection can also lower the level of cooperation. Some users of specialized services are fearful that criticism of the service will result in service cutbacks or possibly termination. Such an outcome would clearly worsen the situation for current service users. This worry may be overcome by a careful introduction to the survey, which states explicitly that the results will only be used to improve current service and not as an excuse to reduce or terminate the service.

SUMMARY

This paper has explored variances among transportation-handicapped respondents captured by a set of alternative sample frames. Although no claim is made that the particulars of these captured variances are representative or the trends transferable, certain basic differences have been emphasized. Very importantly, this discussion has presented a transferable framework for selection among alternative sample frames, which clearly relates sample-frame characteristics to research objectives.

In the Greensboro study, the agency-sampling approach captured a wider range of travel behaviors,

probably reflecting the wide age range, relatively high level of employment, and wide income range of the agency sample respondents. The agency-sampling approach possesses the unique advantage of being easily targeted to subgroups with particular handicaps, through the selection of agencies specializing in service to particular subgroups of the handicapped population. In this manner, particular handicaps may be intentionally overrepresented at minimum cost. Likewise, the ability to target more narrowly the populations captured by the agency sample permits the researcher to compensate for underrepresentation of particular handicaps. The researcher may wish to use this ability in connection with other sampling techniques. For example, if a random-sample approach underrepresents the wheelchair-confined or the blind, then a supplemental sample from an agency frame may be of great value.

Knowledge of differences in populations captured by the various sample frames, an understanding of the impacts of various physical handicaps on questionnaire design and administration, and a clear statement of research objectives permit the researcher to select, design, and administer a survey of the handicapped population in such a manner as to minimize cost and maximize useful output. It is highly important that all three of the above considerations be taken into account simultaneously. All too frequently, researchers are preoccupied with the practical difficulties of obtaining a sample frame of the handicapped population and do not examine the unintended impacts that frame selection can have on the research objectives. This article has illustrated some of those potential impacts as observed in the Greensboro study.

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REFERENCES

1. U.S. National Health Survey. Limitation of Activity and Mobility Due to Chronic Conditions in the United States, 1972. National Center for Health Statistics, U.S. Department of Health, Education and Welfare, Rockville, MD, Series 10, No. 96, 1974.
2. R.M. Michaels and N.S. Weiler. Transportation Needs of the Mobility Limited. Northeastern Illinois Planning Commission, Evanston, IL; Transportation Center, Northwestern Univ., Evanston, Sept. 1974.
3. Peat, Marwick, Mitchell and Company. Elderly and Handicapped Data Collection--Interim Rept. No. 1: Data Requirements for Elderly and Handicapped Transportation Planning. UMTA, Dec. 1979.
4. Grey Advertising, Inc. Summary Report of Data from National Survey of Transportation Handicapped People. UMTA, June 1978. NTIS: PB 291 765.

User-Side Subsidies: Delivering Special-Needs Transportation Through Private Providers

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The user-side subsidy is a method for delivering low-cost transportation services to selected groups of travelers. Under a user-side subsidy program, certain target groups of users are permitted to purchase trips from a transportation provider at fares that are below those charged to the general public. For each subsidized trip delivered, the provider receives a voucher, scrip, or a ticket from the user, which can be redeemed at the subsidizing agency for an agreed-on value—usually the full-fare value of the trip. Over the past several years, the Service and Methods Demonstration Program of the Urban Mass Transportation Administration has been exploring various applications of the user-side subsidy concept through a number of demonstrations and case-study evaluations. This paper summarizes and compares the major evaluation findings from these projects to make some general statements about the overall feasibility and cost-effectiveness of providing special needs transportation services through user-side subsidies. It examines the concept from the perspective of three principal groups—the subsidizing agency, the user, and the transportation provider. Relevant issues of concern to each of these groups are identified and discussed and those issues most relevant to federal policymakers are highlighted.

The user-side subsidy is a promising technique for delivering low-cost transportation service to selected groups of individuals through private providers. Under a user-side subsidy program, certain target groups of users are permitted to purchase trips from a transportation provider at fares below those charged to the general public. For each subsidized trip delivered, the provider receives a voucher, scrip, or a ticket from the user, which can be redeemed at the subsidizing agency for an agreed-on value—usually the full-fare value of the trip.

User-side subsidies offer several potential advantages over the more common provider-side subsidy arrangement. Under a provider-side subsidy, payments are made directly to a transportation provider to maintain certain specified fare and service levels. Because the provider receives the same subsidy regardless of demand, there is very little incentive to improve service levels beyond the specified minimum or to do anything else to attract additional patronage. Under a user-side subsidy, the total subsidy payment is directly related to the number of subsidized trips carried. Consequently, there is a strong incentive for the transportation provider to attract additional demand and increase productivity.

The user-side subsidy is also a more efficient subsidy arrangement because payment is made only for those trips actually taken by the target group. At low levels of demand, this can result in substantial cost savings for the subsidizing agency. Finally, a user-side subsidy program can be implemented without disrupting existing transportation pricing structures or operating environments.

Over the past several years, the Service and Methods Demonstration (SMD) Program of the Urban Mass Transportation Administration (UMTA) has been exploring various applications of the user-side subsidy concept through a number of demonstrations and case study evaluations. These evaluations have focused, for the most part, on the application of user-side subsidies to provide low-cost, shared-ride taxi service for elderly and handicapped people. Findings from these evaluations have provided valuable information on a number of issues, including program costs, barriers to implementation, alternative payment methods, project use and user characteristics, and impacts on service providers.

The purpose of this paper is to draw on these evaluation findings to make some general statements about the overall feasibility and cost-effectiveness of providing special-needs transportation services through user-side subsidies. The following three sections address the concept of user-side subsidies from the perspective of the subsidizing agency, the user, and the transportation provider. Relevant issues of concern to each of these groups are identified and discussed based on currently available findings. A final summary section highlights those issues most relevant to federal policymakers and discusses the compatibility of user-side subsidies with current national goals and philosophies.

ADMINISTRATIVE ISSUES AND FINDINGS

User-side subsidies, like any subsidy program, involve the expenditure of public funds for designated target groups to achieve objectives that are deemed worthy. In the context of special-needs transportation, the major objective of a user-side subsidy is to satisfy the transportation needs of certain elderly and handicapped individuals at a reasonable cost to the public. From the perspective of the subsidizing agency, therefore, the most important issues concern overall program costs and methods of cost containment, the ease with which the program can be implemented, and its overall acceptability to targeted users, transportation providers, and the general public. These major issues are discussed below based on evidence obtained through SMD evaluation efforts.

Concept Acceptability

User-side subsidies for special-needs transportation services have, in general, been well received by intended target groups, transportation providers, and the general public. Two of the four UMTA demonstration sites (Kinston, North Carolina; and Lawrence, Maine) have continued their programs with local funds after federal demonstration funds ended. In Danville, Illinois, user-subsidized taxi service was replaced by user-subsidized fixed-route bus service, which has also been continued by using local funds. Of the completed SMD demonstration projects, only Montgomery, Alabama, chose not to continue some form of a user-side subsidy program. All the programs in the case-study sites were initiated and continue to operate with local funding.

Despite the fact that user-side subsidies are, in effect, a form of public assistance, there has been surprisingly little negative public reaction toward the programs at any of the demonstration or case study sites. On the contrary, public opinion toward the programs has been highly favorable. In Danville, a random telephone survey of households found that 94 percent of those who knew about the user-side subsidy program thought that it was a good idea. More than 75 percent felt that the program should be continued beyond the demonstration period by using local funding. On the other hand, support for extending user-side subsidies to other transportation-disadvantaged groups (specifically, the young nondriver and the nonelderly poor) was much less enthusiastic. This suggests that the intended

target groups may be an important factor in determining the overall acceptability of a user-side subsidy program in a local area.

Implementation Considerations

User-side subsidies have been successfully implemented in a variety of locations that have significantly different taxi regulatory policies and fare structures. The concept itself is extremely adaptable to local conditions and, in most instances, can be implemented without the need to modify any local transportation ordinances or existing fare systems.

One implementation issue that had to be addressed in all UMTA-funded demonstrations concerned local taxi ordinances regarding shared riding. Under a policy that permits shared riding, a taxi operator may pick up additional passengers going in the same general direction as the first passenger and charge each of them a separate trip fare. Current UMTA policy authorizes the expenditure of federal funds for subsidizing taxis only if they allow shared riding. Consequently, in each of the UMTA-sponsored demonstration projects, any local ordinances prohibiting shared riding in taxis had to be repealed, at least for subsidized trips.

None of the demonstration sites encountered strong opposition to the ordinance change from either taxi operators or citizen groups. On the other hand, the ordinance change had virtually no impact on local taxi operations. That is, most taxis continued to provide exclusive-ride service to both subsidized and nonsubsidized passengers. One reason for the ineffectiveness of the ordinance change was that the demand for taxi trips in most of the project sites was too dispersed (geographically, in time, and among competing taxi operators) for any single operator or firm to efficiently group trips on a shared-ride basis. Moreover, most operators were reluctant to degrade existing service levels for fear of losing customers to competing taxi firms who had not instituted a shared-ride policy.

Only one demonstration site (Montgomery) made a serious attempt to promote shared riding through additional regulatory reform. First, a taxi ordinance was introduced that allowed taxi dispatchers to delay project requests for up to 1 h in order to facilitate grouping of shared-ride trips. Next, the existing meter-based taxi fare system was replaced by a grid fare system for shared-ride trips. Last, the city reduced the minimum taxi charge or "flag drop" from \$1.00 to \$0.80 for all subsidized trips, the rationale being that the increased productivity from shared riding would more than offset any reduced revenues from the lowered flag drop.

Although there was no objection in principle from the taxi operators toward shared riding, they were adamantly opposed to any reduction in fares. Many operators threatened to drop out of the user-side subsidy program unless the \$1.00 flag drop was reinstated for project trips. The dispute was ultimately resolved when the program director agreed to reimburse taxi operators the additional \$0.20 for each correctly filled-out subsidy voucher that they turned in.

The issue of whether shared-ride taxi service can be effectively implemented only in conjunction with a zonal-based fare system has not yet been fully resolved. Clearly, a meter-based fare system tends to penalize taxi riders for any diversion made to pick up additional riders. A zonal-based-on-grid system overcomes this problem by allowing fares to be calculated on the basis of the origin and destination of each rider rather than on the total distance traveled. In Montgomery, however, the new grid system proved to be too confusing and too

tedious for many taxi operators, who either dropped out of the program or refused to participate altogether. In three of the locally funded case study sites--Seattle, Milwaukee, and the Los Angeles Harbor Area--user-side subsidy programs were implemented without changing from the existing meter-based fare system. However, it is not clear to what extent shared riding was practiced by taxi operators at these sites or whether the issue of a practical meter-based shared-ride fare structure was even considered.

All evidence from the SMD evaluations suggests that user-side subsidy implementation problems can be minimized by avoiding major changes in local institutional structures or in the existing operating practices of the transportation provider. Major institutional changes not only require the expenditure of substantial amounts of project staff time and effort, they may also create unfavorable local publicity that could ultimately undermine the entire program. Similarly, attempts to change the operating practices of private transportation providers in any way that they perceive to be detrimental to their business may ultimately result in their refusal to participate. Without the cooperation of the private operator, the fundamental advantage of user-side subsidies is lost.

Program Administrative Costs

The total direct cost to the public for a user-side subsidy program consists of the subsidy itself plus the costs associated with initiating and administering the program. Subsidy costs are determined for the most part by local policy decisions and are discussed in the next section along with various methods of cost containment.

