

THE UNIVERSITY OF MANITOBA
THE ECONOMICS OF AN EMERGENCY AMBULANCE SYSTEM

by
Richard James Chamberlin

A THESIS
SUBMITTED TO THE FACULTY OF GRADUATE STUDIES
IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE
OF MASTER OF ARTS

DEPARTMENT OF ECONOMICS

Winnipeg, Manitoba

Autumn, 1973

THE ECONOMICS OF AN EMERGENCY AMBULANCE SYSTEM

ACKNOWLEDGEMENTS

The task of preparing this study was greatly facilitated by the help of the following people: Prof. R. F. Harris, Professor of Economic Thought, University of Manitoba, who read drafts of the paper and offered valuable assistance in establishing perspective and format; C. G. Chapman, Director of Ambulance Services, The Manitoba Health Services Commission, who gave generously of his time to discuss with me some relevant issues; D. James, also of the Manitoba Health Services Commission, who intimated to me some details of conduct within the ambulance industry; J. Wylie, President, Wylie Ambulance and Rescue Service, who, by his public criticisms of existing ambulance facilities, inspired me to undertake the analysis; T. Mann and M. Thomson, The Canadian Paraplegic Association (Central Western Division), who sought out and collected important information to which I did not have access; Dr. D. Bruser, Mall Medical Group, who supplied valuable unpublished data; Dr. H. Dubo, Manitoba Rehabilitation Hospital, who provided me with detailed information about paraplegia. My wife, Willi, provided the secretarial skills.

Winnipeg, Manitoba
Autumn, 1973

Richard J. Chamberlin

Concluding Remarks	155
Appendices	158
Bibliography	195

TABLE OF CONTENTS

Acknowledgements	iv
List of Tables	vii
List of Figures	ix
Introductory Remarks	1

PART I. THE PUBLIC INTEREST

Chapter

I. The Public Interest I	9
II. The Public Interest II	19

PART II. THE INDUSTRIAL ORGANIZATION

III. Market Structure	53
IV. Market Conduct	98
V. Market Performance	111

PART III. THE CHOICE AMONG ALTERNATIVES

VI. Perspective	135
VII. Choosing an Alternative	142

LIST OF TABLES

Table

1.	Emergency and Elective Ambulance Calls, 1963	69
2.	Ambulance Company Details	79
3.	Representative Firm	81
4.	Average Price	85
A- 1.	Five Avoidable Traffic Deaths in Metropolitan Winnipeg, 1966	168
A- 2.	Manitoba: New Injuries	171
A- 3.	Metropolitan Winnipeg: New Injuries	172
A- 4.	Ailments Related to Traumatic Paraplegia and Their Relative Importance as a Cause of Death	175
A- 5.	Hospital Time	177
A- 6.	. . . . .	177
A- 7.	. . . . .	182
A- 8.	Hospital Time	182
A- 9.	. . . . .	183
A-10.	. . . . .	185
A-11.	. . . . .	188
A-12.	Hospital Time	189
A-13.	. . . . .	190

Table

A-14.	.....	192
A-15.	.....	192
A-16.	.....	193

LIST OF FIGURES

Figure

1.	. . . . .	26
2.	. . . . .	36
3.	. . . . .	38
4.	. . . . .	40
5.	. . . . .	41
6.	. . . . .	43
7.	. . . . .	67
8.	. . . . .	80
9.	. . . . .	89
10.	. . . . .	89
11.	. . . . .	91
12.	. . . . .	92
13.	. . . . .	94
A-1.	. . . . .	178
A-2.	. . . . .	184
A-3.	. . . . .	190

ABSTRACT

THE ECONOMICS OF AN EMERGENCY AMBULANCE SYSTEM

Richard J. Chamberlin

The subject of the thesis is a critical review of ambulance services in the City of Winnipeg. The thrust of the analysis is to specify all requirements of an optimal ambulance service, to determine the degree to which the present service in Winnipeg meets these requirements and, finally, to examine and to evaluate alternatives for the provision of a service. The paper, therefore, falls into three parts.

Part One examines on two levels the requirements of ambulance service in terms of public interest criteria: (1) a definitional level where the elements of the definition are ranked according to importance and (2) a more detailed level where the public interest criteria are discussed at length. The criteria involved are cost and price efficiency, adequacy of output, and equity considerations. These criteria bear a mutually determined relationship with allocative, distributive, and technical efficiency. Real and potential hazards to the public interest are identified and a theoretical model of social well-being is set up.

Part Two studies the provision and use of Winnipeg ambulance services in terms of market structure, conduct and performance. That which is experienced in terms of performance is compared to the performance expected from a service which would satisfy all the public interest criteria. Here it is important to determine how far current provision deviates from optimal provision.

Part Three identifies four general alternatives for the provision and use of an ambulance service. The alternatives are: a fully private system, complete public provision, public-private provision and joint venture, and private provision with varying degrees of public regulation and/or public support. These alternatives in terms of their operational significance are discussed in detail and evaluated in relation to the performance criteria. In conclusion, the most appropriate alternative or alternatives (and their concomitant effects upon the existing industrial structure) are specified.

Ambulance-care in Winnipeg is provided by a mix of public and private enterprise. Public ambulance activity bears no relation to nor co-ordination with the other operations. Within one system of care delivery there are at least two distinct policies and two distinct forms of organization, one competing with the other for no apparent good reason. Further, there is effectively no public support of the private ambulance service.

Ten conservative small scale capitalists, functioning as owner-manager-attendants, comprise the ambulance industry in Winnipeg. The oldest firms lead the others in maintaining profit margins and in attracting market shares through artificial product differentiation. An apprenticeship-entry-limited growth sequence has constituted past firm development. New regulations effectively prohibit entry but place few stringent requirements upon existing entrepreneurs.

There are various sources of demand for elective and emergency care, each unique in its own way. Through the development of a set of prices and other promotional gimmicks, the firms attempt to tap every source in order to maintain market shares. The trend of demand over time has been stable upward.

In ambulance services, large scale of plant and an oversized industry have generated technical inefficiency in terms of excess capacity resource wastage. The operation of the industry, characterized by confusion, path-crossing, public-private competition, as well as an inept call mechanism and inappropriate payment procedure, has generated technical inefficiency in terms of duplicative resource wastage and distributive inefficiency in terms of unevenly and inappropriate dispersed resources. There is inaccess to ambulance care because of both abundance and paucity of ambulance facilities. This results in allocative and distributive inefficiency: the allocation of resources has not been such as to match that collection of outputs provided with that collection of outputs which will maximize aggregate welfare; because some individuals are able to get proper care and others not, that collection of resources allocated to the ambulance sector has not been distributed among the members of society so as to maximize welfare. The prices charged, while reflecting technical inefficiency, give rise to distributive inefficiency: recipients of ambulance care are paying a price which represents consumption of resources greater than that amount for which they are responsible. Finally, the public well-being is reduced. This has efficiency implications with regard to the economic use of human resources; it has moral implications with regard to loss of life and limb.

Ambulance service provision options were evaluated and the alternative chosen is essentially private provision coupled with regulation and support. Included also are elements of joint venture as well as public-and-private provision except that, in the latter case, the two are no longer at cross purposes. The alternative, although a mixed organization, is a concerted mixture of activity directed toward a single end, and is designed to make market performance compatible with the chosen performance criteria.

INTRODUCTORY REMARKS

In 1687, Sir William Petty¹, concerned about losses to the economy from the London plagues, estimated the value of an Englishman's production, the extra probability of his dying if he remained in London, and the costs of transportation out of the city. He concluded that moving people would be a wise investment yielding an eighty-four fold return.

The work of Petty was probably the first attempt² at organized thought about people as capital assets. Since then, such interest has increased only slightly with a resurgence beginning in the late 1950's³. The study both of health and the other prime area of human investment, education, has recently attracted increasing financial and intellectual resources including leading talent from the economics profession.

Increases in the stock of reproducible physical capital do not normally account for all of the growth of our per capita output. Conventional explanations of this say that economies of scale may have permitted output to rise proportionately more than the increase in resources. Improvements in the quality of capital goods may have occurred without

1. Burton A. Weisbrod, "Investing in Human Capital", a paper presented for the National Conference on Canadian Goals, Fredericton, September 9-12, 1964.

