Changing Mobility Patterns and the Aging Population in Sweden

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A number of investigations of travel habits and patterns of activity of the elderly have been carried out in Sweden during the 1980s. The results from a study made by the Department of Traffic Planning and Engineering at the Lund Institute of Technology are presented. The purpose of this study was to determine (a) older people's access to various means of transportation, (b) travel habits of older people and their difficulties in using various means of transportation, and (c) the extent to which these factors influence the social situation of older people compared with various background variables such as age and physical incapacity.

There has been much interest in studying the living conditions of the elderly in Sweden during the 1970s and 1980s. One major reason for this interest is the large and steadily growing number of elderly in the general population. Currently the elderly—that is, those 65 years of age and older—constitute a good 17 percent of the population in Sweden. Available prognoses indicate that this share will go on increasing into the 21st century until it encompasses 20 to 23 percent of the population. The prognoses also indicate that it is the oldest part of the population that will increase the most, that is, those more than 80 years old. At present, one of five people of retirement age in Sweden is more than 80. According to the prognoses that have been made, one of four retired persons will be more than 80 at the beginning of the 21st century.

This phenomenon has received a good deal of attention in Sweden. For the past several decades, an overriding goal of social planning has been to make it possible for the country's population to use the services and participate in the activities provided by society. Another goal has been to enable the elderly to go on living in their own homes as long as possible, instead of having to move to social or medical institutions. This kind of planning requires a well-functioning system of traffic and transportation for the elderly to facilitate their active participation in society and to maintain their social contacts with relatives and friends.

Therefore, a number of investigations have been carried out in Sweden during the 1980s in order to study travel habits and patterns of activity of the elderly. The results from such a study that was made at the Department of Traffic Planning and Engineering at the Lund Institute of Technology are presented. The purpose of this study was to determine

- Older people's access to various means of transportation,
- Travel habits of older people and their difficulties in using various means of transportation, and
- The extent to which these factors influence the social situation of older people compared with various background variables such as age and physical incapacity.

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METHOD AND AIM OF THE STUDY

The investigation was carried out in two Swedish cities: Malmo in southern Sweden (population of about 215,000) and Skelleftea in the north (population of about 30,000), in both central and more peripheral residential areas. The results are based on postal questionnaires (619 in Malmo, 301 in Skelleftea), interviews in the home (43 in Malmo, 49 in Skelleftea), and practical experiments with boarding and leaving buses (11 people in Malmo). The selection of respondents for the questionnaires was stratified to assure that those of advanced age would be included in the investigation. Age, sex, and marital status (married or single) were used as stratification variables. Interviews were conducted in the homes with a selection of those who had participated in the postal questionnaire.

The investigation is based on the available a priori information about the status of the elderly in traffic. Figure 1 shows the causal principle model that served as the foundation for constructing the investigation. The model's point of departure is that various individually defined circumstances in combination with the design of the traffic system create different opportunities for different people to cope in traffic, and that this in turn influences the degree of fulfillment or satisfaction they experience.

By "individually defined circumstances" is meant sex, age, and physical capacity, as well as socioeconomic status, actual access to means of transportation, and individual habits. When combined with the traffic system's design, these factors produce individual dependent capability problems, or varying abilities to cope in traffic. All this constitutes the basis for the person's travel activity, for example, shopping and doing other errands and maintaining contacts with friends and relatives. Beyond this, different people have different needs and habits that influence both their travel activity and the way in which they experience traffic problems. If travel activity is low, or if the problems are great, dissatisfaction with the travel situation arises.