Administrative costs, on the other hand, are more difficult to predict or control. They are related not only to program policies but integrally to project demand and productivity. The major component of administrative costs is staff labor. In the user-side subsidy demonstrations funded by UMTA, permanent staff requirements averaged about 2.5 full-time positions once the projects were fully operational. Between one-third and one-half of the total staff time was devoted to subsidy distribution and redemption. The one major exception to this was in Danville, where exclusive use of vouchers eliminated the need for subsidy distribution outlets, and a computerized voucher-processing system minimized staff time for subsidy redemption. These features combined to reduce permanent staff requirements to just more than one half-time position.

Typical monthly operating costs for four user-side subsidy demonstrations are shown in Table 1. In every site except Danville, direct labor and overhead formed the bulk of monthly operating costs. Labor cost differences among the other sites reflect differences in wage rates and hours worked.

Looking at project costs on a per-trip basis, it becomes obvious that administrative costs are relatively independent of the number of project trips actually taken. In both Kinston and Danville, for example, total monthly administrative costs were similar in magnitude. However, although Kinston generated only about 3000 project taxi trips per month, Danville's project taxi use averaged more than 7500 trips per month. Because the administrative costs could be spread over a substantially larger base in Danville, the average administrative cost per trip was only \$0.20 compared with \$0.64 in Kinston. Thus, the administrative overhead of running a user-side subsidy program appears to enjoy significant economies of scale, suggesting that the

Table 1. User-side subsidy monthly operating costs.

Item	Danville	Montgomery	Kinston	Lawrence
Administrative (\$)				
Labor ^a				
Direct labor	475	2125	1400	2582
Overhead (25 percent)	75	531	350	646
Total labor	550	2656	1750	3228
Office rental and supplies	350	1773	200	555
Promotion and advertising	100	83	10	63
Computer	500	325	-	-
Total administrative	1500	4837	1960	3846
Avg administrative cost per trip ^b (\$)	0.20	1.60	0.64	0.48
Avg subsidy per trip (\$)	1.02	1.45	0.83	0.76
Total public cost per subsidized trip (\$)	1.22	3.05	1.47	1.24

Note: Danville cost figures reflect a typical project month in 1976; cost figures for the other three sites reflect typical project months in 1979.

^aStaff time and average wage rate: Danville, 88 h/month @ \$5.40; Montgomery, 404 h/month @ \$5.01; Kinston, 367 h/month @ \$3.81; Lawrence, 350 h/month @ \$7.38.

^bAverage number of subsidized taxi trips per month (1979): Danville, 7500; Montgomery, 3016; Kinston, 3070; Lawrence, 8080.

Table 2. User-side subsidy annual program costs.

City	Total Program Costs (\$)	Administrative Cost (\$)	Subsidy Payments (\$)	Project Demand (no. of trips)	Avg Cost per Trip (\$)	Administrative Cost per Trip (\$)
Danville (1976)	109 715	18 000	91 715	89 900	1.22	0.20
Montgomery (1979)	110 447	58 044	52 403	36 187	3.05	1.60
Kinston (1979)	54 251	23 520	30 731	36 832	1.47	0.64
Lawrence (1979)	119 770	46 116	73 654	96 954	1.24	0.48
Kansas City (May 1977-April 1978)	137 479	48 120	89 359	56 383	2.43	0.85
Los Angeles (December 1978-November 1979)	142 250	31 576	110 674	59 323	2.40	0.53
Seattle (1980)	199 000	59 000	149 000	44 600	4.46 ^a	1.12
Milwaukee (1980)	993 348	75 500	917 842	136 770	7.26 ^a	0.55

^aThe relatively high average cost per trip in Seattle and Milwaukee can be attributed to the high meter-based taxi fares in these cities and local policy decisions to not limit subsidy payments by distance traveled.

concept may be financially viable even in larger urban areas.

In order to get a complete picture of the public costs for a user-side subsidy trip, the average per-trip subsidy payment must be added to the administrative costs. In the demonstration sites, per-trip subsidies varied from a low of \$0.76 in Lawrence to \$1.45 in Montgomery. Total public cost per subsidized taxi trip ranged from approximately \$1.20 in Lawrence and Danville to \$3.05 in Montgomery. All these costs are substantially lower than those observed for publicly owned or operated specialized demand-responsive transit systems.

Total annual costs for a user-side subsidy program are, of course, largely a function of total project demand. Table 2 presents a comparative summary of annual project costs for those user-side subsidy programs recently studied by the SMD Program. Although no general formula for estimating annual program costs readily emerges from these projects, a reasonable order-of-magnitude estimate can be made by assuming an administrative cost of \$40 000 to \$70 000 per year, depending on local wage rates, and adding to this an estimate of annual project demand times the estimated subsidy per project trip.

Subsidy Costs and Cost Containment

The costs attributable to user-side subsidy payments are the product of the average subsidy per trip and the total demand for trips by eligible users. Therefore, subsidy costs can be influenced through various combinations of adjustments in the per-trip subsidy amount, restrictions on project eligibility, and limitations on total subsidized tripmaking.

These methods of cost containment are discussed below.

Subsidy Limits

Subsidy levels in those projects evaluated by the SMD Program ranged from 50 to 95 percent of the unsubsidized taxi fare. These levels were generally set by local program policy and reflected trade-offs among taxi service quality, transit fare comparability, and overall program funding limits.

The subsidy level influences total subsidy costs in at least two ways. First, the higher the subsidy level, the greater the public expenditure per trip, independent of demand. Second, as the subsidy level increases, the per-trip cost to the user decreases, which causes overall project demand to increase because of negative demand elasticities. Evidence of demand elasticity with respect to changes in fares and subsidy levels comes from the Danville demonstration where a combined taxi rate increase and reduced subsidy level resulted in a 104 percent average fare increase for subsidized users. In response to this fare increase, there was a 28 percent decrease in overall project tripmaking, indicating a fare elasticity of -0.27. Therefore, although per-trip subsidy costs dropped by approximately 24 percent (from \$1.02 to \$0.78), total monthly program subsidy costs dropped by nearly 46 percent (from \$8200 to \$4400).

Besides adjustments in subsidy levels, many projects have placed ceilings on the total subsidy paid per trip. In Los Angeles, for example, a project user could travel any distance less than or equal to a meter fare of \$3.00 for \$0.15. Beyond this limit, the user paid at the metered rate. In Lawrence, any

taxi trip within the city boundaries or to specified locations just beyond the city limits, such as the hospital, can be paid in full with subsidized tickets. Trips to any other location can be paid with tickets up to a limit of \$1.50 (this being the maximum taxi fare for trips within the city). Additional fare charges must be paid in cash. In Milwaukee, the user is required to pay the first dollar of a taxi fare in cash and can then sign a voucher for any additional charges up to a \$7 maximum (\$10 for wheelchair users). For any charges beyond this maximum, the user must again pay out of pocket. The practical effect of a per-trip subsidy ceiling is to eliminate the risk of subsidizing a trip beyond a reasonable trip distance or beyond the boundaries of the program area.

Eligibility Restrictions

Another way to reduce total subsidy costs is to place tighter restrictions on who is eligible for the subsidy. By limiting eligibility to the most disadvantaged groups of potential users, a user-side subsidy program can reduce overall subsidy demand without adversely affecting those who need the subsidy most.

The two principal criteria used to restrict eligibility in user-side subsidy programs have been income and severity of handicap. In Pittsburgh and Milwaukee, eligibility is limited to handicapped people who cannot use conventional transit service because of their disability. The elderly who have no other qualifying disability are not eligible for the subsidies. In Seattle, the able-bodied elderly may register for the user-side subsidy program if their annual incomes are below specified levels.

Limitations on Tripmaking

A third method of subsidy cost containment that has been employed at several of the evaluation sites is to limit the number of subsidized trips an individual can take in a given time period. At those sites that used prepaid tickets or scrip as their subsidy mechanism, tripmaking limits were enforced by limiting the amount an individual could purchase in any one month. In Montgomery and Danville, where the use of vouchers precluded pretrip monitoring of purchases, redeemed vouchers were collected monthly, sorted by user ID number, and checked for possible violations of the established tripmaking limits. Individuals who were found to exceed the limit were issued warnings stating that continued abuse would result in forfeiture of subsidy privileges.

Other evaluation sites, most notably Seattle and Pittsburgh, have imposed no constraints on the number of trips subsidized users may take and have found little or no evidence of subsidy abuse or frivolous tripmaking. These findings, combined with the fact that effective trip-frequency monitoring procedures are both difficult and expensive, suggest that limitations on project tripmaking may not be an efficient method of cost containment for special-needs user-side subsidy programs.

Prevention of Subsidy Fraud

An issue directly related to cost containment and of major concern to policymakers is the potential for fraud within a subsidy program. Fraud not only drives up total program costs, it also reinforces negative public opinion and undermines the credibility of the program itself. In a user-side subsidy program, the potential for fraud exists with both the user and the transportation provider.

A variety of techniques have been implemented in user-side subsidy demonstrations to safeguard against user fraud. In-person registration was an integral part of many programs, and it effectively screened out individuals who were not eligible for the subsidy. Project identification cards, issued by the subsidizing agency, increased the risk to unauthorized users of being detected, and limits on project tripmaking or subsidy purchases decreased the benefits to eligible users of selling their subsidized trips to others.

In none of the projects studied by the SMD Program was there any significant evidence of user fraud. This observation held for sites that chose not to implement any of the above safeguards as well as those that did. Whether it was the absence of benefits that could be derived from user fraud or some common character trait that makes elderly and handicapped people inherently honest, it seems reasonable to conclude that user fraud is not a significant problem, at least among this target group.

Similarly, there was relatively little indication of fraud on the part of the service providers. In Montgomery, taxi operators who turned in what appeared to be altered or improperly filled out project trip vouchers were first warned and then denied reimbursement. Although this action did cause some operators to withdraw from the program, it also resulted in a substantial improvement in the quality and accuracy of the vouchers that were subsequently submitted. None of the sites that used tickets or scrip reported any evidence of fraud by taxi operators.

IMPACTS OF SUBSIDIES ON TARGETED USERS

User-subsidized taxi service provides eligible users with demand-responsive, curb-to-curb transportation service at a fraction of the cost paid by nonsubsidized taxi users. Moreover, at most of the sites studied by the SMD Program, subsidized users enjoyed the added benefit of exclusive-ride service, even though the programs were designed to subsidize trips on a shared-ride basis. Clearly, this represents a higher level of service than that found in other modes of public transportation typically available to the elderly and the handicapped. These level-of-service differences suggest that user-subsidized taxi service would tend to attract those target group members who are transit dependent and cannot afford to use full-fare taxis for all their travel needs.

Analyses of the four user-side subsidy demonstrations reveal that the projects were in fact successful in attracting those individuals who were most transit dependent and least able to afford full-fare taxi service. Equally important is the evidence of a self-selection process, whereby only those members of the target group most in need of user-side subsidies actually chose to register for and use the service.

The number of people who registered for the user-side subsidy programs in the four demonstration sites ranged from 26 percent of the estimated eligible population in Kinston to nearly 45 percent in Danville. However, registration did not necessarily imply active use of the subsidy program. In Kinston, more than 35 percent of those who registered for the program took no subsidized taxi trips during a typical month. In Montgomery, the percentage was closer to 90 percent. Average subsidized taxi use ranged from 0.56 trip per registrant per month in Montgomery to more than 4.5 trips per registrant per month in Kinston. Even in Kinston, however, average subsidized taxi use was

substantially below the maximum allowable number of trips (16-20) that could be taken.

When project registrants in Kinston and Montgomery were asked why they did not use the subsidized taxis more often, more than one third of them said that they did not need the service more than they were already using it. A substantial number of people who registered but did not use the service indicated that they registered simply to have a back-up means of transportation in case their primary (and preferred) means were ever unavailable.

There is no conclusive evidence from the evaluations that user-subsidized taxi services significantly increased the mobility of individuals who could not otherwise use conventional fixed-route bus service. In most of the demonstration sites, between 60 and 70 percent of project registrants were able-bodied elderly. Moreover, the percentages of the transportation-handicapped who registered for the subsidy programs were not significantly greater than those of eligible nonregistrants. Similarly, there was no indication from the demonstrations that transportation-handicapped registrants made greater use of the subsidized taxis than nonhandicapped registrants did.