2. Ibid.

3. Mark Blaug, A Selected Annotated Bibliography in the Economics of Education, University of London, Institute of Education, London, 1964.

being reflected in prices; or improvements may have taken place in techniques of organizing production resulting in increased productive efficiency. However, an alternative explanation might be that the stock of total capital has grown more rapidly than such conventional measures indicate. There is intangible as well as tangible capital, human capital, enhanced either through health or education expenditure. On the health side, there are clearly many advantages to such investment: increased longevity and lifetime labour productivity as well as increased human happiness and decreased suffering. Preventive health care can be doubly rewarding. Not only can it reduce the incidence of disease and ameliorate human suffering and the production effects of illness, but it also may permit labour and capital resources devoted to caring for the sick to be released for other purposes.

The development of the human investment "revolution" in economic thought and its impact on the health and medical care industry have been profound. Governments everywhere are becoming more aware of the usefulness of regarding health as a capital good. Per capita public and private health expenditures in Canada are among the highest in the world. The shift from private to government payments has been largely responsible for the rapid growth rate of public spending on health services over the last ten years. This spending is expected to increase more rapidly than any other area of government expenditure reaching almost \$5 billion by 1975, double the 1967 level⁴.

4. The Economic Council of Canada, Sixth Annual Review Perspective 1975, Queen's Printer, Ottawa, September, 1969, p. 33.

The health industry is clearly one of our most important. Moreover, ambulance services are crucial to the effective operation of this industry, providing one important link in the health care delivery chain. Basically, it is the function of an ambulance service to transport a person who has become sick or injured from an environment which is not wholly conducive to his physical well-being to one in which his medical needs can be most effectively satisfied. Such transportation may take place from the scene of a sickness or injury to hospital or from one hospital to another, but in all cases, the sole criterion of involvement is to prevent avoidable death or injury by skillful handling and adequate treatment and to make the patient as comfortable as possible with the facilities available. Conditions affecting the patient before an ambulance arrives or after the patient has been delivered to hospital are beyond the scope of the ambulance system.

Privately owned ambulance services in Winnipeg date back to the late 1940's. The provision of a public police ambulance occurred even earlier. Over the years, greater interest has been shown by the general public in the ambulance services that are available to them. Occasionally an outspoken critic of the existing order will identify problems and public concern centres around the topic for several months. However, it would appear that people in their roles as potential users of ambulance services have never taken any serious action to alter the system in any way; changes that have occurred, and these have been few, have been introduced under the initiative of the ambulance owners or, on very rare occasions, through government regulation.

Research into the ambulance industry has been rare, consisting only of minor reports during the past few years. The first concern about ambulance service improvement emerged at the time of the "Hall Commission" of 1964⁵,--ambulance operators as well as members of the Manitoba Medical Association submitted briefs to the Commission on various subjects. The Manitoba Medical Association continued to release occasional publications about ambulance care and features of the service. Suggestions were not heeded. During 1965-66 a report⁶ on ambulance services throughout Manitoba was released by the Ambulance Service Committee under the auspices of the provincial government. The study, however, was far more descriptive than argumentive and failed to develop any strong central thesis. Some helpful recommendations were put forth but there was no response by any authority except for establishment of the position of "Provincial Ambulance Officer" within the Manitoba Health Services Commission--primarily someone who might watch developments in the industry and listen to and follow up complaints about ambulance services. The activities of the Ambulance Officer have gravitated toward problems in rural Manitoba and various orientation and retraining programs have been introduced there. However, again, little attention has been devoted by any level of government to the ambulance industry in Winnipeg.

5. Emmett M. Hall (Chairman), Royal Commission on Health Services, 2 Vols., Queen's Printer, Ottawa, 1964.

6. The Ambulance Service Committee, G. L. Pickering (Chairman), Report on Ambulance Services, Province of Manitoba, 1965.

Thus, it would appear that, had any improvements at all been needed in the ambulance system over the years, no reliable plan was ever drafted by which alterations in the existing pattern of development might be effected. Alternatively, although guidelines for a better service have been set down by studies on the matter, no one has felt a need for reform. The Metropolitan Winnipeg Emergency Measures Organization presented a brief to the Metropolitan Winnipeg Council in 1968 which, however, was largely a copy of the Manitoba Medical Association brief to the Hall Commission; the Ambulance Officer presented to the provincial government a "concept" of ambulance operations in 1969⁷. Early in 1971 the Ambulance Officer was able to have accepted by the Manitoba Provincial Government a body of regulations⁸ designed to govern standards of training, vehicles, equipment, and procedure in the industry. These became effective November, 1971, over twenty years after ambulance services in Winnipeg emerged.

The industry has grown at a pace of one new firm every two years, on the average, since 1963. Apparently, entry has been easy and conditions comfortable. The ambulance owners attempted on several occasions to form associations or establish agreements, none of which was successful. During 1972 a "Professional" ambulance service has appeared, combining the resources of three firms into one answering and dispatch service. The organizers claim to have brought faster emergency

7. The Manitoba Hospital Commission, Suggested Standards of Vehicles, Medical and Rescue Equipment, and Report Forms for Ambulance Organizations, September, 1969.

8. Manitoba, The Public Health Act, Manitoba Regulation 8/71, February 4, 1971.

service to the city. During the same period, a small group of firms approached the Manitoba Provincial Government asking to be subsidized in order to provide a better service; there have been no further developments on this matter⁹. Generally, ambulance owners appear to be functioning as a group fairly well with no important disagreements apparent.

The thrust of this analysis is to specify the requirements of an adequate ambulance service, to determine the degree to which the present service in Winnipeg meets these requirements, and, finally, to examine and to evaluate alternatives for the provision of a service. The paper, therefore, falls into three parts.

Part One examines on two levels the requirements of ambulance service in terms of public interest criteria: 1) a definitional level where the elements of the definition are ranked according to importance and 2) a more detailed level where the public interest criteria are discussed at length. The criteria involved are cost and price efficiency, adequacy of output, and equity considerations. Real and potential hazards to the public interest are identified and a theoretical model of social well-being is set up.

Part Two studies the provision and use of Winnipeg ambulance services in terms of market structure, conduct, and performance. That which is experienced in terms of performance is compared to the performance expected from a service which would satisfy all the public interest

9. This study was completed in late 1972. Therefore, any statements regarding "current data" or "current situations" are valid for that time period.

criteria. Here it is important to determine how far current provision deviates from optimal provision.

Part Three identifies four general alternatives for the provision and use of an ambulance service. The alternatives are: a fully private system, complete public provision, public-private provision and joint venture, and private provision with varying degrees of public regulation and/or public support. These alternatives in terms of their operational significance are discussed in detail and evaluated in relation to the performance criteria. In conclusion, the most appropriate alternative or alternatives (and their concomitant effects upon the existing industrial structure) are specified.

PART I

THE PUBLIC INTEREST

CHAPTER I

THE PUBLIC INTEREST I

1. Introduction

Generally, public policy has three objectives. Firstly, it is important that the existing combination of outputs corresponds to the combination which will maximize the aggregate welfare of individual members of society; this is allocative efficiency. Secondly, resources used to produce any particular output or output combination should be allocated so that the output in question is being produced efficiently; this is technical efficiency. Thirdly, aside from what is produced or how efficiently it is produced, the particular aggregate output should be allocated among members of society so that welfare is maximized; this is distributive efficiency. In summary, it is the "public interest" which is held up as the objective of good public policy. Public interest depends also upon market performance--less public well-being derives from relatively poor performance and greater well-being from relatively better performance. The public interest, in the case of ambulance industry analysis, is manifested in four forms. These are summarized below and explained further in Chapter II.

1. The Physical Well-being of the Public

In terms of this analysis, physical well-being means the absence of avoidable death and injury. To conform to the jargon used

throughout the paper, this will be called "adequacy of output", qualitative and quantitative, i.e.: lives are saved both through a better quality service and through such a service's being provided to more people who need it. This has implications for allocative efficiency in that, within the existing bundle of goods society is receiving, the ambulance care component may be inadequate, requiring more resources to improve it qualitatively or quantitatively.

2. Least Cost Operation Consistent with Provision of Adequate Output

The ambulance industry, in its operation, should consume the least amount of resources consistent with provision of adequate output. The industry can consume no resources and provide no service or it can consume varying amounts of resources, provide varying standards of service, and do so at varying levels of efficiency. It is in the public interest and consistent with the technical efficiency proviso stated above, that for any given level of service quality and quantity, peak efficiency is reached, that is, minimum input for a given output.