One major purpose of the study was to show whether, and if so to what extent, various factors affect a person's travel activity and his or her inability to make necessary outings. Three travel objectives were studied: shopping, visiting, and

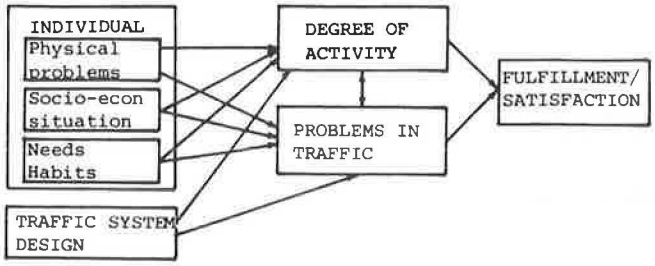

FIGURE 1 Causal principle model for the investigation.

recreation. These were regarded as response variables. All three travel objectives were measured in the following manner:

1. Making the trip daily (= 6 trips/week),
2. Making the trip a few times a week (= 3 trips/week),
3. Making the trip a few times a month (= 0.6 trip/week), and
4. Making the trip seldom (= 0.1 trip/week).

The variables that were considered explanatory variables in the analysis were

1. Sex,
2. Age,
3. Marital status (living alone or with someone),
4. Physical incapacity (vision, hearing, mobility),
5. Physical incapacity that causes problems in traffic,
6. Experienced problems in traffic with different means of transportation, and
7. Access to transportation.

Variables 4, 5, and 6 were all measured in a three-part categorical scale, as follows: severe problems, light problems, and no problems. For the experienced-problems variable, every means of transportation was measured separately. The access-to-transportation variable was created for the analysis. The older population was thus divided into five groups according to the initial hypothesis that individual access to a means of transportation provides greatest flexibility and satisfaction. In order to be placed in a certain transportation group, a person had to use that means of transportation on a regular weekly basis.

Thus, a person with access to an automobile was placed in the first group; this group accounts for 32 percent of older people. The next group, 21 percent, consists of those who have their own bicycle and continue to use it, but who do not have access to a car. Next comes a group who have the possibility of being driven by a relative or friend, but who do not have access to a car of their own or to a bicycle (6 percent). The next group, and the largest one, accounting for 36 percent of older people, have no possibility of getting around outdoors other than walking or using public transportation. And finally, there is the group made up of those who are eligible for Special Transportation Service. They make up 5 percent of the older population and are regarded as occupying the worst situation in terms of transportation possibilities.

It is also important to point out that it is primarily those up to the age of 75 who have access to a car in the household, mainly men and those generally who have not suffered any noteworthy physical disability. Thus it is those who are in some way dependent on society for their transportation, either those who are users of public transportation or those who qualify for Special Transportation Service, who are clearly overrepresented in the older age groups, in other words, those over the age of 75, women, and those who have begun to suffer noticeably from some kind of physical disability.

The overall purpose of the study was to investigate those factors that may be considered to have major significance when the patterns of movement and degree of activity among older people are studied. Is it being old per se, or are there other important factors to be taken into account? This age group is by no means homogeneous. Therefore, merely being older in and of itself cannot always be assumed to be a significant factor. Rather, other factors influence one's capacities, especially in traffic situations. Other such factors are, for example, sex, marital status, physical incapacity, access to transportation, and experienced problems in traffic with different means of transportation.

These last two factors are of particular interest. They represent external factors that can influence what measures are to be taken if the goal is to remedy the decrease in activity that is assumed to be typical for the elderly. Although individual factors such as the ability to function physically, sex, marital status, and even age may influence the degree of activity, these factors are more difficult to deal with than, for example, shortcomings in the traffic environment or inadequate access to means of transportation. Although such external factors may also be hard to deal with simply and directly, there is nevertheless a practical possibility of doing something about them. This should be a basic premise in the business of planning traffic and transportation for the elderly.

The analyses thus include two kinds of explanatory variables:

- those in which the interest is to really measure the effects on the degree of activity (the external factors) and
- those in which the effect on the degree of activity is more to be controlled for than actually measured (the individual factors).

RESULTS

To study the influence of different explanatory variables on the degree of activity, to begin with, analyses of two-dimensional contingency tables were conducted. In these analyses one factor was compared with each one of the three response variables at a time (the degree of shopping, visiting, and recreation).