Looking at the former travel modes of project users, it was found that 45 and 50 percent of the subsidized taxi trips in Montgomery and Danville, respectively, and 84 percent of the trips in Kinston were previously made by taxi at full fare. This suggests that many project users had no alternative to taxis and that the principal benefit that accrued to them because of the subsidy was a decrease in their overall cost of travel. After taxis, other formerly used travel modes included riding with others (16-26 percent), walking (6-15 percent) and, in Montgomery (which was the only site that had fixed-route bus service), the bus (15 percent).

There is as yet little quantitative evidence from the evaluations that user-side subsidies significantly increased the overall number of trips made by eligible users or that users traveled to different destinations or at different times than they did previously. Nevertheless, a substantial number of subsidized tripmakers at each site reported that their travel opportunities increased as a result of the subsidy program. Regardless of whether these travel and mobility changes are real or not, it may be concluded that those individuals who avail themselves of the subsidy are in fact deriving some measure of benefit from their actions.

IMPACTS OF SUBSIDIES ON TRANSPORTATION PROVIDERS

After the subsidized users themselves, private transportation providers receive the greatest benefits from a user-side subsidy program. In most of the projects evaluated by the SMD Program, the subsidies effectively lowered taxi fares for project users without reducing the per-trip revenues of the taxi operator. As discussed in the previous section, the lowered taxi fares resulted in significant mode shifts and possibly some induced taxi tripmaking by subsidized users. In either case, taxi operators realized an increase in the total number of taxi trips and hence an increase in their revenues.

The expectation of increased demand was sufficient incentive for most taxi operators to agree to participate in the user-side subsidy programs. Taxi operators were also willing to accept the additional administrative burdens and cash-flow risks of accepting noncash payments for project trips. As shown in Montgomery, however, taxi operators were not willing to accept less than full-fare reimburse-

ment in return for the expectation of increased demand.

A potential drawback to using private transportation providers to deliver special-needs transportation services concerns differences in service quality between subsidized and nonsubsidized trips. If, for example, taxi operators believed that subsidized trips were less profitable or more onerous than other trips, they might deliver lower-quality service (e.g., longer wait times, less courteous service, or even service refusals) to subsidized tripmakers. To date, however, there has been little or no evidence of unauthorized service discrimination toward subsidized taxi users in the SMD evaluations. In Montgomery, taxi operators were authorized by a local ordinance to hold service requests from subsidized tripmakers for up to 1 h in order to facilitate grouping of project trips. At most other sites, however, there was no foolproof way for taxi operators to identify the subsidized trips prior to payment.

It has been postulated that the extra demand for taxi service created by a user-side subsidy program would help to stimulate competition in the local taxi industry and encourage innovation. Findings from the SMD evaluations generally support this hypothesis, although much of the evidence tends to be anecdotal and site specific. In Kinston, for example, three taxi drivers, each with a significant clientele of subsidized users, ended their affiliations with established companies and began their own independent operations. In Lawrence, one highly entrepreneurial taxi operator purchased a lift-equipped minibus and then negotiated with the city to provide service for wheelchair-confined tripmakers, with the city subsidizing two-thirds of the fare. The wheelchair clients enjoyed a significant cost savings and the taxi operator effectively cornered the market for this specialized service. Finally, in Seattle, some taxi operators have filed lower fare rates for the elderly and the handicapped, presumably to increase their share of this market.

SUMMARY AND IMPLICATIONS FOR FEDERAL POLICY

The recent findings from the SMD Program and case-study evaluations have shown the user-side subsidy to be an efficient yet popular method of providing special-needs transportation services through private providers. The significant features of user-side subsidies that have been confirmed through SMD evaluation are summarized below:

1. User-side subsidies for elderly and handicapped tripmakers have been generally well received by the public.
2. User-side subsidies are adaptable to most local conditions and can be implemented without major changes to local transportation ordinances, fare structures, or operating practices.
3. Administrative costs for a locally funded user-side subsidy program are relatively modest and largely independent of total project demand.
4. The cost to the public to subsidize a trip through a user-side subsidy program is substantially less than the average per-trip cost of a publicly operated specialized transportation service.
5. Subsidy costs in a user-side program can be effectively controlled through such mechanisms as limits on per-trip subsidy payments, eligibility restrictions, and limits on total subsidized travel.
6. There has been little evidence of fraud by project users or transportation providers in user-side subsidy programs for the elderly and the handicapped.

7. User-side subsidies attract those individuals who are most transit dependent and most in need of the subsidized services. Eligible individuals with other means of transportation take few, if any, subsidized trips.

8. The principal benefits that accrue to subsidized users are a decrease in their travel costs for those trips that would otherwise have been made at full fare and a change from less-attractive travel modes such as fixed-route transit or walking.

9. Private transportation providers are generally supportive of user-side subsidy programs and are willing to absorb small administrative costs in return for the expectation of increased business.

10. There is some evidence that user-side subsidies stimulate competition among private transportation providers and serve as catalysts for innovation within the industry.

However, the most attractive feature of a user-side subsidy by far is its inherent efficiency. A user-side subsidy enables the subsidizing agency to target its program at those groups who are deemed to be most in need without having to extend benefits to other less needy individuals. Moreover, a user-side subsidy can be implemented with minimal interference in the operations and pricing structure of the local transportation industry. It therefore enables the subsidizing agency to utilize the efficiencies and productivities inherent in a competitive, free-market economy to obtain high-quality transportation service at the lowest cost. This combination of targeted benefits and competitive pricing minimizes waste and allows the subsidizing agency to allocate a greater proportion of its budget to direct subsidy benefits.

From a federal policymaking perspective, user-side subsidies seem to offer an efficient way of providing low-cost transportation services to those who really need them without the burden of substantial government intervention in private enterprise operations. Moreover, their ability to separate

income transfer payments from transportation operating costs could ultimately lead to more efficient allocation of federal, state, and local transportation funds. Social service agencies, for example, could extricate themselves from providing separate transportation services for their clients by sponsoring user-side subsidies on existing public and private transportation services. Public transportation would also benefit from widespread adoption of user-side subsidies. With the burden of providing low-cost transportation services to the transit-dependent borne by user-side subsidies, public transit operators could set fares to be more representative of actual operating costs and thereby reduce their operating deficits. Overall transportation subsidies should decrease under such a scenario, since only a subset of the total transit would be eligible for the user-side subsidies.

The application of user-side subsidies to fixed-route public transit services has already been successfully demonstrated in three SMD sites--Danville, Montgomery, and Lawrence. In each of these sites, the subsidized target group consisted primarily of the elderly and the handicapped. In future evaluation efforts, the SMD Program plans to investigate the feasibility of employing user-side subsidies for low-income transit users to offset the adverse effects of a systemwide fare increase.

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Much of the data on which this paper is based came from detailed evaluations of UMTA SMD projects and locally initiated user-side subsidy programs that were studied by the SMD Program. I would like to thank the following individuals for their contributions of both data and valuable insight concerning user-side subsidies: David Koffman of Crain and Associates; Michael Nelson and Mary Lovely of Charles River Associates, Inc.; and Lawrence Bruno, of UMTA's Office of Service and Methods Demonstrations.

Economies of Scale in Transportation for the Elderly and the Handicapped

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The costs of 36 transportation services for the elderly and the handicapped were analyzed to determine whether there are economies of scale in the provision of special transportation. A U-shaped cost curve was found for unit costs as ridership is increased by increasing the service area. In the case of increasing ridership by increasing the number of trips within a fixed service area, there are decreasing costs per passenger trip and a U-shaped curve for costs per passenger mile. However, because small agencies receive more unpriced resources in the form of shared overhead and volunteer labor and because of increased management costs and quality of services, coordinated or consolidated services may not lead to lower unit cost.

The number of programs that provide transportation to the elderly and the handicapped either as a primary function or as a support function for an organization with another purpose has grown significantly. As a result, several agencies often provide similar transportation services to a similar or to

the same client group within the same service area. Many (1-3) have raised questions about the efficiency of this duplication of service and have suggested that such services should be coordinated or consolidated in order to save money or to produce more service for the same money. This recommendation is based on an underlying assumption that there are economies of scale in provision of special transportation. This paper presents the findings of a study undertaken for the Urban Mass Transportation Administration to test this hypothesis (4).

Increases in the scale of operation as measured by ridership can occur in two separate ways: by increasing the number of riders within a given area (for instance, by broadening the criteria for use of the system) or by increasing the service area of the system. Therefore the hypothesis of economies of

scale was separated into two questions:

1. Do unit costs (i.e., costs per passenger trip or passenger mile) decrease with increases in ridership that are due to increasing the number of riders or special groups served within an area?

2. Do unit costs decrease with increases in ridership that are due to increasing the service area?

To answer these questions, we collected and analyzed the costs of 36 special transportation services in northeastern Illinois.

In our search of previous literature, we located only one study that dealt with the question of economies of scale for special transportation services. A 1977 article by Kidder and others (5) found economies of scale for a sample of 18 special service systems. By using regression analysis to develop a logarithmic cost model, they found that "a preliminary fitting of cost per passenger kilometer to number of passenger kilometers produced by the systems shows a nonlinear, negative slope relation that 'bottoms out'" (5, p. 37). In addition, Kidder and others mentioned two other findings of interest in light of our own study. They observed that the data did not exhibit "the expected upturn in the average cost curve at the higher operational scale" (5, p. 37). They attributed this to the ability of the larger systems to convert to fixed-route service. They also noted that two of the systems, the costs of which differed significantly from predicted costs (in opposite directions), received a high proportion of operating funds from government subsidy, suggesting to them that there is a causal link between receiving government subsidies and unit costs.

Our study differs from that by Kidder and others in that, in addition to size, we included other variables that affect costs (e.g., mode of service and percentage of passengers in wheelchairs). Our findings differed in that our models do not indicate that unit costs bottom out, but on other points we did come to similar conclusions, as will be pointed out in the following sections.

METHODOLOGY AND SAMPLE DESCRIPTION

In order to study the relation of size to unit costs, we gathered data by sending questionnaires to 429 special service providers in the Chicago metropolitan area. Based on their ability to provide detailed cost information, 36 agencies were chosen from the respondents for in-depth interviews. Information on costs, services-in-kind received by the agencies, ridership, and characteristics of their service, service area, and clients was gathered from the questionnaires and interviews.

Because many of the directors of the transportation services did not recognize all the costs attributable to the transportation service, costs had to be imputed in many cases. Imputed costs were of two types: those that the agencies did not keep records of but did attribute to the transportation function (e.g., vehicle maintenance costs) and those that the agency did not attribute to the transportation function (e.g., a staff person's time when that person's primary function was not related to transportation).

Two sets of costs were calculated from this information. The first set, financial costs, represents the actual money paid by the agency and subsidizing agencies for transportation. These costs include drivers' wages, fuel, maintenance, vehicle insurance, vehicle depreciation, the salaries of administrative and clerical staff whose primary job

concerns the transportation service, and building cost or rent for space primarily devoted to the transportation service. Salaries and rent for space not primarily devoted to transportation were not included because the agency would probably have paid these even if transportation were not provided. In all cases, vehicle depreciation was included even if some other agency had paid part or all of the purchase price because in effect this is the same as if the other agency had provided an operating subsidy.

We called the second set of costs opportunity costs. These include all the above financial costs plus salaries for that portion of the time spent in the transportation service by anyone not previously included, rent for that portion of space partly devoted to transportation for any space not previously included, and an imputed wage for volunteer drivers. (Wages were imputed at \$3.50/h, the lowest wage for any of the paid drivers, because the volunteers generally had little or no training or previous experience.) Although no additional monetary expenses were incurred by these three items, they represent resources that could be used for other purposes if the transportation service were not provided. Thus, opportunity cost represents the total resources expended for the transportation service, whereas financial cost represents the marginal monetary cost of the service.