3. Marginal Cost Pricing of Ambulance Services

In Part II, Chapter III, an hypothesis of constant variable costs in the provision of ambulance care is supported. Keeping this in mind, it is economically logical in the present case that the price paid for ambulance services, largely stand-by services, should equal short-run variable cost in the same way that it is logical for a seller of any service to charge a price of a user equal to costs incurred in serving that one user over and above costs of providing

the service generally. With constant variable cost in the provision of a stand-by service, variable cost will equal marginal cost and, if price is to equal variable cost, it will also equal marginal cost. The criterion for pricing of ambulance services, therefore, is that price equal marginal cost. This criterion of ambulance operation is related to the distributive efficiency proviso stated above in that, persons obliged to use an ambulance should also be obliged to pay only that cost generated by their use of the service and not the costs of anyone else's use nor any excess profits of entrepreneurs.

4. Fairness in Ambulance Provision

It is desirable generally that all users or potential users of any service who pay the same price receive the same availability and quality of service. Receipt of differential quality or availability by those paying the same price is inequitable, especially if these users or potential users can do little to change the situation. Additionally, it is desirable that all firms are afforded an equal competitive chance in the market; public policy toward firms must not be discriminatory. Rivalry among firms must stem from fair competitive forces, i.e.: firm against firm, and not groups of firms against firm or monopolist against potential firms. Clearly, all elements of this "equity" criterion are also based upon the distributive efficiency proviso stated above.

The hierarchy of importance into which these components of the public interest must be placed is obvious. The critical output of the industry is emergency care--a service provided to people in dire need.

Adequacy of that output is an indication of how well the service is being provided, and has direct implications for the physical well-being of the user. Ultimately, the output of the ambulance industry is to eliminate avoidable deaths and avoidable injuries and, in general, to safeguard the health of people needing the service. This component, therefore, is of primary importance. Cost and price efficiency and equity are jointly important. These, however, also influence the industry's ability to provide adequate output. A given standard of service will result in a given number of avoidable deaths and injuries. Society loses, in explicit economic terms alone, the contribution to production these individuals would have made had they not been hindered. The term "avoidable" death or injury is defined and discussed in the following section; the explicit costs of this death and injury are estimated in Chapter V.

2. Avoidable Death

Dr. David Bruser of the Mall Medical Group¹⁰ and a team of medical experts studied death due to traffic accidents from mid-August, 1966, to early August, 1967, in order to determine how well emergency cases were being treated, with particular attention to ambulance care. The number of avoidable deaths resulting from medical and ambulance services¹¹ in Manitoba was estimated. The paper shows the probability of avoidable death to be positive.

10. Dr. David Bruser, "Some Thoughts on the Emergency Care of Accident Victims", unpublished working papers, Manitoba, 1967.

11. Medical services are administered by physicians and institutions such as hospitals and clinics. Non-institutional first-aid care constitutes ambulance services.

The study analyzed 119 deaths. The guideline used was: if the accidents causing these deaths had occurred within the casualty department of the Winnipeg General Hospital, would the death have been prevented; if so, then why did the death occur? In delegating responsibility for avoidable death in this way, the committee, of course, recognized the time factor in ambulance transportation and built it into its judgements. There is no indication of which type of ambulance system this criterion would be translated into. The model system might be elegant and expensive or it might be similar to the system in Winnipeg. But it is clear that this "optimal" system, i.e.: that in which there are no avoidable deaths, was judged by purely medical criteria. For example, it is possible that, in terms of explicit costs and benefits, there is an optimal number of avoidable deaths which is greater than zero, but medically there must be none. Clearly it is difficult to identify this criterion with a specific ambulance system. However, Dr. Bruser roughly explains the criterion as follows: "avoidable" death or injury would not occur if standards of training were "quite high", as those in Chapter II suggest, if equipment and vehicles satisfied the requirements of some "comprehensive" body of regulations, such as those for which Appendix A provides an outline, and if the overall organization of the industry were such as to provide a "very responsive" service, as illustrated in the following chapter.

The geographical area in which the accidents occurred included Winnipeg and proximal rural Manitoba. The findings were that, of the 119 deaths, 25 were considered preventable on the above criterion: 14 were due to avoidable delay in treatment (7 of these were under 40 years

of age); 4 were due to faulty observation after treatment was instituted; 4 were due to complications of treatment (ex: pulmonary embolism, infection); 3 were due to unavoidable circumstances of climate and geography. Therefore, 22 deaths were avoidable.

The ambulance system was considered largely responsible for these deaths, but inadequate hospital care was also a contributing factor. The responsibility of the hospital falls within the category of "faulty observation after treatment was instituted", however, this blame also must fall partly on the ambulance system, as certain confidential case studies, which the writer has examined, indicate. The inference to be made is that, of the 22 avoidable deaths, 4 were beyond control of the ambulance system, placing upon that system responsibility for 81.82% of the explicit costs attributable to avoidable deaths¹².

Although Dr. Bruser's study indicates that 22 deaths were, to a large extent, caused by inadequate ambulance facilities, it tends to under-estimate the cost attributable to ambulance services in Winnipeg. Firstly, only hospitalized emergency cases were studied; victims who died en route or at the scene of the accident were not considered. Also, evidence had to be conclusive before the committee would blame someone or something for the avoidable death; therefore, although there may have been other deaths resulting from a faulty ambulance service, evidence may not have been conclusive or available. Further, all hospitalized cases were and are being followed through to ultimate result. Consequently, there may be deaths attributable to a faulty ambulance system which have

12. See Chapter V.

not yet occurred or had not occurred at the time the study was released. Finally, only traffic accidents were examined in estimating avoidable death. The implications of this depend upon whether the existent ambulance system is better at treating auto accident victims than other types; no hard and fast conclusions can be drawn.

Without the advantage of supplementary research on this topic (Dr. Bruser's study is the only one of its kind known to the medical community in Manitoba), the 22 avoidable deaths cannot be further documented.

3. Avoidable Injury

1. Paraplegia

Paralysis is probably the severest injury resulting from inadequate or improper ambulance care. A study by the National Institute of Neurological Diseases and Blindness¹³ estimated that 10% of all quadriplegics became paralyzed at some time after their injury due to faulty handling and transportation. A study by W. O. Geisler et al.¹⁴ included the following in its conclusions.

1. A study has been made of 958 cases of spinal cord trauma in relation to early handling and its influence on preservation of spinal cord function and patient survival.

13. National Institute for Neurological Diseases and Blindness, Dr. P. Bucy (Chairman). "Paraplegic Workshop", Report of Proceedings in Paraplegia News (December, 1968) p. 8.

14. W. O. Geisler, M.D., M. Wynne-Jones, M.D., and A. T. Jousse, M.D., "Early Management of the Patient with Trauma to the Spinal Cord", Medical Services Journal, Canada, Vol. 22, (July-August, 1966) p. 512 - 522.

2. The importance of proper first-aid was deduced from the fact that 29 patients developed further paralysis through faulty handling.¹⁵

While the study shows 3.02% of paraplegia to be the result of inadequate first-aid, it refers to the development of further paralysis, whereas individuals may be injured in such a way that a spinal cord injury is actually inflicted by those providing first-aid; the estimate does not take this into account.

Unfortunately, neither study refers to Winnipeg and no such analysis has been done here. However, medical experts and authorities from the Canadian Paraplegic Association¹⁶ point out that the first-aid management of potential and early spinal cord injuries requires the greatest of skill and a considerable amount of training; none of the ambulance attendants in Winnipeg is required to reach such a level of expertise. So as to establish at least an idea of the rôle the ambulance system has played in causing initial and further spinal cord injury, an average of the two available opinions-- 6.51%--will be used in determining the explicit economic costs of paraplegia attributable to the ambulance industry.

2. Other Injury

Where the means of treating accident and sickness victims are inadequate, avoidable injury will occur due either to failure of the ambulance system in preventing the injury or sickness, or to actual imposition of the sickness or injury by the ambulance service.

15. Ibid. p. 522.

16. Personal Communication.

No investigations into the responsibility of ambulances for general injuries are known; it is only the studies of avoidable death and paraplegia which will be drawn upon in this analysis.

4. The Trend of Thought on Ambulance Services and the Public Interest

In 1972, a federal working party¹⁷ reviewed ambulance services and established standards of performance, mainly from a quality of service point of view. The members of the working party were drawn from across Canada, including the Manitoba Provincial Ambulance Officer.

The essence of the report serves to underwrite the placing of primary importance in this paper upon standards of quality in ambulance care provision and secondary importance upon technical efficiency and finance. The study also recognizes the interdependence of adequacy of output on the one hand, and financial arrangements and organization on the other, an interrelationship upon which the present paper places considerable emphasis.