These two-way analyses demonstrated, for example, a significant decrease in the degree of activity with increasing age (Table 1). With shopping, for example, a decrease in activity level is not really shown until the age of 80, when weekly

TABLE 1 DEGREE OF ACTIVITY IN DIFFERENT AGE GROUPS

	Percentage of Activity by Age Group				
Weekly Activity	65–69	70–74	75–79	80–84	85+
Shopping	95	94	92	90	76
Visiting	44	42	32	28	24
Recreation	30	25	22	14	18

shopping decreases from 90 percent of the population to 76 percent. Visiting also decreases with age. Among older people up to the age of 75, nearly 50 percent visit relatives and friends every week. Thereafter, the percentage successively decreases, and less than one-fourth of those over 85 pay a visit every week. The same is the case with recreational activities. Whereas about 30 percent of those in the younger group participate in recreational activities on a weekly basis, for those in the older group it is only about 15 percent.

Thus it would seem reasonable to assume that patterns of movements change, and especially that the degree of activity decreases with increasing age. Two possible hypotheses arise: (a) only growing older per se results in altered travel habits and diminished activity, or (b) there are other, "hidden" factors that dictate a reduction in the activity of older people. The results of this research come down heavily on the side of the second hypothesis.

Other individual factors that were examined (sex, marital status, and physical incapacity) also showed the same pattern, that is, a decreasing activity level with, for example, increasing physical incapacity. A more important finding, however, was that external factors such as access to transportation and experienced problems in traffic with different means of transportation also showed a significant correlation with the degree of activity. Table 2 shows the degree of activity with various means of transportation.

TABLE 2 ACTIVITY WITH VARIOUS MEANS OF TRANSPORTATION

	Percentage of Activity by Means of Transportation				
Weekly Activity	Car	Bicycle	Ride with Friends	Walk or Ride Bus	Special Transportation Service
Shopping	95	95	95	91	85
Visiting	52	50	50	33	9
Recreation	32	31	27	18	9

When one examines the degree of activity in the various means of transportation, one finds, for example, that of the first group—those who have access to their own car—95 percent make shopping trips every week. That number is somewhat less (91 percent) for the group who have access only to public transportation, and lowest of all (85 percent) for those who are restricted to Special Transportation Service. The same worsening situation is found when one looks at the data for those who make weekly social visits (from 52 percent to 33 percent to 9 percent) as well for those who make weekly trips for recreation (from 32 percent to 18 percent to 9 percent). All the differences are statistically significant.

When the experienced problems with different means of transportation are examined, it appears that the two means of transportation most used by the oldest people and by those with physical disabilities—walking and taking the bus—are also the two modes that cause the most problems. There are significant differences in the degree of activity between the pedestrians and bus passengers that report problems and those that do not.

To summarize, the two-way analyses clearly showed, perhaps not very surprisingly, that it is not merely growing older that correlates with a decrease in activity. It was shown that other variables are also important, such as sex, marital status, an individual's physical condition, an individual's access to means of transportation, and the problems an individual experiences when employing various means of transportation. However, to conclude that an influence exists on the basis of this analysis is not quite satisfactory. The analyses also showed that most of the variables studied are in some way correlated (Figure 2).

Figure 2 implies that the next step in the analyses is to use analytic methods that permit a simultaneous overview of all the

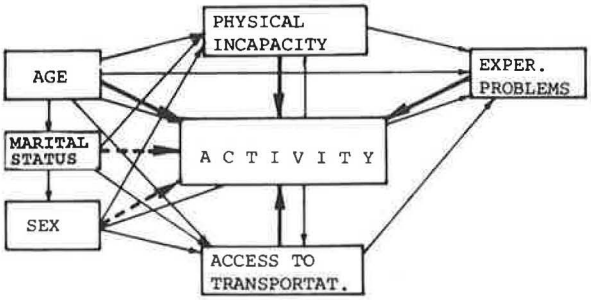

FIGURE 2 Correlation between all studied variables (two-way analyses).

variables studied in order to identify those factors that influence a person's degree of activity. Especially interesting is the attempt to quantify the influence of various factors and thereby compare the effects of different factors on the degree of activity among those who otherwise appear to be equal with regard to other variables examined.