It might be argued that opportunity costs are not a useful measure because special service agencies are constrained by actual monetary costs. However, comments made during interviews suggest that opportunity costs are meaningful to the agencies although the directors of the agencies do not articulate these costs in monetary terms. For instance, several directors mentioned the "headaches" involved with transportation provision. We suggest that those headaches actually represent a reduction in the quality or quantity of the agencies' primary output (e.g., therapy or meals). Further, one director of an agency that had changed from the provision of transportation to the purchase of transportation included in the benefits of the change the ability to absorb the loss of one staff person, although she never attributed the person to the provision of transportation or to the cost of providing transportation. This suggests that opportunity costs might actually be greater than we estimated. As for volunteers, if they were not used for driving, they could be used for some other purpose. (This is not to say that agencies should not use free services or share overhead when the opportunity is available. In fact, many small agencies could not provide transportation other than by taking advantage of these opportunities.)

Of the 36 agencies in the sample, 24 were operated by local governments, 7 by social service agencies, 3 by charitable institutions, and 2 by private companies. In all cases, the agency or company had another function besides providing special transportation services, although for the two private companies, the additional function was transportation related. Twenty-nine of the agencies provide service that is largely (more than 30 percent) demand responsive. Most of these require a 24-h reservation. The seven non-demand-responsive agencies provide primarily fixed-route or subscription service. Fifteen agencies provide service to the wheelchair user, although wheelchair passengers make up more than 5 percent of the ridership for only eight of the agencies. Thirty-three of the 36 agencies receive some government assistance. None of the agencies cover full expenses by fares. In fact, 20 charge no fares at all. Four agencies contract with another organization to provide service (except for the screening of clients), and an additional six

agencies lease vehicles from another organization.

Three agencies use volunteer drivers. Two of these operate on the basis of a volunteer being assigned to one trip. In this case, the volunteer will make a pickup at the passenger's home, take the passenger to his or her destination, in many cases wait, and then take the passenger home. Several of the agencies provide transportation to the general public, although their prime objective is to serve a particular group.

In order to discover the effects of size and other parameters on unit costs, financial and opportunity costs were analyzed by using two methods. First, the average costs of different types of agencies were compared. Second, cost models were developed by using regression analysis. The findings of those two methods are presented in the next two sections.

COMPARISON OF COSTS

In order to compare the effects of size and other variables on the costs of special service transportation, the sample was subdivided into different sizes or types of agencies, and the means of operating statistics and financial and opportunity costs were calculated for each agency type. Table 1 presents these means.

Cost efficiency is a result of two operating characteristics: low operating costs and high productivity. Thus an agency with low costs per hour or per mile can be cost inefficient if it also has low vehicle productivity. Therefore, three measures are important: productivity, operating cost (cost per service hour or per vehicle mile), and unit cost (cost per passenger trip or per passenger mile). This distinction can clearly be seen when the sample is divided into agencies that primarily provide demand-responsive service and agencies that primarily provide other types of service (subscription and fixed-route). Demand-responsive services have significantly lower costs per service hour and vehicle mile. This may be partly because they use smaller vehicles. However, because their vehicle productivities are lower (a third of that of the other services), their costs per passenger trip and per passenger mile are higher.

This division also bears out the finding of Kidder and others (5) that larger agencies provide fixed-route services. The mean ridership of the agencies in our sample that provide primarily demand-responsive service was 18 000 trips/year, whereas the mean ridership of the other agencies was 82 000 trips/year. This raises an important question that we could not answer from our study. As ridership increases, do agencies tend to change from demand-responsive to subscription and fixed-route service? If this is true, it may imply that larger agencies are achieving cost efficiencies by limiting service to recurring trips or trips along major routes. Although this type of service generally allows for higher vehicle productivity than individually scheduled, many-to-many trips, it excludes clients with less easily scheduled travel needs. On the other hand, the correlation between large riderships and subscription and fixed-route service may occur because these types of services do not survive at low riderships.

The second division of the sample was based on whether the agency provided service for wheelchair passengers. The mean cost per service hour was higher for those agencies that provide this service, perhaps partly because the vehicles are equipped with lifts. Although the drivers may have more training, they receive approximately the same wages. However, the cost per vehicle mile is lower

for agencies that provide wheelchair service. This implies that the vehicles have a higher rate of miles per service hour (this is not necessarily the same as speed because the vehicle may not actually be in use during a service hour). The fact that the wheelchair services have lower vehicle productivities and provide longer average trips may account for the higher miles per service hour. We hypothesize that the wheelchair-bound passengers take longer trips because they take fewer shopping and social trips due to physical barriers at those sites. The remaining trips, medical/therapy and work, tend to be longer (6). The cost per passenger trip is higher for wheelchair service, whereas the cost per passenger mile is lower; this is a result of the longer average trip distances.

The ratio of opportunity cost to financial cost for agencies that provide wheelchair service is much lower than that for the agencies that do not provide the service. This is partly because they do not use volunteers; the additional work required to handle wheelchairs and the requirements of the frequently more severe disabilities of wheelchair passengers probably discourage both potential volunteers from offering their services and agencies from using less professional drivers.

The third subdivision of the agencies was according to whether the transportation service was operated by a government agency. We found that government agencies have lower operating costs per service hour, partly because the special transportation operations of government agencies frequently share vehicle maintenance facilities and insurance coverage with other local government fleets. Average maintenance costs and insurance costs for government agencies are, respectively, \$0.61 and \$0.37 per service hour, whereas for nongovernment agencies they are \$1.31 and \$1.17. In addition, the government agencies are less likely to provide more expensive service for wheelchair-bound passengers. Interestingly, administrative costs are virtually the same for the two types of agencies (\$2.43 per service hour for government and \$2.45 for nongovernment). However, the cost per vehicle mile for government agencies is higher, which implies that these agencies use their vehicles for relatively few miles per service hour. The cost per passenger trip for government agencies is lower, whereas the cost per passenger mile is higher. This reflects the fact that the average trip distance is half that of nongovernment agencies, which may be because the service areas of government agencies are smaller (the largest is 6x6 miles) than those of nongovernment agencies.

The ratio of opportunity cost to financial cost for the government agencies is much lower than that for the nongovernment agencies. This is partly because the nongovernment agencies are more likely to use volunteer drivers. The nongovernment agencies appear to use their "free" drivers inefficiently; their average driver cost per service hour is \$5.70 even though they pay wages averaging \$4.18/h (including imputed wages for volunteer drivers). This helps account for the difference in opportunity costs per service hour for government and nongovernment agencies.

Finally, the agencies were divided into small, medium, and large based on their annual ridership. The ratio of opportunity costs to financial costs is 1.4 for the smallest agencies, whereas it is 1.1 for medium and large agencies, which indicates that the small agencies receive more shared overhead and/or volunteer labor. Thus, although financial costs per service hour are lowest for the small firms, their opportunity costs per service hour are highest. The small agencies' cost per vehicle mile is also high-

Table 1. Service characteristics and costs of sample.

Sample Division	N	Avg Trip Distance (miles)	Productivity (passenger trips/vehicle hour)	Financial Costs (\$)				Opportunity Costs (\$)				Opportunity to Financial Costs Ratio
				Per Service Hour	Per Vehicle Mile	Per Passenger Trip	Per Passenger Mile	Per Service Hour	Per Vehicle Mile	Per Passenger Trip	Per Passenger Mile	
Overall	36	4.3	4.6	10.80	1.16	2.78	0.80	13.05	1.40	3.51	1.00	1.3
Demand-responsive mode	29	3.6	3.9	10.33	1.10	3.01	0.86	12.49	1.31	3.82	1.07	1.3
Other mode	7	7.2	7.6	12.74	1.39	1.85	0.55	15.37	1.74	2.24	0.70	1.2
Provides wheelchair service												
Yes	15	5.1	4.3	11.35	1.06	3.08	0.78	13.23	1.24	3.55	0.90	1.2
No	21	3.7	4.8	10.40	1.24	2.57	0.82	12.93	1.52	3.48	1.07	1.4
Government agency												
Yes	24	3.3	4.8	10.34	1.29	2.57	0.88	12.28	1.56	3.04	1.04	1.2
No	12	6.7	4.3	11.72	0.88	3.21	0.61	14.61	1.05	4.44	0.90	1.5
Size of ridership												
<20 000	23	4.4	4.3	10.38	1.22	2.69	0.79	13.29	1.53	3.69	1.05	1.4
>20 000 and <50 000	7	3.6	4.0	11.51	1.00	3.68	0.93	12.60	1.10	3.96	1.02	1.1
>50 000	6	4.6	6.8	11.57	1.55	2.06	0.67	12.68	1.28	2.29	0.77	1.1

est for financial as well as for opportunity costs. Given that their productivity and average trip distance are about the same as those of the overall sample, it seems they are not using the vehicles as much as they could. However, the medium-sized agencies have very low productivities and short trip distances. As a result, they have the highest cost per passenger trip even though their operating costs are low. The large agencies have the lowest unit costs (both per passenger trip and per passenger mile) for both financial and opportunity costs although their operating costs are in the medium range. This is due to their high productivities.

To summarize, the smallest agencies have low financial costs per service hour because they take advantage of free services. Because they have medium productivities they take advantage of these low financial operating costs to achieve low unit financial costs. However, in terms of opportunity costs, they have high operating costs and therefore relatively high unit opportunity costs, possibly because they use these free services inefficiently.

The large agencies have relatively high financial operating costs because they receive few free services. Their opportunity operating costs are in fact slightly below average. Because they have a high productivity rate, they actually have the lowest unit opportunity costs.

The medium-sized agencies have medium to low operating costs but very low productivities. As a result, their unit costs are high. It appears that the large agencies are the most efficient; however, it should be remembered that the large agencies are more likely to provide fixed-route or subscription service.

It should be noted that productivities vary more between agencies than operating costs (i.e., cost per service hour or per vehicle mile). This implies that there is more potential for decreasing unit costs (i.e., cost per passenger trip or per passenger mile) by increasing productivities than by decreasing operating costs. Increasing rider density (trips per square mile of service area) is more likely to increase productivity (trips per vehicle hour) than increasing service area. Therefore, it appears that increasing rider density will have a greater effect on lowering unit costs.

RELATION OF UNIT COSTS TO SIZE

The agencies and the type of service that they provide differ from one another in many ways that may affect unit costs. In order to isolate the effects of size, the effects of other types of differences

must be taken into account. We attempted to do this by developing cost models by using regression analysis.

For financial costs, however, we did not find statistically significant models of unit financial costs that included any measure of size. This appears to indicate that there are constant returns to scale for financial costs. Figure 1, which shows financial cost per passenger trip plotted against total annual ridership, seems to confirm this. The plot shows that there is great variation in unit costs for the smallest agencies. Some of this variation is probably due to the higher amount of shared overhead and volunteer labor that the small agencies are more likely to receive. Also, when total transportation costs are low, the agencies may not control them as closely, which may add to the variation for small agencies.

The cost models fitted for opportunity costs are presented in Table 2. The model of cost per passenger trip explains 88 percent of the variation in the data and has an F-value of 14.30, which is significant at the 1 percent level. The t-values indicate that the intercept is not significant and the coefficient for revenue from government subsidy is significant at the 10 percent level. All the other coefficients are significant at the 5 percent level. The model for cost per passenger mile explains 82 percent of the variation in the sample and has an F-value of 10.37. The intercept and coefficient of rider density are significant at the 10 percent level. All the other coefficients are significant at the 5 percent level.