There can be little argument that comprehensive health care service must provide adequate means of transportation of the acutely ill from their homes or the site of an accident, to the emergency facilities of a hospital. Nevertheless, most provinces in Canada have been slow in ensuring availability of this vital element of primary health care to all citizens. Also overlooked has been the realization that the personnel of ambulance services are the first contacts with emergency care for almost all vehicle accident victims and a very high percentage of other emergencies (e.g. cardiovascular accidents). Thus, the significance of these workers as skilled members of the Health Team, and hence their need of first class training, has been largely ignored.

17. Advisory Committee on Hospital Insurance and Diagnostic Services, Report of the Working Party on Ambulance Services to the Sub-committee on Quality of Care and Research, Ottawa, April 13, 1972.

The exclusion of the costs of ambulance service from any Federal-Provincial cost sharing formula has undoubtedly hampered the development of effective ambulance services throughout most of Canada. Most certainly it has precluded the assurance of 24-hour availability of adequate service....

At the present time in provinces without an insured ambulance service, the costs of ambulance transportation are borne either entirely by the patient or are partially covered by government subsidy to private ambulance operators. Where there is government subsidy to private operators, the cost to the patient is reduced. However, it can still prove a considerable hardship for a large number of patients requiring emergency transportation to hospital...¹⁸.

In the following chapter, the public interest criteria are studied more closely and a model is developed which shows how particular levels of quality of ambulance service, in terms of amounts of avoidable death and injury, might generate costs and how these costs can be compared to the costs of providing those levels of quality.

18. Ibid. p. 3.

CHAPTER II

THE PUBLIC INTEREST II

1. The Public Interest Criteria in More Detail

Cost Efficiency

The absence of any market power implies by definition that peak efficiency has been reached in a firm or industry, subject to the proviso that production is taking place according to the most efficient state of the art. For any given submarket, the above requirement means

that $\frac{MPP_a}{P_a} = \frac{MPP_b}{P_b} = \frac{1}{MC_x}$, where MPP_a and MPP_b denote the marginal physical

products of inputs a and b respectively, P_a and P_b indicate the prices

of those inputs, and $\frac{1}{MC_x}$ is the reciprocal of the marginal cost of

product x. Moving out of the submarket to include the production of all inputs to the submarket operation, the same marginal conditions must apply. This, of course, assumes continuous substitution.

Ambulance enterprise, however, is faced with indivisibilities since staffed vehicles available twenty-four hours per day are items of large expenditure and cannot be subdivided according to the level of output. As a result, and Chapter III will demonstrate this, short-run unit cost schedules to the firm are downward sloping and the resulting long-run schedule is a rather jagged envelope of such curves.

Given these factors, two cost situations for ambulance firms are desirable. Firstly, the lowest long-run unit costs should be attained for any given quality of service provision. That is, the lowest long-run average cost curve to the firm should be established. Secondly, the position reached on the lowest unit cost schedule should be the lower most point consistent with provision of a stand-by service. This is necessary because a unit cost point higher than this "best" point reflects not only payment for idle stand-by resources, but for excess capacity resources and the resulting inefficiency. The absolute minimum point on the envelope curve which will also be a minimum point on a short-run average cost curve, is not reachable because the service is a stand-by service and some capacity must be available at all times even if only used rarely. The extent of such warranted excess capacity will be specified below under "Adequacy of Output."

Price Efficiency

Theoretically, a marginal cost price which equals average cost is an economically efficient price and, for private enterprise in general, the minimum price necessary in the long-run; there should be no excess profit. It is inefficient that price be greater than or equal to an average cost which is, because of excess capacity, greater than marginal cost. (Note that optimal pricing in an industry is a goal which can be pursued meaningfully only if optimal pricing is achieved elsewhere in the market.) Recalling the equation presented above under "Cost Efficiency",

efficient pricing can be expressed in the following way: $\frac{MPP_a}{P_a} = \frac{MPP_b}{P_b} =$

$\frac{1}{MC_x} = \frac{1}{P_x}$, which equates the price of the output, P_x , with the marginal cost of producing that output, MC_x . Again, the same marginal conditions must apply to the production of all inputs to the submarket operation. Marginal cost pricing is justified in this way: the price an individual pays for a good or service should be equal to the difference between the total cost of providing the particular output to all users including this individual and the total cost incurred by supplying everyone except the user in question. This value will represent the consumption of resources for which this particular user is responsible.

An efficient price for ambulance calls in Winnipeg (of an average one hour duration and of an average 15 to 20 miles in total length) is a variable cost price of roughly three to five dollars. This efficient price criterion is based upon the actual cost of inputs to the trip of a "representative" ambulance firm, discussed in Chapter III.

Adequacy of Output

In the text book case of perfect competition, demand is satisfied in an optimal manner--price equals marginal cost and there is no undue restriction of output or raising of price. In the other extreme case, monopoly, price is greater than marginal cost and output is less than it would be at the point where price equals marginal cost; consumer surplus is reduced. The curtailment of output in this manner is not critical in any industry selected at random (say the pin industry), but the problem becomes more serious in the case of a "public safety" industry and the matter of adequate output is of vital concern.

Entrepreneurs, when deciding upon their scales of plant, will, on the demand side, take into account only effective user demand. However, one feature of the ambulance industry which is atypical of most is that there is required at any one time a minimum number of ambulances consistent with public safety as established by first-aid and rescue standards. This number is called the "warranted" amount of ambulances. The number of units provided by the private operators may or may not satisfy the required standards. Concern about the warranted number is based on the problem of "availability" of ambulances when needed; and availability is defined in terms of time elapsed in dealing with an emergency. One indicator, therefore, of adequacy of emergency output quantitatively is the "time-lag" involved in reaching an emergency once the ambulance is called. The number of cases transported is another indicator.

Adequacy of emergency output is also measured qualitatively. Whereas quantity of output is regarded as that number of emergency cases conveyed to hospital and consuming a certain amount of time, quality concerns the ability and training of attendants, nature and condition of vehicles and equipment, and accountability of the system. "Output", therefore, is defined as follows: that number of emergency or elective cases delivered to hospital, each within a certain amount of time consistent with the exogenous conditions of climate, traffic, and nature of illness or injury (emergency care only), and treated according to a certain standard of quality. Adequacy of output so defined depends upon five factors: organization, number of ambulances, stability and dependability of the service, progressiveness of the

industry, and standards of training, equipment, and vehicles. Unless otherwise specified, assertions regarding quality of care indices are based upon discussion with authorities from the medical community and the Manitoba Health Services Commission.

1. Organization

This is a broad term encompassing all the pervasive features of the service.

- (a) Payments Mechanism: An ambulance ride is a service provided by an entrepreneur to a user; the payment received by the entrepreneur for rendering this service constitutes his livelihood--his prime motive is to earn a profit which is satisfactory. In the majority of cases where goods and services are bought and sold in the market place, immediate payment is a condition of sale. If the seller is uncertain of getting payment, he may demand payment. If the purchaser wishes to pay later, he may be refused the good or service or may be obliged to pay more for it later. Although normally urgent, most consumption is not emergency in nature; it is seldom that the good or service must be provided immediately. Ambulance services are an exception. Emergency care must be received immediately regardless of price or other conditions of sale. And yet, a profit-seeking entrepreneur is serving someone whom he likely does not know and requires payment from this stranger for the service: one's physical well-being might be predicated on the ability to pay immediately. Clearly, such a payments mechanism might lead to situations of avoidable delay in transporting a patient to