Because this investigation is based mainly on qualitative data and only some quantitative data, the analytical methods that seemed appropriate were analysis of covariance and logistic regression. Two different analysis methods were used because neither is quite satisfactory by itself: analysis of covariance implies certain (doubtful) statistical assumptions, and logistic regression implies renouncing available information in the basic variables. The results from the two different methods turned out to be very similar; only the results from the analysis of covariance are shown in this paper.

The statistical method of analysis of covariance requires that the response variable be quantitative, which is the case in this analysis. Degree of activity is measured in a way that makes it possible to express the activity in number of trips per week. Analysis of covariance can deal with both quantitative and qualitative explanatory variables, but the analysis is statistically more powerful when the number of qualitative variables is low. Therefore a number of the qualitative variables were quantified by means of an estimation method based on normal distribution. The variables that were measured on a three-part categorical scale (physical incapacity, physical incapacity that causes problems in traffic, and experienced problems in traffic with different means of transportation) were thus transferred to three quantified values (see Figure 3, for example).

The assumption behind the estimation in Figure 3 is that there is a hidden variable called "hearing incapacity" that is normally distributed over the population studied. The three-part categorical scale (severe problems, light problems, and no

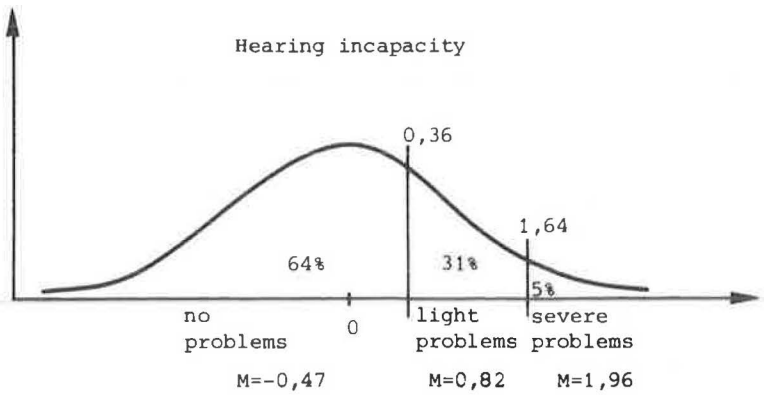

FIGURE 3 Quantified values of the variable "hearing incapacity."

TABLE 3 CREATION OF VARIABLE "PROBLEMS IN TRAFFIC"

	Means of Transportation						
	Car	Bicycle	Ride with Friends	Bus	Walk	Special Transportation Service	Total
Problem (p_i)	1.67	–	1.20	2.33	0.88	–0.29	–
Frequency (f_i)	4	0.6	–	0.1	4	0.6	9.3
Problem × frequency	6.68	–	–	0.23	3.52	–0.17	10.26

NOTE: Mean problem: 10.26/9.3 = 1.10; p_i = quantified value from the variable problems when a certain means of transportation is used; f_i = frequency (e.g., the number of trips/week the person actually makes with a certain means of transportation).

problems) was therefore translated into quantitative values of the hidden variable. Because it is known that 64 percent of the population studied claims to have no hearing incapacity, this implies that the mean value of the border, which of course varies from person to person, between claiming no problems and light problems is 0.36. In each group the median was used as the value representing the persons in the three groups. So those claiming no hearing incapacity are given the value –0.47 on the quantitative variable "hearing incapacity."

On the basis of this estimation method the following qualitative variables were made quantitative:

- The three physical disability variables: mobility, vision, and hearing; and
- The five variables representing the problems with using each means of transportation (car, bicycle, ride with friends, walk or ride the bus, and Special Transportation Service).