The effect of increasing the service area when rider density is constant is shown in Figure 2. It can be seen that there are economies of scale as the service area is increased to an optimal size and diseconomies above that size. For opportunity cost per passenger trip, the most efficient size of service area (i.e., the one with lowest unit cost) appears to be in the range of 300-500 miles² (see Figure 2a) regardless of the rider density. However, for opportunity cost per passenger mile, the most efficient size of service area depends on the rider density as shown in Figure 2b. This may reflect the relationship between service area and average trip distance. When rider density is high, service may be more efficiently provided if trip distances are kept short (which is an inherent result of small service areas). It should be mentioned that there were no agencies in the sample with service areas in the range between 350 and 750 miles² and only a few larger than 750 miles². In fact, the majority of service areas (25 out of

Figure 1. Financial costs per passenger trip versus annual ridership.

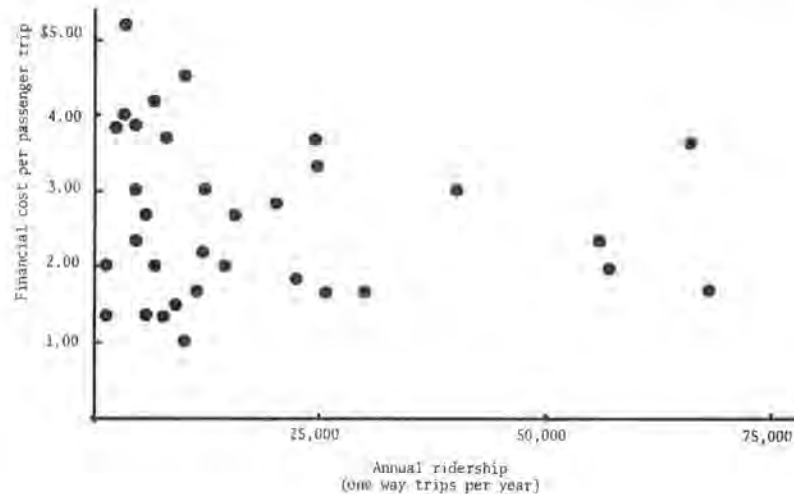


Table 2. Models of opportunity cost for special services for elderly and handicapped.

Independent Variable	Dependent Variable			
	Cost per Passenger Trip	t-Value	Cost per Passenger Mile	t-Value
Intercept	-0.0398	0.02 ^a	-0.8157	1.86 ^b
Measure of output				
Service area (100 miles ²)	-2.4512	4.69	-0.3812	2.44
(Service area) ²	+0.2849	4.82	+0.0439	2.70
Rider density (10 000 trips/mile ²)	-1.0593	2.25	-0.3744	1.95 ^b
Passenger miles (10 000 trip miles)			+0.0052	2.22
1/passenger miles			+0.3655	
Quality of output				
Avg trip distance (miles)	+1.0837	3.21		
(Avg trip distance) ²	-0.0869	3.57		
1/avg trip distance			+1.0451	5.56
Mode (d) (1 = demand responsive)			+0.9131	5.03
Proportion wheelchair	+3.7931	2.26		
Input price				
Driver wages (\$/h)	+0.8642	2.60	+0.2823	3.47
Organizational factors				
Government agency (d) (1 = government agency)	-2.5758	3.11	-0.3973	2.91
Proportion government subsidy	+1.6710	1.76 ^b		
Individual volunteers (d)	+3.0020	2.35		
Environmental factors				
Proportion older than 65 (%)	-0.1827	2.96	-0.0350	2.30
R ²	0.88		0.82	
F-value	14.30		10.37	

Note: (d) indicates dummy variable. Unless otherwise indicated, the t-value is significant at the 5 percent level.

^at-Value is not significant.

^bt-Value is significant at the 10 percent level.

36) are 36 miles² or less. Thus, this sample provides evidence for a U-shaped curve, but it may not be accurate as to the size of service area at which costs begin to rise or how low they are at the optimum size.

The effects of increasing rider density on opportunity unit costs are shown in Figure 3. The effect on cost per passenger trip is constant decreases in cost with increasing scale. For cost per passenger mile, the effect depends on the size of the service area. Agencies with very small service areas experience economies of scale for all ranges of rider density in the sample. Agencies with medium or large service areas, however, have U-shaped cost curves with respect to costs per passenger mile.

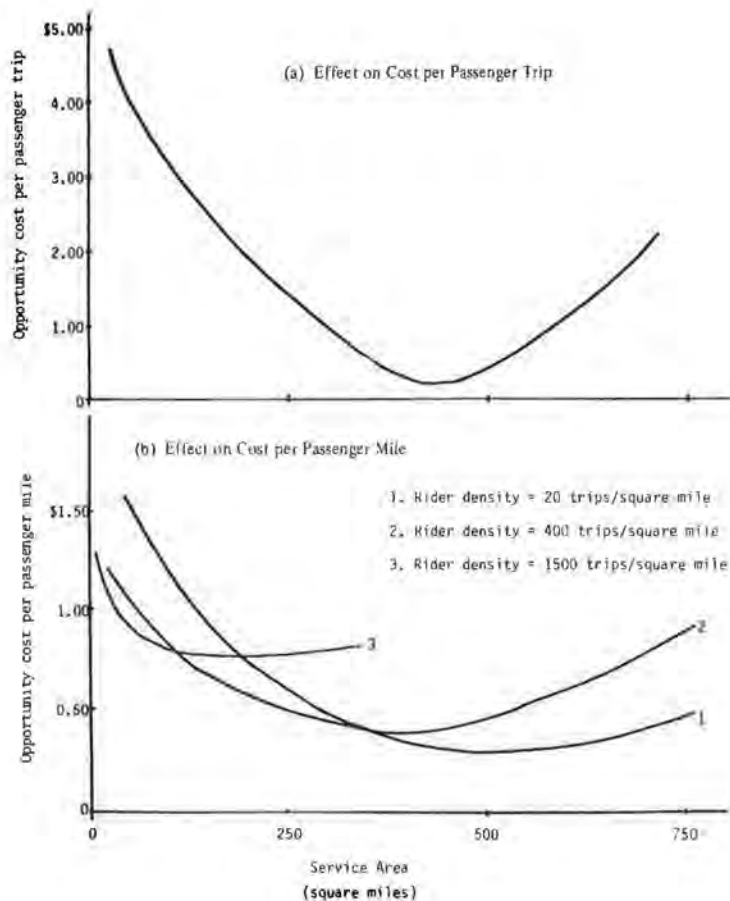
In summary, it appears that agencies with very small service areas and low rider densities are inefficient. They probably could reduce unit costs by expanding ridership either by increasing rider density (e.g., broadening criteria for service) or by increasing service area. Agencies with large service areas appear to operate more efficiently with low rider densities. Thus, large service areas

may be efficient in low-density or rural areas (where they are probably necessary if enough destinations are included to be useful to the passengers) but less efficient in dense, urban areas. Obviously, these implications need to be tested further. If the actual causes of the relationships were further understood, it might be possible to overcome the apparent inefficiencies of certain combinations of sizes of service areas and rider densities by transferring management or operating techniques.

FINAL REMARKS

Although our research indicates that there are economies of scale when total resources are considered, there are problems with recommending the coordination or consolidation of special transportation services in order to take advantage of the potentially greater efficiency of a larger ridership. One difficulty concerns the use of unpriced resources (i.e., shared overhead and volunteer labor) under a new organizational arrangement. A

Figure 2. Effect of service area on unit opportunity cost.



second is based on empirical evidence concerning the actual unit costs of consolidated and coordinated services.

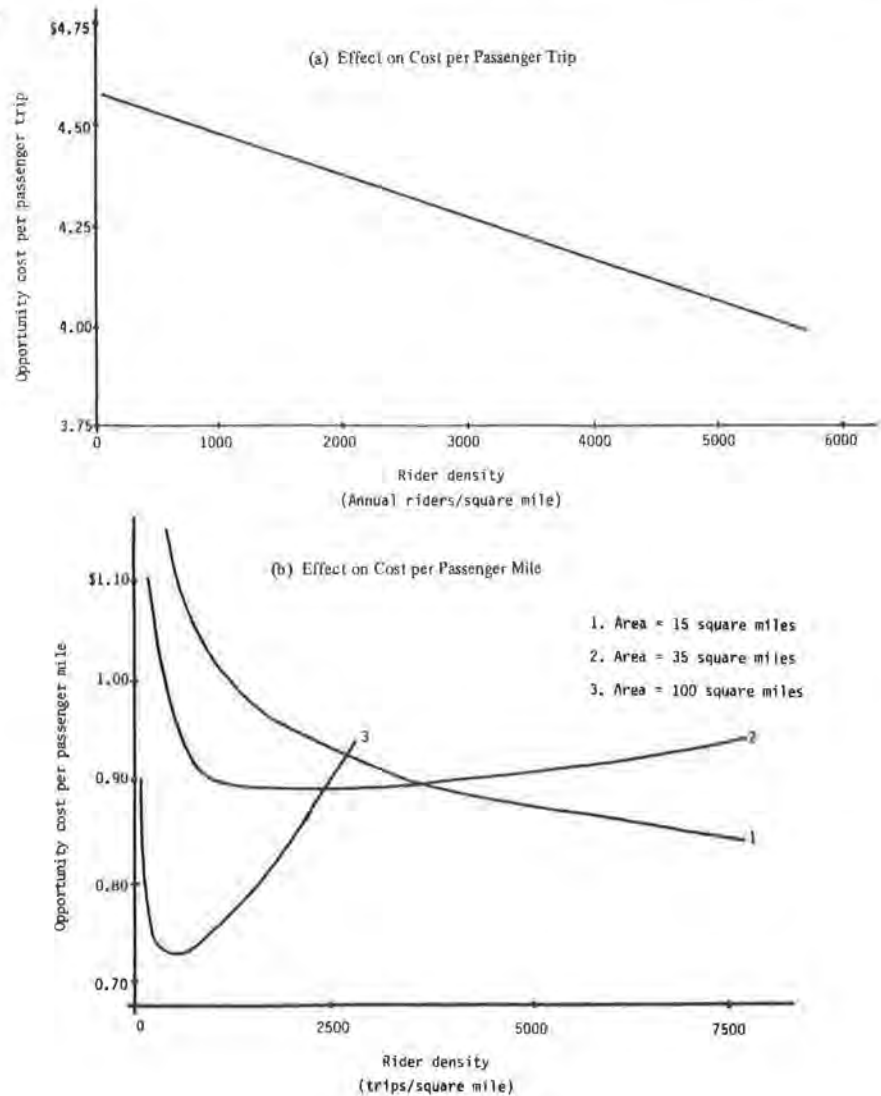
Our study of economies of scale indicates that from the point of view of actual money paid (by the provider and by other organizations that subsidize the provider) for special transportation services, returns to scale seem to be constant. In other words, there is no optimal size for special transportation services. On the other hand, from the point of view of total resources used, there are economies of scale. Special transportation services with small service areas and/or low rider densities are inefficient. (Agencies with very large service areas are also inefficient.) Thus agencies with very small riderships would apparently operate more efficiently if they enlarged their ridership or if they coordinated or consolidated their transportation services with other agencies. But this is true only if the unpriced resources (i.e., shared overhead and volunteer labor) are effectively used in some other capacity after coordination or consolidation. Given the tight budget constraints of most agencies providing special transportation, it seems likely that any shared overhead released by a reorganization of transportation services will be put to good use. Although there are relatively few agencies that use volunteer drivers, the effect of volunteers in reducing financial cost is much greater. Further, these agencies may not find other uses for the volunteers and, if they do, the volunteers may not offer their time for the new job. Although most providers seem to prefer not using volunteer drivers (because they are less reliable, do not have special training, and increase problems with insurance), agencies with tight budgets may

have no choice other than to continue to use volunteers or to discontinue the provision of transportation.