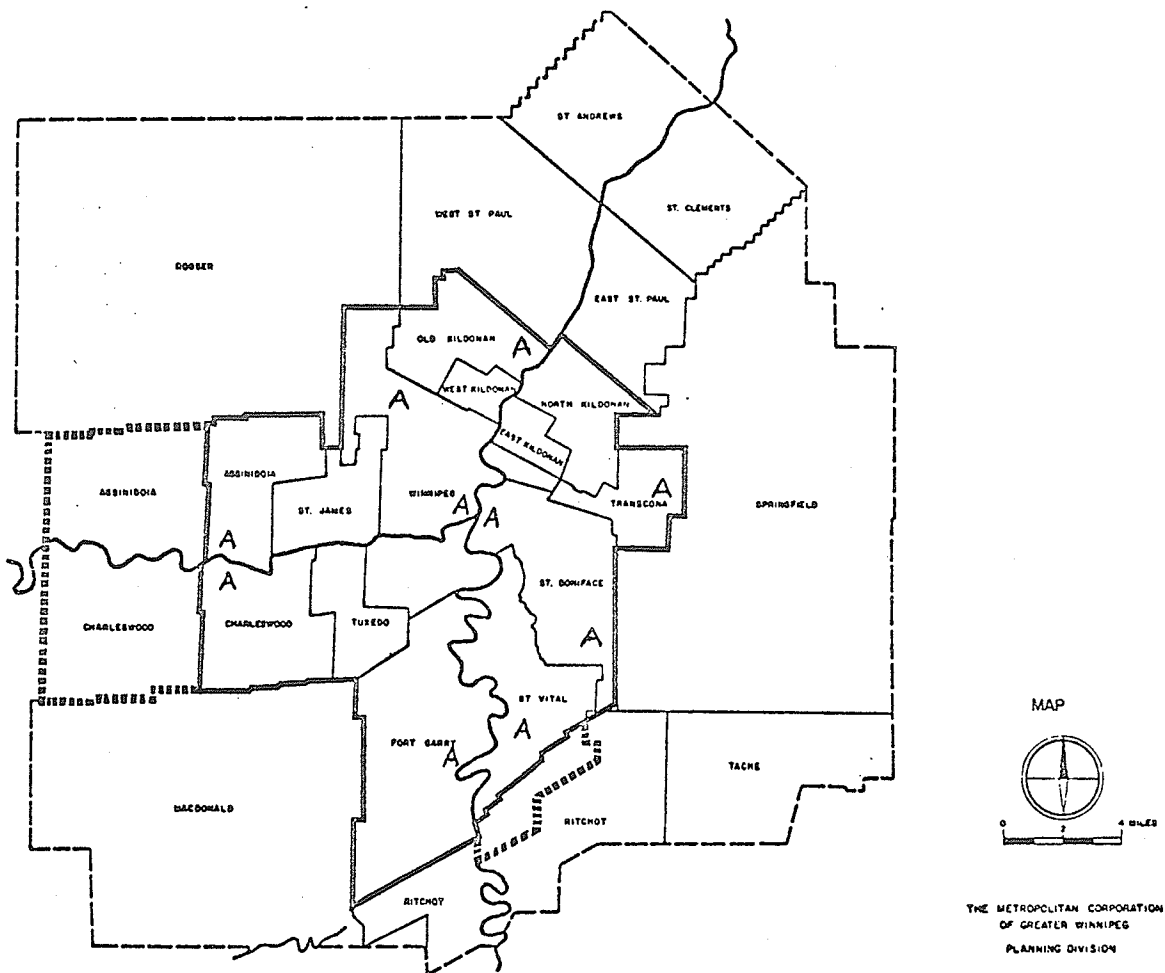
hospital, or, in fact, the patient is not transported at all by ambulance. The time-lag under these conditions could be lengthened unnecessarily. (The Manitoba Federation of Labour has called for universal ambulance insurance coverage for just these reasons.¹⁹) Therefore, the payments mechanism criterion is that access to emergency ambulance care must not be predicated on the ability to pay.

- (b) Communications: Ambulances must be notified of the need for their service. It is possible to call the companies individually, but one common number to a central control is an efficient way of calling ambulances. Moreover, radio contact between the central telephone control and ambulance outlets would speed the dispatching of ambulances from the most strategic location. Radio contact between the outlet and the ambulance would add to the efficiency of such co-ordination. Finally, radio contact between ambulance and hospital will render the emergency ward aware of what to expect and will permit instructions regarding treatment to pass from hospital to ambulance. Therefore, the communications criterion is that complete verbal contact be maintained by all participants in ambulance service provision. This implies provision of a telephone network to receive calls and a radio network to dispatch and co-ordinate calls and assist ambulances in performing their function properly.

19. Manitoba Federation of Labour, Legislative Submission to Premier and Cabinet, Winnipeg, January 30, 1973.

(c) Jurisdiction and Location: When more than one private ambulance operator arrives at the scene of an emergency, there might be some disagreement as to who should receive the business. This problem might also arise where a public and private vehicle arrive at the same emergency. Further, two public vehicles from different communities may spend valuable time debating their areas of jurisdiction. Therefore, the jurisdictional criterion is that ambulance coverage of the city be zoned with overlap among zones when necessary. This would eliminate path crossing, pirating, and jurisdictional disagreements. The location criterion is that ambulances be strategically dispersed and coverage complete.

FIGURE 1



LEGEND:

- Boundaries of area under former Metropolitan Corporation of Greater Winnipeg.
Additional areas included under "Unicity."

Figure 1 presents a map of Winnipeg. The letter A's denote ambulance locations throughout the city which would be required for complete ambulance coverage.

- (d) The Hospital: The emergency ward of the hospital should be prepared for the cases that arrive. This can be achieved with appropriate equipment and staff but also by maintaining radio contact with ambulances as they approach the hospital with patients. Further, emergency wards of different hospitals are equipped and staffed in different ways which renders them capable of handling completely only certain types of emergencies. If a patient is conveyed to one hospital and cannot be treated adequately, he must be taken to another while valuable time is lost. Therefore, the hospital criterion is that hospitals should be prepared for cases which arrive but, at the same time, the ambulance system should match the hospital to the needs of the patient so that treatment is administered efficiently and effectively. This decision is part of first-aid care and can be made by any qualified first-aider.
- (e) Accountability: Because an ambulance service is involved with physical well-being and human lives, it should obey any quality standards which are set down and account for the details of its activity in the treatment of patients. It is only in this way that responsibility and order can exist. Moreover, any studies of ambulance systems rely heavily upon data collection by ambulance operators of their procedures and case loads. The accountability criterion, then, is that responsibility and collection of day-to-day information are important for adequate ambulance service.

2. The Number of Ambulances

If an ambulance is called to an emergency and the ambulance is available, then, given other features of climate, traffic, and organization, time consumption probably will be low. But if the ambulance is not available, another must be called. The additional call will take time and the ambulance will be slower in arriving if it is farther away. On the average and other things equal, the time-lag will vary inversely with the number and strategic disposition of ambulances. Since this lag must be minimal, the number and location of ambulances is important.

A satisfactory criterion for the quantity of vehicles to provide both emergency and elective care is 1.2 vehicles per 50,000 population. In the case of Winnipeg, this suggests 12 warranted ambulance vehicles, 10 in continuous operation and 2 available for back-up service. This number of vehicles will generate the warranted excess capacity or stand-by capacity discussed above under "Cost Efficiency".

3. Progressiveness

Some forms of industrial organization are more innovative than others depending upon the extent to which incentives to improve and develop new ideas are constrained. Where change is within the realm of possibility, frequently a large research budget is necessary. Some fields of endeavour offer greater scope for change than others; one classic example is that of medical technology. With regard to ambulance care, it is most important that the newest methods of treatment be adopted, that more sophisticated or reliable equipment

be acquired when available, and that the development of new ideas be pursued.

4. Stability and Dependability

If firms frequently enter and/or leave an industry or the industry ceases to exist temporarily, output provision becomes unstable and unreliable. This is particularly undesirable if some users are excluded at such times. The provision of emergency ambulance care is important and, in terms of criteria, the number and distribution of ambulances must be constant at an adequate level over time. If a change is to take place (for example, the exit of a firm), it must not be unexpected, for adequacy of output will be at risk. When private enterprise supplies ambulance services, an automatic reporting and compensatory network would be necessary to satisfy the criterion of a continuous service over time.

5. Training, Equipment, and Vehicles

According to the American College of Surgeons²⁰, the training which an ambulance attendant should receive requires that he be knowledgeable in the following:

1. The limitations of immediate care.
2. Transportation of the unconscious patient and general principles of resuscitation.
3. Airway care and artificial respiration.

20. American College of Surgeons, The Committee on Trauma, Emergency Care, Robert H. Kennedy, M.D. (Editor), W. B. Saunders Company, 1969.

4. Cardiac arrest and external cardiac compression.
5. Heart attacks and strokes.
6. Drowning.
7. Oxygen inhalation and suction.
8. Shock and electric shock.
9. Burns and exposure to cold.
10. Bleeding.
11. Head and neck injuries.
12. Eye injuries.
13. Chest injuries.
14. Abdominal injuries.
15. Fractures, dislocations, and the movement of spinal injury patients.
16. Poisoning by drug, chemical, food, or gas.
17. Transportation of the emotionally disturbed patient.
18. Emergency child birth.
19. Communicable disease--sanitation.
20. Coroner's cases--D.O.A.
21. Equipment and how to use it.
22. Emergency vehicle operation.
23. Communications.
24. Procedure in terms of reporting, vehicle operation, emotions, conversation, personal appearance, uniform, and professional manner.