To represent a person's problems in traffic as a whole, a new variable was created (Table 3). A "mean problem" representing a person's problems in traffic as a whole was created according to the following formula:

$$\frac{(p_i \times f_i)}{f_i}$$

This value represents the variable "problems in traffic with different means of transportation" in the analysis and was one of the explanatory variables. The explanatory variables in the analysis were hereby the following eight variables:

1. Sex (qualitative variable),
2. Age (quantitative variable),
3. Marital status (qualitative variable),
4. Physical disability:
   a. mobility (qualitative variable),
   b. vision (quantified variable),
   c. hearing (quantified variable),
5. Access to transportation (qualitative variable), and
6. Problems in traffic with different means of transportation (quantified variable).

The results from the analysis of covariance indicated that there is a difference among the three different activities studied (shopping, visiting, and recreation). Starting with shopping, the average for the age group was 3.5 shopping trips a week. The variables that have a significant influence on the degree of shopping activity are age, marital status, mobility impairment, and problems with various means of transportation. The difference between one group aged 73 and another aged 83 (i.e., a 10-year age difference) is 0.2 shopping trip a week, which means a decrease of 5 percent. On the other hand, those with serious impairments of movement make 20 percent fewer shopping trips a week than those who have no such impairment. And those who have light problems with all means of transportation they actually use make 15 percent fewer weekly shopping trips than those with no problems at all (all means of transportation used included).

Similarly, when visiting activity was examined, the average for all those over 65 is 1.5 visits a week. The significant variables regarding degree of activity here are age, marital status, access to a means of transportation, and mobility impairment. The 83-year-old group makes 20 percent fewer such trips a week than the 73-year-old group. Those with major mobility

impairment make about 30 percent fewer social calls per week than those with no such impairment. Inferior access to means of transportation results in 15 percent fewer visits a week for the group who use public transportation compared with those who have a car in the household and 40 percent fewer visits a week for those depending on Special Transportation Service.

Once again, for the whole age group the average number of recreational trips a week is 1.0. The significant variables with regard to the degree of activity are access to transportation and mobility impairment; thus age per se does not influence recreational activity. Those who have severe impairment of movement make 35 percent fewer recreational trips a week than those who have no such disability. Inferior access to transportation is so significant that people dependent on public transportation make 40 percent fewer recreational trips a week than those who have a car in the household. Even worse, those entirely dependent on Special Transportation Services make 60 percent fewer recreational outings than those who have access to a car.

CONCLUSION

The analyses show that even if age per se does have a significant influence on such activities as shopping and visiting, it is by no means the most important factor. Rather, where shopping is concerned, more important factors are the person's physical capacity and problems encountered by older people when out in traffic, especially as pedestrians and bus passengers. Where visiting is concerned—and the same applies to recreational trips—access to transportation plays a major role.

These results described are interesting and important, mainly, of course, because the degree of activity as people grow older is not only a matter of aging and because aging is not the most important factor involved. This is both interesting and important because it indicates that measures can be taken to improve the situation. On the other hand, it is with mixed feelings that one must conclude that older people's difficulties in remaining active are the result of the shortcomings of various means of transportation or the shortcomings of the traffic system itself. The design of the traffic and transportation systems plays a large role in the decrease of activity. It is important to take action now, considering that the prognoses show that it is the oldest segment of the population that will grow the most in the coming decades.

The question of whether a person's degree of activity could be dealt with through measures taken in the transportation and traffic systems can be answered affirmatively on the basis of this study. From the introductory part of this study in which the problems experienced with all means of transportation were examined, it is obvious that such measures often consist of minor changes in the physical surroundings or in public transportation. For example, level walking surfaces, good snow removal, and clearly demarked curbs are important for pedestrians; for bus passengers, easy boarding and exiting of the vehicle and proximity to a bus stop. Furthermore, such measures would also be appreciated by other people as well.

This study indicates that there is good reason to assume that the social situation of certain groups of people would be improved if measures were taken to improve their access to transportation or to improve their possibilities of coping with various means of transportation. The natural question to ask in conclusion, then, is not "Can we plan the traffic environment from the point of view of the needs of older people?" but rather "Can we reasonably refrain from doing so?"