The coefficients of the other variables in the opportunity cost models are for the most part as expected. Cost per trip increases with average trip distance up to distances of about 6 miles. For trips longer than 6 miles, the cost begins to fall off because the longer trips are usually provided by subscription and fixed-route service at higher vehicle productivities. The cost per passenger mile falls off and gradually flattens out as trips get longer. The models indicate (as Table 2 also did) that providing demand-responsive service is more expensive per passenger mile and providing wheelchair service is more expensive per passenger trip. Unit costs go up as driver wages go up, which is expected. Unit costs go down as the percentage of the population of the service area that is 65 or older increases. Since many of the agencies serve the elderly, increases in elderly population mean that trip origins are closer together, thus decreasing the time and mileage spent in deviating to pick up passengers.

If the agency assigns voluntary drivers to individual trips, the opportunity cost per trip is considerably higher. This appears to be an inefficient use of labor; however, it may be that the drivers would not volunteer if they were assigned to drive a van picking up several passengers for a set period of time. As the agencies that assign volunteers to individual trips usually provide trips with few other alternatives (e.g., they cross jurisdictional boundaries), they may be filling a rather special role in transportation for the elderly and the handicapped.

Figure 3. Effect of rider density on unit opportunity cost.



Finally, if the transportation is provided by a government agency, the unit costs are lower, as also shown in Table 1 and discussed in the last section. However, the opportunity cost per passenger trip increases 1.7 cents for every 1 percent of operating revenue provided by government subsidy. Two possible causes for this relationship are the costs of accountability (e.g., more record keeping) and the inefficient use of resources that the agencies perceive as free (i.e., the subsidies). The nature of the relationship among government operation, government subsidy, and cost requires further investigation.

The second problem with increasing efficiency through consolidation is that empirical evidence indicates that the unit costs of agencies providing consolidated transportation are actually higher than the opportunity costs of uncoordinated special transportation services. [This evidence comes from research we are currently engaged in as well as previous research by others (7).] These increased unit costs are undoubtedly due partly to the increased management necessary to coordinate services for several agencies that have differing requirements. Probably more importantly, however, these transportation-only agencies increase costs in attempting to improve the quality of their product. Our research indicates that they do provide a higher

quality of transportation; for instance, vehicles are maintained better and drivers have more training.

This poses a difficult choice for those interested in special transportation. Ideally, special transportation services should be consolidated so that the transportation is efficient and of high quality. However, this apparently will result in higher costs in a period when funds are getting scarcer.

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REFERENCES

1. J. Revis. Social Service Transportation. TRB, Special Rept. 184, 1979, pp. 10-19.
2. D. Cutler. Reality of Coordinating Transportation Services: Major Issues. TRB, Special Rept. 186, 1979, pp. 52-55.

3. Institute for Public Transportation. Statewide Study of the Feasibility of Coordinating and Consolidating Specialized Transportation Services. New York State Department of Transportation, Albany, Oct. 1978.
4. L. Robins, A. Pagano, and C. McKnight. Economies of Scale in Paratransit: Special Service Agencies and Taxicab Companies. UMTA, May 1981.
5. A. Kidder, L. Sen, G. Amedee, and D. McKelvey. Costs of Alternative Transportation Systems for the Elderly and the Handicapped in Small Urban Areas. TRB, Transportation Research Record 660, 1977, pp. 34-38.
6. C. McKnight and others. Integrated Para-Transit Transportation Planning for Off-Peak Low Density Travel--Rept. 2: Elderly and Handicapped Transportation. School of Urban Sciences, Univ. of Illinois at Chicago Circle; UMTA, Sept. 1978.
7. J. Burkhardt. Coordination and Consolidation of Agency Transportation. TRB, Transportation Research Record 784, 1980, pp. 1-6.

Two Options for Travel Needs of Mentally Retarded: Implications for Productivity and Cost-Effectiveness

JANE K. STARKS

The mentally retarded have a growing effective demand for transportation because of progressive deinstitutionalization. Simultaneously, local transit operators have a renewed obligation to implement special efforts that meet the travel needs of the retarded. This paper examines two options that would comply with the interim directives pertaining to Section 504 of the Rehabilitation Act of 1973. First, mobility training for independent travel on fixed-route systems is a very cost-effective option of interest to both line-haul operators and social service agencies who must purchase transportation for the mentally retarded. Furthermore, independent travel ability greatly enlarges employment, recreational, and locational opportunities for the mentally retarded individual. The second option is extending paratransit services to the mentally retarded. Client mixing and time sharing of the mentally retarded with other patrons, especially the elderly, can be both practicable and desirable. Incorporated paratransit services for the mentally retarded are practicable because of the complementary travel-demand patterns of the elderly and the retarded. Combined services are desirable because the mentally retarded can form a ridership core that is efficient and remunerative to serve. Problems can and do arise, occasionally because of client misbehavior, more often because of inadequate planning by transit operators. Nonetheless, incorporating the mentally retarded onto paratransit systems already serving the elderly or devising a system for the retarded can significantly raise the productivity of special transit systems.

The mentally retarded make up a significant fraction of the nominally handicapped. In the United States they represent 3 percent of the national population, or approximately 6.1 million individuals. The majority of retarded persons--between 75 and 90 percent--can, with special assistance, be expected to function independently in community life(1).

Unfortunately, the mentally retarded have been uniformly overlooked by federal transportation policymakers, despite their sizable numbers, their special transportation needs, and, most importantly, their qualification as a distinct transportation-handicapped population under relevant federal legislation (2). The most widely used estimate of the national population of the elderly and physically transportation handicapped is 7.4 million (3). However, the mentally retarded are not included in this count (unless they are also physically handicapped). This omission is rather astonishing: The addition of the 6.1 million mentally retarded persons to the 7.4 million elderly and physically disabled would exceed the initial estimate of the travel handicapped by 82 percent. It suggests that there is really a total of 13.5 million transportation-handicapped individuals in this country.

This is a particularly appropriate time to examine the transportation needs of the mentally retarded and the major options available to meet those needs. First, U.S. transit operators have just received new interim directives from the U.S. Department of Transportation (DOT) concerning their obligations to the physically and mentally handicapped. Because of these new policy directives, many local transit operators are struggling to define and develop new transportation services.

Second, this is an opportune moment to examine the special transportation problems of the mentally retarded because of the increasing emphasis in the social service delivery system on the deinstitutionalization of the mentally retarded. As more of these citizens are returned to the community or are placed there directly, their effective demand for transportation services will increase.

Third, some agencies and institutions dealing with the mentally retarded have not recognized the potential effectiveness of several transportation options in meeting the needs of the mentally retarded. In particular, these agencies have been slow to perceive the value and success of training the mentally retarded to use conventional fixed-route transit.

CHOOSING MOST COST-EFFECTIVE OF TWO MAJOR TRANSPORTATION OPTIONS

This paper will focus on two separate methods of meeting the transportation needs of the mentally retarded: mobility training and the provision of separate special paratransit services. The paper will suggest how these two options can and should be viewed by agencies in three different positions:

1. Local communities and transit operators endeavoring to devise the most appropriate or cost-effective method of serving different types of handicapped people,
2. Current special efforts or community paratransit systems trying to increase the usefulness and productivity of their services, and
3. Agencies responsible for the mentally retarded who are struggling to provide these citizens with a productive and meaningful life.

This paper argues that the most appropriate response to the transportation needs of the mentally retarded will be conditioned by the kinds of transportation services available in a given community. Where fixed-route transit services exist, travel-training is an effective and usable option for most of the mentally retarded. Where special transportation systems are the only available or feasible service, the productivity of these services could be enhanced by incorporating the mentally retarded into the existing system. The implementation of both options might be practicable and cost-effective in communities served by both paratransit services and fixed-route transit.

It is imperative that transit operators and paratransit systems operating in part or totally with DOT funds recognize that they have the legal obligation to serve the mentally retarded. This paper suggests that it is crucial for such systems to consider the most cost-effective way to provide these citizens with required services. If they do not, such systems may be inundated with the inevitable demand of these citizens as their numbers increase in transit service areas (through deinstitutionalization) and they or their advocates become aware of their rights.

Careful planning will allow transit operators and paratransit systems to accommodate the mentally retarded in the most cost-effective manner. Moreover, this paper argues that such systems can use the travel patterns of these citizens to increase the overall ridership and productivity of both paratransit and conventional transit services.

LEGAL OBLIGATIONS TO MENTALLY RETARDED

The mentally retarded clearly are encompassed by the interim regulations pertaining to Section 504 of the Rehabilitation Act of 1973, issued by DOT on July 21, 1981, by virtue of the inclusion of the retarded in previous legislation (2). The eligibility of the mentally retarded for prior special-efforts legislation is established by Section 16(d)(2) of the Urban Mass Transportation Act of 1964, which states that

for the purposes of this act the term "handicapped person" refers to 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.

Under the interim regulations, local transit operators who are recipients of Urban Mass Transportation Administration (UMTA) Section 5 funds are allotted autonomy in how and to whom they provide special transportation services. The only stipulation is that operators must make a minimum expenditure in amounts equivalent to 3.5 percent of their Section 5 funds on special-transportation efforts for all the handicapped (Federal Register, Vol. 46, No. 138, July 20, 1981).

However, the interim directives charge special-efforts transit operators to focus their compliance endeavors on "those handicapped persons who are employed or for whom the lack of adequate transportation constitutes the major barrier to employment or job training." This requirement is especially applicable to the mobility needs of the mentally retarded, whose primary travel demand is for commutation to job-training centers or competitive or residual (workshop) employment destinations (4-6).

OPTION ONE: MOBILITY TRAINING FOR FIXED-ROUTE TRANSIT

Mobility training is a program designed to teach mentally retarded pupils how to ride regular fixed-route transit without continuing assistance or special aids. The number of retardates who are potentially able to benefit from mobility training is very high--5.4 million (of moderately and mildly retarded individuals), or 89 percent of the national population of 6.1 million retarded persons (6).

Independent travel ability benefits the retarded individual in several ways. Increased mobility enlarges employment opportunities, improves the accessibility of educational and recreational resources in the community, and enhances the individual's sense of worth and competency (5,6). Furthermore, independent mobility for the mentally retarded reduces significantly the social service cost of providing alternative special transportation services to untrained individuals (5,6).

Mobility-training programs for the mentally retarded were adapted largely from earlier training programs created for the blind (5). Curricula from a variety of programs that instruct the mentally retarded in the use of fixed-route transit share a number of features: a very high teacher-to-pupil ratio, safety and pedestrian skills, and route familiarization and on-site training (4-6). A more detailed description of mobility training was provided in an earlier paper (2).

The applicability of mobility training in any community depends on whether a line-haul system is in place. When it is, mobility training is, with certainty, the cheapest available alternative. It is more cost-effective to train a mentally retarded individual to ride a line-haul system than to provide that same person with specialized transportation services.

Comparing Costs of Mobility Training and Specialized Services

If both options are a possibility, the costs can be compared. The full cost of mobility training can be contrasted with both the average and the marginal cost of providing equivalent paratransit service for the same number of trips. Unfortunately, such a comparison is possible only when both sets of cost data are available.

Current mobility-training costs have been provided by the Center in Mental Retardation, located at the California State University at Los Angeles (CSULA). This program, which was begun in July 1980, has trained 140 mentally retarded individuals to travel independently by using the Southern California Rapid Transit District (SCRTD) bus system.

The Center in Mental Retardation reports the average, one-time cost of instruction to be approximately \$280 for each individual. This average cost includes administrative overhead, salary and expenses for instructors, insurance, and the purchase of the SCRTD bus passes required for the training period. The \$280 includes additional training, although recidivism (the need to relearn travel skills) is not a problem. Instead, retraining has been devoted to learning additional routes, which enables the retarded client to take advantage of expanded recreational and social opportunities.

Data from several sites (e.g., the Center in Mental Retardation and the Good Shepherd Center for Independent Living in Los Angeles, the Center for the Retarded in Houston, and the Conrad School in Pittsburgh) show that individual instructors are able to train a minimum of 36 mentally retarded pupils a

year to successfully use fixed-route transit. Often the number of individuals trained is much higher.