The ambulance attendant should be able to recognize the problem, deal with it immediately and effectively, and control complications.

Ideally, a course in first-aid should be provided in 300 to 600 hours, preferably full time. At least one-third of any such course must consist of drill. Regular annual in-service tests and training are in order. An ambulance attendant must be no more and no less than a fully qualified first-aider; the utilization of policemen or firemen as ambulance attendants is inappropriate and the utilization of registered nurses, interns, or doctors is superfluous.

The equipment contained in ambulance vehicles should meet the minimum requirements set down in Regulation 8/71 presented in Appendix A.

The ambulance vehicle also should satisfy the minimum requirements expressed in Regulation 8/71. A four-stretcher capacity, two-attendant vehicle is required. Other vehicles such as what are commonly known in Winnipeg as "fire rescue" vehicles with their staff complement are inappropriate as ambulances; the police "dual purpose" vehicles are insufficient as ambulances. This is the training, equipment, and vehicle criterion.

In summary, the criterion under review was that of adequate output. This criterion was specified as a zero avoidable death and injury norm. The sub-criteria were: quantity of cases treated, time consumed in treatment, and quality standards, thus revealing the quantitative and qualitative dimensions of output adequacy. The number of cases treated should be that which is required by the public; the time consumption, other things equal, should have a maximum of 40 minutes; the quality standards were enumerated above. These sub-criteria

were specified in terms of organization, progressiveness, number of ambulances, stability and dependability, and standards of training, equipment, and vehicles.

The optimum level of avoidable death and injury is not empirically known. However, theoretically, this value will occur where the incremental benefits and costs of improving the ambulance system and reducing death and injury are equal. To arrive at this marginal equality, explicit benefits or implicit benefits or both can be compared to costs of improvement. Explicit benefits occur in terms of avoidance of lost production of persons victimized by a faulty ambulance service. Implicit benefits occur in terms of human or psychic costs which are infinite. Therefore, there exists a choice of two optimal levels of avoidable death and injury depending upon which benefits are included in the criterion. An "explicit economic" criterion would compare only explicit benefits with costs to determine the optimum. An "overall economic" criterion would compare all benefits, explicit and implicit, with costs to determine the optimum. In that case, the optimum would be zero which also happens to be the criterion chosen by the medical community. For purposes of analysis, this public well-being criterion of zero avoidable death and injury is chosen because, in the writer's opinion, it is the most desirable and provides a distinct measure according to which comparisons can be made. Clearly, this choice can be defended either on economic grounds or medical-moral grounds.

The model developed at the end of this chapter provides a way of thinking about the rôle of economics in this exercise. It shows two sets of criteria in action and how trade-offs might take place. The

reader may choose his or her own criteria and compare them to the performance indicators identified in Chapter V.

Equity

Fairness to both firms and consumers is an important part of any public interest formula. The equity criterion therefore consists of three parts. The same price should be charged for the same type and quality of service. There should be no unfair competition whether among private entrepreneurs or among public and private bodies. In the case of ambulances, what is "good for the producer" in terms of fair competition, adequate payments mechanism, and considerate legislation, is "good for the consumer" in terms of physical well-being. Finally, there should be recognition of an option value price, i.e.: $(\text{average total cost} \cdot \text{output}) - (\text{average variable cost} \cdot \text{output}) = \text{the option value bill to be paid by the public at large}$. The public generally is responsible for covering this cost because it is the public which derives benefit from it. This is the essence of the equity criterion.

2. The Model

Introduction

This original model is a theoretical and visual aid in showing how the ambulance firms, the ambulance industry, and society are inter-related in terms of the costs and benefits of ambulance care provision. The model is "theoretical" in that it deals with the concepts developed on page 32 above. Because the optimum level of avoidable death and injury cannot be demonstrated empirically, a theoretically logical set of curves is presented in model form to show the contribution of theory in expressing this optimum. The solution to the "explicit economic" criterion can be shown graphically as greater than zero but less than present avoidable death and injury²¹ (it cannot be shown cardinally because empirical evidence to specify the curves is unavailable). Further, the solution to the "overall economic" criterion can be shown as zero avoidable death and injury. Finally, the present level of avoidable death and injury can be shown. Also, by showing how firms and the industry relate to this component of attained performance, the model leads the way into a discussion, firstly, of how the level of avoidable death and injury was established (the nature of market

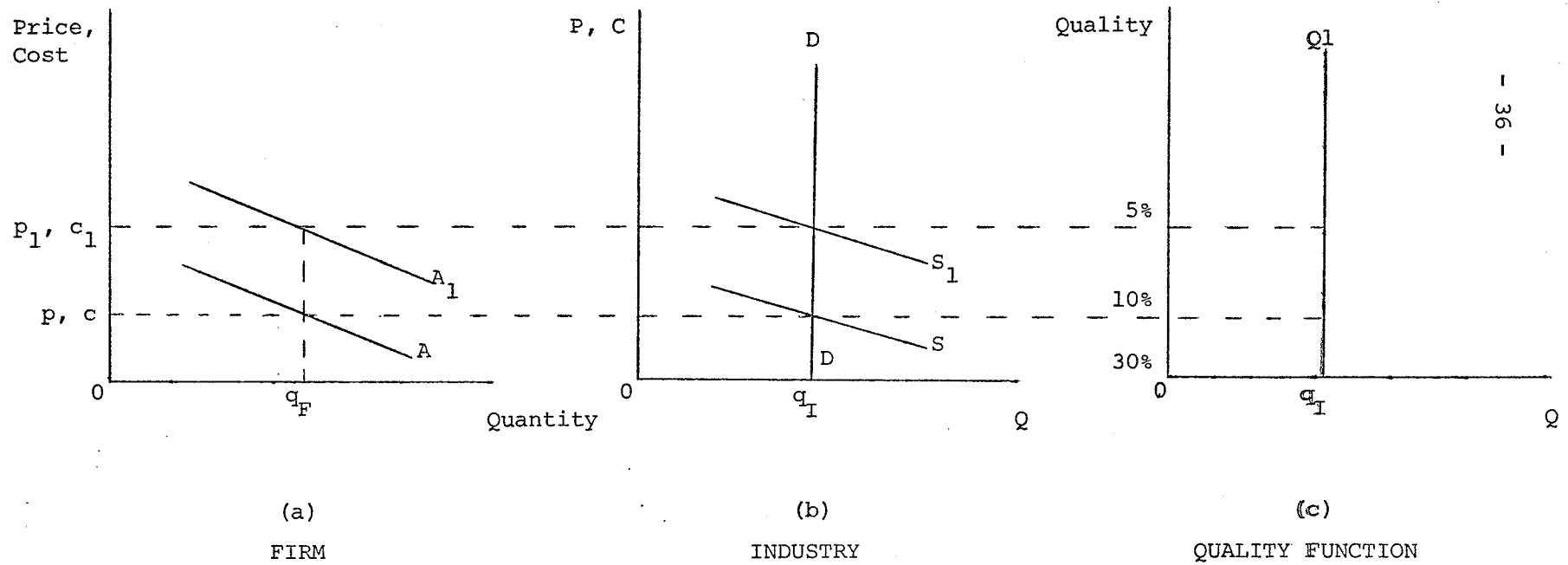
21. The development of the model below emphasizes not only that zero avoidable death and injury may be quite expensive to reach, but that explicit benefits, as expressed in the model, will be small as this point is approached. Hence, the explicit economic optimum will be greater than zero. Moreover, as later chapters illustrate, the present explicit costs of avoidable death and injury are quite high and initial improvements to reduce these can be made easily. Hence, the explicit economic optimum will be most likely less than this amount.

structure, conduct, and performance) and, secondly, of public policy formulation to improve market performance by inducing changes in the structure and conduct of the market.

Quality and Cost

The presence of avoidable death and injury imposes costs upon society. It is possible to depict graphically the relationship between different standards of service of emergency ambulance care and different levels of cost in terms of lost production and the use of medical resources (explicit costs). At the same time, the cost of providing an ambulance service satisfying different levels of quality can be plotted. As a first step, however, the relationship between levels of quality and cost to the industry and firm are shown.

FIGURE 2

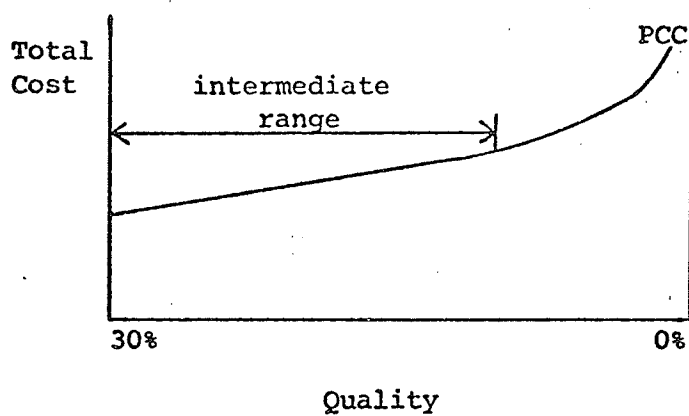


In Figure 2, part (a), is the firm, in part (b), the industry (where price and cost in dollars are measured vertically and units of output horizontally in both cases), and a functional relationship between quantity and quality of service in part (c). Higher cost schedules to the firm ($A, A_1, \dots A_n$) result in higher cost schedules to the industry ($S, S_1, \dots S_n$) and the higher costs are due to higher levels of quality. (Note that at this point it is more convenient to include what was formerly referred to as "time-lag" and "quality" respectively both under the term "quality".) The scale on the vertical axis of part (c) is measured in terms of a percentage of avoidable death and injury; a higher level of quality indicates a lower percentage. The 30% value is an arbitrary starting point. Units of output are measured horizontally.

The Production Cost Curve

A production cost curve, PCC, can be drawn which compares, in Figure 3, various levels of quality, measured along the horizontal axis in terms of percentages of avoidable death and injury, to different amounts of total cost incurred by an entire ambulance system in providing those particular levels of quality, measured vertically. It is presumed that higher levels of quality would cost a greater amount.

FIGURE 3



Total cost is measured vertically; quality is measured horizontally, with an arbitrary starting percentage of 30%, reaching zero toward the right. The shape of the PCC is highly a matter of conjecture. It seems reasonable that the curve will slope upward to the right indicating greater expense for higher levels of quality. Also, it is feasible that the curve will bend steeply upward as peak quality is neared. In fact, the curve may become asymptotic to an imaginary line drawn vertically from 0% reflecting the proposition that the "ultimate" is only approachable, not attainable--in order to provide a "perfect" service, the ambulance would have to be virtually a "hospital on wheels", staffed by interns or doctors--costs would become very high and avoidable death and injury may never be completely eliminated.

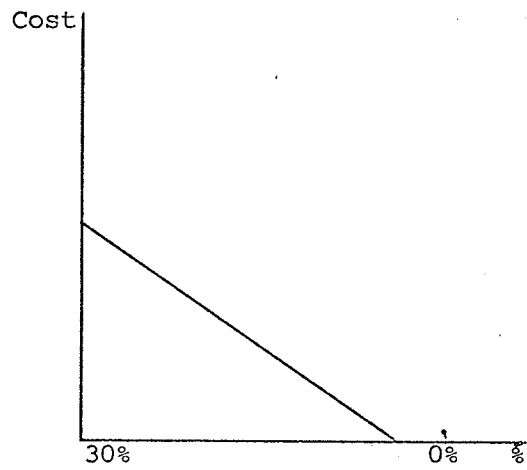
Nothing reliable can be said about the expected slope of the curve in the intermediate range. Both fixed and variable outlay are required to raise the standard of service quality.

As Figure 2 indicates, if the industry is private, it remains in equilibrium as expenditure is incurred if all firms react in the same way; total cost equals total revenue at all times as quality increases and the total volume of emergency demand remains unaltered at that amount shown by the vertical industry demand curve, D-D in Figure 2 above. In other words, there is one PCC for each level of output; there is a higher one for higher levels of output. It is assumed that total cost increases as output increases although this is not necessarily true of all cost functions.

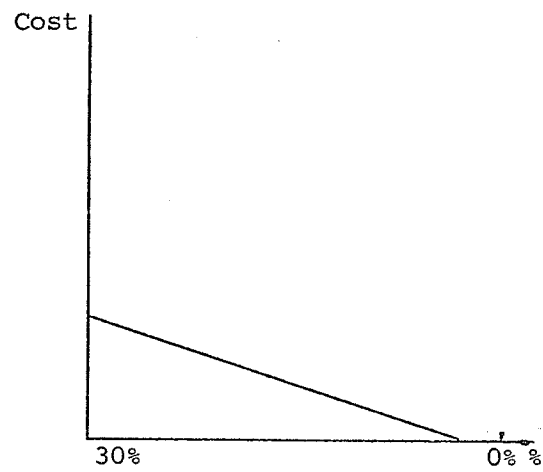
The Social Burden Schedule

Deaths and injuries due to accident or illness are a cost to society and to the individuals involved. However, the important costs in this analysis are those attributable to avoidable death and injury. A "social burden" schedule can be plotted depicting a logical relationship between different levels of quality of service, measured horizontally as percentage avoidable death and injury, and the accompanying levels of cost generated, measured vertically in dollars. It is logical that lower levels of quality result in higher social burden: the curve will slope downward to the right. Little can be said accurately about its slope. With complete data, one schedule could be computed for avoidable death, another for avoidable injury, and both aggregated to obtain the total curve, as in Figure 4.

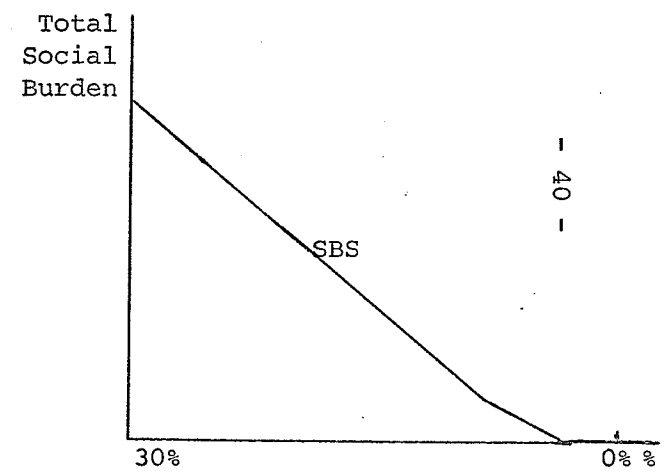
FIGURE 4



(a) Avoidable
Death



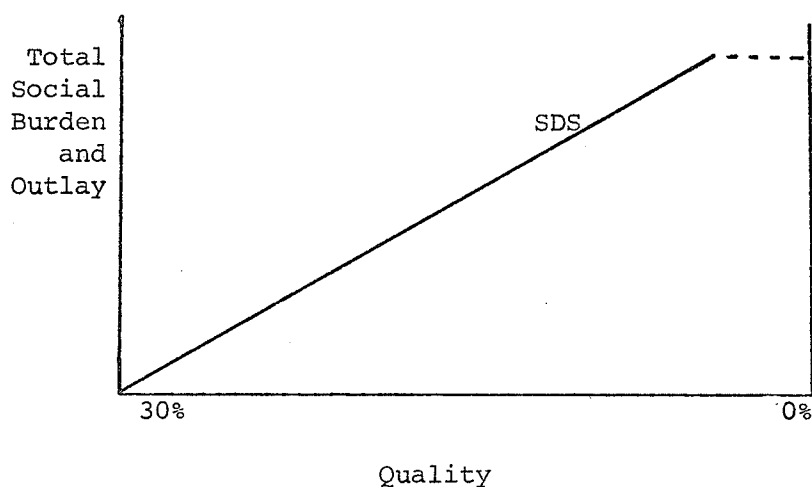
(b) Avoidable
Injury



(c) Aggregate
Schedule

Because the SBS shows the benefits to be derived from improving quality and reducing the incidence of death and injury, it does indicate a sort of "demand" for improved quality. In fact, a curve can be derived from it which is a demand curve, or, alternatively, a "break-even" curve.