From the perspectives of both transit operators and social service agencies, the cost of training (and subsidizing travel thereafter, if necessary) is much cheaper than the cost of providing or purchasing special transportation services. The average cost per one-way trip supplied through special transit services has been estimated to vary from \$7.62 (7) to \$10.40 (8). The State of California currently sets a maximum rate of \$9.65 per round trip, which private transit providers are allowed to charge for ambulatory individuals.

The following scenario, by using Los Angeles data (which may be on the higher end of the cost spectrum), illustrates the difference in cost between the options of mobility training and special transportation services. If a mentally retarded individual needs to travel to a workshop 250 days a year, the cost for one year would be estimated as follows:

1. Mobility training: The cost of training (\$280) combined with the cost of bus passes for 11 months purchased from SCRTD (\$286) yields a total cost of \$566, which, divided by the number of one-way trips (500), yields a cost of approximately \$1.13 per one-way trip.

2. Purchased paratransit: The cost of purchasing the same 500 one-way trips from a private provider (at \$9.65 per round trip) would total \$2412.50 annually.

3. Supplied paratransit: The cost of directly supplying those 500 one-way trips, even at \$7.62 per one-way trip, would be \$3810 annually.

It is obvious that, in terms of costs alone, travel training is a far more cost-effective special-efforts alternative. The cost of instruction for mobility training would have to more than quadruple in order to become equivalent to the costs of supplying or purchasing special paratransit services. Conversely, from the perspective of social service agencies, for every four or more individuals who can, with mobility training, be diverted from paratransit to fixed-route transit, one additional person can be supplied with special transportation who is not capable of being travel-trained.

Further Considerations Regarding Mobility Training

Investment in mobility training is justified by the reported high rates of success. The Ray Graham Center in Chicago reported that, of 40 individuals who participated in their training program, 90 percent achieved proficiency in independent travel (4). The Center in Mental Retardation in Los Angeles reports that only one of the 140 individuals who have undertaken training since the program began in 1980 was unable to learn independent travel skills. This represents a remarkable rate of success because the Center in Mental Retardation used no preselection criteria other than need for participation in the program.

The primary impetus for establishing mobility-training programs has been the great need to travel to workshop or job-training sites (4,5). At the Center in Mental Retardation, an estimated 80 percent of the clients were trained for home-based trips to workshop sites. Furthermore, the Center expects that those individuals who receive training will continue to travel independently to workshop sites when training is completed. It is important, therefore, that transit operators note that this overwhelming need for work or workshop trips fulfills the interim 504 directives, which require that

special efforts be focused on trips for these purposes (Federal Register, Vol. 46, No. 138, July 20, 1981).

OPTION TWO: SPECIAL TRANSIT SERVICES

In the absence of effective line-haul transportation service the mentally retarded must rely on special transit services, including those provided by transit operators in compliance with the 504 directives. In fact, the mentally retarded are currently using these services in substantial numbers.

Information from several quite diverse systems indicates the magnitude of the effective demand of the mentally retarded for these services: The mentally retarded make up 30 percent of the ridership on special transit systems in Riverside and Pomona Valley (southern California), more than 33 percent of the ridership on Metrolift (Houston), 25 percent of the ridership of the special transit system in Fort Worth, and 33 percent of the ridership from a five-county area served by the Southeastern Michigan Transportation Authority (SEMATA). The patronage of the mentally retarded was neither anticipated nor planned for when these systems were implemented.

This paper argues that paratransit systems subject to Section 504 mandates or to similar state mandates (as in California) must recognize the potential as well as the problems offered by the travel patterns of the mentally retarded. These citizens have the legal right to use such systems. Ignoring their needs will not lessen the likelihood that they will use, and perhaps overwhelm, special-efforts systems. At the same time, an intelligent approach to meeting the special needs of the mentally retarded will often increase the overall efficiency and productivity of the system.

This last point should be of interest to community and social service paratransit systems not subject to Section 504 mandates. Recognizing the special travel patterns of the mentally retarded can be useful to system planners trying to increase the productivity of their system or effectively exploit underutilized capacity.

Mentally Retarded as Core of Special Transit Service

Special-efforts transit operators and other community transportation providers should note that, under certain conditions, the mentally retarded can constitute a ridership core of regular or periodic travelers frequently using a system (9). They may serve as the foundation of a paratransit system by virtue of both the nature and the quantity of the trips they make.

Many systems for the elderly and the handicapped currently serve sizable numbers of elderly people (10). The travel demand of the mentally retarded is divergent from, yet complementary to, the travel demand of the elderly. The mentally retarded have a greater density of demand than do the elderly in terms of spatial location and the frequency of travel. The progress of deinstitutionalization has resulted in a situation where, increasingly, individuals who formerly would have been housed in large congregate-care facilities are now consigned to group living in the community.

Other travel characteristics exhibited by the mentally retarded augment this density of demand. These include a conventional commutation-trip pattern according to trip purpose, trip frequency, and time of travel. Just as with travel-training, the primary trip purpose of the mentally retarded who rely on paratransit systems is travel to workshops (9,11,12).

For example, Get About, a system serving all the elderly and handicapped in the Pomona Valley of California, reports that for a three-month period ending in June 1981, travel to workshop sites constituted 37.1 percent of all passenger trips taken. On this system travel to workshop sites is conducted on a regular and frequent basis, usually three to five days a week. This pattern is seen in other systems that have a sizable clientele of the mentally retarded (9,11,12).

The elderly have a demand for special transit services that is quite distinct from the travel demand of the mentally retarded. The elderly are quite often less efficient to serve and are becoming more so in part because they are becoming more locationally dispersed. For example, in Los Angeles, the elderly have increasingly begun to live independently in separate households; in turn, such households are decentralizing within the Los Angeles region (13). The trend toward the decentralization of the residential location of the elderly has been confirmed as a national trend for metropolitan areas (14). Lowered living density decreases the level of demand for transit services and also renders those services more difficult to deliver (15).

The primary travel demand by the elderly for special transit services is for social and recreational needs combined with a more occasional need for social service and medical trips (16). Correspondingly, the need for this travel is at sporadic, infrequent intervals. Unless elderly patrons are attending congregate meals, travel by the elderly on paratransit systems is conducted on an individual rather than on a group basis. All these factors will reduce vehicle productivity for special systems serving the elderly.

On the other hand, the mentally retarded who have a need to attend workshops tend to travel in groups and with greater frequency than either the elderly or the physically handicapped and with a need for travel that is concentrated in the peak periods. Also, because they are traveling to shared destinations, the mentally retarded can be served on a relatively fixed route. All these trip-making characteristics increase vehicle productivity for systems serving the mentally retarded (17).

Travel Patterns and Vehicle Productivity

Because the travel demand of the mentally retarded is predominantly directed toward peak periods whereas that of the elderly is directed toward the off-peak, complementary demand patterns are created. Thus, paratransit operators can time-share their clients, providing subscription service in the peak and demand-responsive service largely for the elderly in the off-peak. By taking advantage of this time-sharing potential, operators can improve vehicle productivity without having to increase their systems' capital stock investment (18).

Time-sharing was used in this fashion by a paratransit system serving Rochester, New York. The Association for Retarded Citizens there needed to have some of their clients transported to a workshop. By allocating vehicle time to serve this group, the paratransit operator was able to provide at least twice as many trips per vehicle service hour as could be provided by the regular service for the elderly and handicapped (9). In this instance, the paratransit services were created around a ridership core composed of the mentally retarded.

A different example, Call-a-Ride of Barnstable County, Inc., of Massachusetts, is a demand-responsive system that was originally created to serve the elderly and physically handicapped in a rural area. A fiscal crisis precipitated by a loss

of funding motivated the system to incorporate the mentally retarded into its existing services. Through incorporating the retarded, Call-a-Ride was able to share indirect costs and extend more services to individuals with special transportation needs. The system was able to increase its ridership for fiscal year 1978 from 46 000 trips to 70 000 trips (an increase greater than 52 percent) without having to expand its vehicle fleet (12). This ensured Call-a-Ride's continued operation.

Easyride of New York City provides an instructive example of the consequences of not incorporating the type of demand-responsive services most used by the elderly with subscription services most useful to the mentally retarded. Easyride was established to serve primarily the elderly; consequently, only 3 percent of its ridership consists of mentally retarded patrons (19). Furthermore, Easyride reported a vehicle productivity figure (measured as the number of trips divided by the number of service hours) of 2.15. This figure would have been lower had not Easyride transported groups of elderly clients to congregate meal sites.

Easyride attributed its low productivity to inordinate amounts of nonproductive vehicle time caused by the underutilization of the system during peak travel periods (19). A system like Easyride could have improved its productivity by using the travel demand of the mentally retarded to exploit empty service hours. It appears that increasing the ridership of the mentally retarded beyond 3 percent would have constructively addressed the need reported by Easyride to "increase demand during the early morning and late afternoon service periods" (19).

Comparison of Two Systems

Easyride has previously been compared with Dial-a-Bat of Brockton, Massachusetts, because both systems possess comparable service areas and fleet sizes (19). Most of the patronage of Dial-a-Bat exhibits a travel-demand pattern that is equivalent to the demand for travel by the mentally retarded on other systems (no claim is made that Brockton's subscription service is used largely by the mentally retarded) (11).

Contrasting unit operating cost ratios of both systems illustrate the consequences of not incorporating peak subscription services for the mentally retarded with off-peak demand-responsive services for the elderly. Table 1 illustrates the opportunity costs of foregone vehicle productivity (19).

The subscription-based ridership core contributed significantly to Dial-a-Bat's productivity. For example, the vehicle productivity ratio of 12.73 obtained for Dial-a-Bat's subscription service greatly exceeded the vehicle productivity ratios generated by the demand-responsive systems of both Easyride and Dial-a-Bat (2.15 and 1.58, respectively). Even though Dial-a-Bat's demand-responsive productivity alone was even lower than Easyride's, the average productivity of Dial-a-Bat's combined system (7.15) was three times greater than that of Easyride. Dial-a-Bat was explicitly able to use the contracted subscription services to cross-subsidize the demand-responsive service, which was less efficient to provide (11).

Potential Conflicts

Although paratransit systems can increase productivity by incorporating the mentally retarded into the system, problems can arise in some situations. If a paratransit system is at service

Table 1. Operating costs of foregone vehicle productivity.

Cost	Unit Operating Ratio			
	Dial-a-Bat			Easyride (demand-responsive)
	Subscription	Avg	Demand-Responsive	
Vehicle productivity	12.73	7.15	1.58	2.15
Fare level (\$)	3.50	-	1.00	NA
Recovery ratio (%)	-	40	-	NA
Revenue per vehicle hour (\$)	-	5.60	-	NA
Cost per trip (\$)	1.02	3.26	5.49	12.87
Daily trip generation	358	-	91	144

Notes: Adapted from earlier table (18). NA = not applicable.

capacity, it may experience congestion because of excess demand by the mentally retarded for peak-period service hours. This reduces the ability of the paratransit operator to serve demand-responsive trips. Often, as on the Houston Metrolift, elderly patrons are denied service during the early morning and late afternoon service periods, which are instead devoted to trips made by agency-contracted mentally retarded patrons (20).

The problem of congestion is caused by limited capacity and by social service agencies who "dump" their clients onto paratransit systems provided by both transit operators and community-wide social service agencies. This problem is encouraged by a low fare or donation-only policy. A combination of low fares and flexible rules regarding the eligibility of patrons creates a cost-savings incentive for agencies to use the system for their clients to a degree unanticipated by the operator.

This phenomenon is currently being experienced by Get About, a donation-based human service transportation system serving the Pomona Valley in southern California. Get About transports large numbers of the elderly, the orthopedically crippled, and, more recently, mentally retarded clients of social service agencies. The ridership share of the mentally retarded has increased substantially. Of all the trips provided for July 1981, 44 percent were taken by 130 mentally retarded individuals. This has created congested service during the peak travel periods and has forced elderly patrons to compete for service with the mentally retarded.

Although the total number of mentally retarded users on Get About is higher, these 130 regular riders form a ridership core that travels five days weekly to congregate workshop sites (37.1 percent of total passenger trip purpose).

Get About attributes its 22 percent increase in productivity (e.g., from 2.89 to 3.54 trips per vehicle hour) to the addition of these mentally retarded patrons to its system during 1980 and 1981. Yet, because Get About is donation-based, it cannot rely on a guaranteed cost recovery through donations to cover the increased marginal costs of extending services to these clients. Get About is faced with the paradox of increased productivity without a concomitant increase in revenue.

POLICY: ISSUES, PERSPECTIVES, AND SUGGESTIONS

Neither mobility training nor special transit services should be pursued exclusively. There will always be a profound need by some percentage of the mentally retarded for special escorted transportation even when an effective line-haul system is in place. Also, in areas without line-haul transit, special transportation services may represent the only option for the mentally handicapped. In areas

served by fixed-route transit, however, mobility training and strictly regulated special transit services may together represent an effective, concerted approach to compliance with the interim 504 directives.

The eligibility of the mentally retarded for special transportation services is not abated entirely if, with training, they could ride buses for some trips. However, transit operators should not provide duplicative special transportation services covering routes also served by fixed-route transit to persons who could be trained to use such transit.

Suggestions for Transit Operators Regarding Mobility Training

The mobility-training option, from the perspective of the transit operator who provides both line-haul and special transportation services, represents a tool for diverting the effective demand of the mentally retarded from paratransit to regular transit modes. As noted earlier, mobility training is inherently more efficient to provide on an individual basis than are special transit services. Substitution of a cheaper service ensures that the transit operator will achieve a more efficient allocation of the expenditures for special efforts.

Mobility training can be interpreted by transit operators as the provision of an indirect transportation service and therefore is in compliance with the interim 504 directives. Payment of the expenses incurred by mobility training rather than providing training directly would also constitute compliance.

There are three ways transit operators can provide travel-training. First, they may directly pay agencies to provide training or they may subsidize training efforts by granting agencies or schools complimentary bus passes. Second, transit operators can provide buses or operating personnel to assist training endeavors, as do, for example, SCRTD, the San Mateo Rapid Transit District, and the Chicago Transit Authority (4). Third, transit operators can initiate system changes (e.g., routing, hours of service) in order to more fully accommodate the work and recreation travel needs of the mentally retarded. Attention to the job-training and workshop needs of the mentally retarded would comply with the special section of the interim 504 directives.

Special Transportation Services

Suggestions for Transit Operators Receiving Section 5 Funds

The provision of special transportation services to the mentally retarded is of course currently an option for transit operators who are recipients of Section 5 funds. Paratransit systems provided by transit operators must actively consider the mentally retarded when planning how to meet their special-efforts obligations. Not only do transit systems have an obligation to provide services to the mentally retarded as to other transportation-disadvantaged groups, but there exists an incentive for doing so--the capture of the productive service features of the travel demand of the mentally retarded.

The best way to accommodate the divergent demands of both the elderly and the retarded is to adopt a dual system like Dial-a-Bat's, whereby two (or more) services are provided from one physical plant. There are several advantages to using a contract subscription service to handle the concentrated demand displayed by the mentally retarded. The pivotal advantage is that the paratransit system can

recover some of the costs of service through contracts with social service agencies.

Contracts accomplish two benefits: they create a predictable source of revenue for the operator, and attractive contract rates will allow the operator to manage demand. By encouraging agencies to register their clients, the operator will be able to induce demand for services and yet discourage agencies from the unrestrained "dumping" of their clients on the system (20).

Transit operators can expect to charge a significant portion of the cost of services because social service agencies dealing with the retarded have a relatively inelastic demand for the purchase of transportation for their clients. Social service agencies that represent the mentally retarded are often willing to pay the costs required to transport their clients to workshops and for other critical needs.

Some issues of equity can arise when public systems charge differential fees for subscription services (versus demand-responsive trips). In this regard issues of both fare and level-of-service equivalency between special transit services and public line-haul systems are also raised (21). These issues cannot be addressed directly here, yet I can note that paratransit operators may argue that they provide qualitatively better levels of service to mentally retarded (subscription) clients in several ways.

First, subscription services eliminate the need to make continuing reservations and therefore guarantee daily (or recurring) capacity (21). Second, a special transit trip often takes only half as long as it would if it were supplied through line-haul transit (21). Third, escorted travel, if necessary for some agency clients, would constitute an improvement in service. Therefore, transit operators may argue that they are justified in charging correspondingly higher rates for those peak-period service hours when escorted, subscription travel services would be offered.

Suggestions for Agencies and Transit Operators Not Receiving Section 5 Funds

Social service agencies and transportation providers (who are not under Section 504 mandates) serving the elderly in particular should be aware that as their elderly clients become more geographically dispersed they will also become increasingly difficult to supply with transportation services (13). Incorporating services with those for the mentally retarded will allow these systems to guarantee the continuation of acceptable levels of transportation services to the elderly.

It is possible to offer assurances to providers who are hesitant to combine transit services for the elderly and mentally handicapped because of a concern about social incompatibility. First, the incidence of inappropriate behavior among mentally retarded patrons may be expected to decrease as community placement, rather than institutionalization, proceeds; there is a direct correlation between the length of institutionalization and the degree of social immaturity of the mentally retarded individual (22, p. 213).

Second, public tolerance of the mentally retarded by their neighbors in residential communities improves with increased proximity (23). That the elderly can acquire tolerance for the retarded persons who share transit services with them is indicated by the experience of the Center in Mental Retardation. Its mobility-training program purposefully hired only senior citizens as travel instructors. Despite their initial concerns, these elderly instructors

developed very strong attachments to their pupils.

As a final note, segregating travel services and facilities for the mentally retarded and the elderly is futile when these two populations are increasingly sharing other facilities. A survey whose respondents included more than half the institutions serving the mentally retarded in the United States revealed that 26 percent of their mentally retarded clients, on their release from an institution, were consigned to nursing home facilities for the elderly (24).

CONCLUSION

The recent changes in federal transportation policy return a large measure of autonomy to local transportation providers in determining how they should respond to special transportation needs. The declining decision role of the federal government coincides with the increasing emphasis on community-based services to the mentally retarded. At this juncture, therefore, the mentally retarded have a growing need for transportation services, whether supplied through special paratransit or through conventional fixed-route transit, whereas local transit operators have a renewed obligation to meet the mobility needs of the transportation handicapped.

As an instrument of federal intent the interim 504 directives are irrelevant to the mentally retarded: Their travel needs have yet to be explicitly addressed by DOT. Yet transit operators should be aware that the mentally retarded may make up a significant fraction of the transportation handicapped in their service area, that the retarded can be served efficiently and remuneratively by paratransit, and that mobility training will enable some clients to use fixed-route transit. Providing these efforts will satisfy federal mandates to comply with the interim 504 directives. Much more importantly, the options described in this paper promise to truly enhance the mobility of the mentally retarded.

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REFERENCES

1. R.C. Scheerenberger. Deinstitutionalization and Institutional Reform. C.C. Thomas, Springfield, IL, 1976.
2. J.K. Starks. Mobility Training for the Retarded: An Issue of Public Transit Accessibility. TRB, Transportation Research Record 830, 1981, pp. 21-25.
3. Grey Advertising, Inc. Summary Report of Data from National Survey of Transportation Handicapped People. UMTA, 1978. NTIS: PB 291 765.
4. E.M. Jordan. Development of a Mobility Training Program for Young Adult Trainable Mentally Handicapped Clients at the Ray Graham Training Center. Nova Univ., Fort Lauderdale, FL, Sept. 1975.
5. M.D. Laus. Travel Instruction for the Handicapped. C.C. Thomas, Springfield, IL, 1977.
6. Transportation and the Mentally Retarded. President's Committee on Mental Retardation, Washington, DC, June 1972.
7. Urban Transportation for Handicapped Persons: Alternative Federal Approaches. Congressional Budget Office, U.S. Congress, Budget Issue Paper for Fiscal Year 1981, Nov. 1979.
8. S. Rosenbloom and others. Cost Analysis for Social Service Agency Transportation Providers. U.S. Department of Transportation, Jan. 1981.
9. T. Brigham and others. Improving Elderly and Handicapped Vehicle Productivity Under Conditions of Low Vehicle Density. In Mobility for the Elderly and Handicapped (N. Ashford and W.G. Bell, eds.), Loughborough Univ. of Technology, Loughborough, England, 1978.
10. S. Rosenbloom and C. Schlessinger. Travel Patterns of Users and Nonusers of Special Transportation Services. In Transportation for the Elderly and Handicapped: Programs and Problems, Research and Special Programs Administration, Office of Technology Sharing, U.S. Department of Transportation, Vol. 2, Feb. 1981.
11. A.B. Cook. The Dial-a-Bat Paratransit Service of Brockton, Massachusetts: Area Transit-Public Transit in Coordinated Human Services Transportation. UMTA, June 1978.
12. L.J. Harman. Transportation for Human Services--A System Operator's Viewpoint. In Mobility for the Elderly and Handicapped, (N. Ashford and W.G. Bell, eds.), Loughborough Univ. of Technology, Loughborough, England, 1978.
13. M. Wachs. Transportation for the Elderly: Changing Lifestyles, Changing Needs. Univ. of California Press, Berkeley, 1979.
14. D.T. Lichtner. Components of Change in the Residential Concentration of the Elderly Population: 1950-1975. Journal of Gerontology, Vol. 36, No. 4, July 1981.
15. R.F. Kirby and others. Paratransit: Neglected Options for Urban Mobility. Urban Institute, Washington, DC, 1977.
16. S. Rosenbloom. Transportation Needs and Use of Social Services: A Reassessment. Traffic Quarterly, Vol. 32, No. 3, July 1978.
17. C.C. Chung. Dial-a-Ride Vehicle Time Analysis and Vehicle Productivity. UMTA, June 1976.
18. Planning Guidelines for Coordinated Agency Transportation Services. Transportation Initiative, Office of Human Development Services, Washington, DC, April 1980.
19. P. Edelstein. Evaluation of the Easyride Specialized Transportation Service. UMTA, Rept. UMTA-MA-06-0049-80-4, Nov. 1979.
20. S. Rosenbloom and D. Warren. Comparison of Two Brokerages: Lessons to be Learned from Houston and Pittsburgh. TRB, Transportation Research Record 830, 1981, pp. 7-15.
21. D. Lewis. Equity in Urban Transportation for Disabled Persons. London School of Economics, London, England, Ph.D. dissertation, 1981.
22. G. Burkhart and R. Seim. The Effects of Institutionalization on Retardates' Social Independence. Journal of Mental Deficiency Research, Vol. 23, 1979.
23. C.K. Sigelman. Community Reactions to Deinstitutionalization. Journal of Rehabilitation, Feb.-March 1979.
24. J. Rubin. Economics, Mental Health, and the Law. D.C. Heath, Lexington, MA, 1978.

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science and technology with the Academy's purpose of furthering knowledge and of advising the federal government. The Council operates in accordance with general policies determined by the Academy under the authority of its Congressional charter, which establishes the Academy as a private, nonprofit, self-governing membership corporation. The Council has been the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering in the conduct of their services to the government, the public, and the scientific and engineering communities. It is administered jointly by both Academies and the Institute of Medicine.

The National Academy of Sciences was established in 1863 by Act of Congress as a private, nonprofit, self-governing membership corporation for the furtherance of science and technology, required to advise the federal government upon request within its fields of competence. Under its corporate charter, the Academy established the National Research Council in 1916, the National Academy of Engineering in 1964, and the Institute of Medicine in 1970.