FIGURE 5



In Figure 5, burden and outlay are measured vertically, quality horizontally. The curve is an inversion of the SBS, above, and shows that society would break-even by spending as much money to increase quality as is saved through reducing social burden; it would spend neither more nor less. The SBS can be described best as follows: the maximum amount that one is willing to pay to avoid losing any given sum is that given sum. The social demand schedule (SDS) reaches a ceiling outlay where the SBS reaches zero. Note that the SBS in Figure 4 reaches zero burden and the SDS in Figure 5 reaches a corresponding ceiling outlay before zero avoidable death is reached. This represents the expectation that the "hard core" avoidable death and injury cases, i.e.: the last

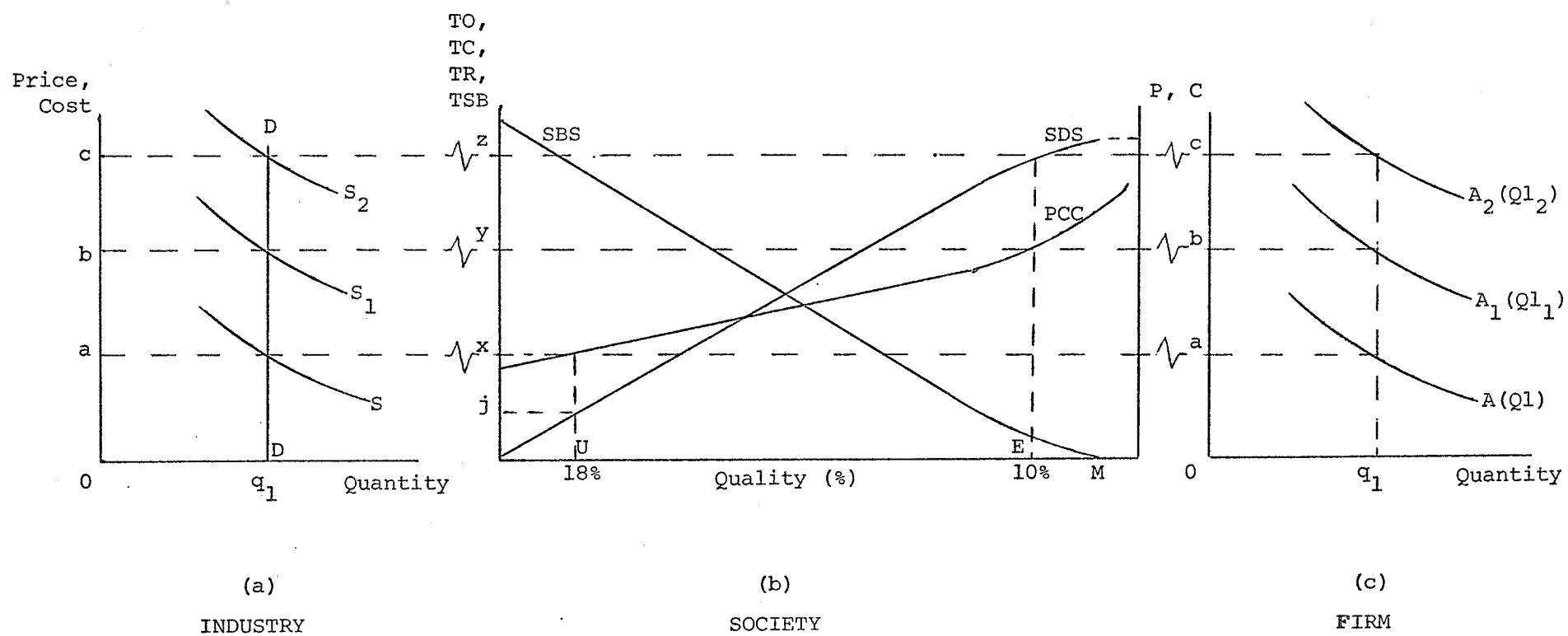
to be eliminated, will consist of the elderly and this group would probably generate zero if not negative explicit benefits in terms of lost production and medical expenses. This same feature appears in Figure 6 below.

A note on social versus private demand is in order at this point. The social demand, i.e.: demand by collectivities of individuals, for life-saving expenditure, is different from that of single individuals. An individual perceives the cost to himself of losing his life as infinite. Society as a decision-making unit perceives such costs as finite and more-or-less equal to medical costs and loss of production with some moral convictions thrown in for good measure. However, the vertical scales of graphs in this model measure, as social burden, only such explicit costs as the former two, not because the model attempts to assert what the social decision-making unit actually considers, but to show the tangible, i.e.: explicit, information which is available to society and which it may consider in such a decision-making process.

The Model

All of the curves so far derived now can be placed in a master diagram and the relations discussed.

FIGURE 6



On the vertical axes of Figure 6, parts (a) and (c), are measured price and cost in dollars and, on the horizontal axes, quantity of output, the scale of measurement for the latter, of course, being different for the industry and for the firm. The right and left vertical axes of diagram (b) denote total outlay (this relates to the break-even schedule), total revenue, total cost, and total social burden. Total revenue and cost are faced by the industry as a whole; total social burden and total outlay are faced by society as a whole. Along the horizontal axis in diagram (b) is measured quality of ambulance service.

In part (a) is placed a vertical emergency demand schedule to the industry, D-D, and successively higher unit cost supply curves, S, S_1 , S_2 , which would result from higher levels of quality. In part (b) are drawn the SBS, SDS, and the PCC; the shapes depicted are, as discussed above, hypothetical. In part (c), successively higher unit cost schedules to the firm are presented, A, A_1 , A_2 , incurred for higher levels of quality, Q_1 , Q_{1_1} , and Q_{1_2} . Note the breaks or "resistances" in the dotted lines joining the three diagrams. These indicate that the vertical axes of parts (a) and (c) are not directly comparable to those of (b) but that they are equivalent to the vertical scale of (b) divided by the number of cases "produced".

The significance, then, of any particular point on the PCC is that total cost equals total revenue, price equals average cost, and the firm and industry are in equilibrium. The first proposition is depicted in the centre diagram; the others are shown in the outside diagrams.

The significance of a point such as 'a' (on the vertical axes of parts (a) and (c)) = 'x' (on the vertical axis of part (b)) = 18% (on the horizontal axis of part (b)) is that quality is denoted by an 18% probability of avoidable death and injury, that total cost equals total revenue at 'x', for the industry, and price to users equals 'a'. Note, however, that the marginal gain to be realized by a reduction in social burden of a given increment (the slope of the SBS) exceeds the marginal cost of doing so (the slope of the PCC). Hence, point 'a' = 'x' = 18% is not an explicit optimum from the social point of view. (This results from the way the curves in the diagram are drawn--the present diagram is presented only as an example of how the curves might look.) At the same time, the demand curve, SDS, indicates that society wants more quality for the going price or for this quality is willing to pay only a lower price. To the right of the intersection of the SDS and the PCC, the SDS lies above the PCC showing that to achieve what society wants can be done at a cost lower than what society would be willing to pay in order to break even. The explicit optimum is reached where the marginal gain from reducing social burden just equals the marginal cost of doing so, i.e.: where the slopes of the SBS and PCC are equal. For the sake of demonstration, assume this to occur at price = b, quality = 10%, and $TC = TR$ at y in Figure 6. However, the amount that society is willing to pay is price = c and total outlay = z. Hence, a consumer surplus is realized equal to zy in part (b). By remaining at the original (sub-optimal) position, $a = x = 18\%$, a consumer surplus equal to zy in Figure 6 is being lost, and an excess of cost over benefit, xj, is present.

The optimal adjustment in this model can be defined in one of two ways. An explicit economic optimal adjustment requires that explicit gains and costs at the margin be equal--any program of expenditure is to be carried on up to that point (additionally, costs must be minimized and costs and gains distributed equitably). This position is indicated by E in Figure 6, part (b). However, the overall economic optimal adjustment (or medical adjustment) is one which eliminates avoidable death and injury. This occurs at point M in part (b). Depending upon actual curve shape, these two "optimal" adjustments could occur at the same point, or they could differ as suggested in the diagram.

The model can be used to show specifically the three dimensions of economic efficiency introduced in Chapter I: technical, allocative, and distributive. These dimensions, in turn, express the four criteria: output adequacy, cost and price efficiency, and equity.

The height of the production cost curve represents the level of technical efficiency, both at the firm level and organizationally. A higher PCC reveals lower technical efficiency in either or both of these respects.

The adjustment reached along the cost and benefit schedules--PCC and SDS--represents the level of allocative efficiency. If marginal cost equals marginal gain, the appropriate amount of resources has been allocated to ambulance care so as to maximize welfare in an explicit benefit calculus. If marginal gain exceeds marginal cost, not enough resources have been allocated to the ambulance sector. Note that all benefits as well as only the explicit ones may be cited, permitting the

overall economic criterion (medical criterion) to enter the allocative efficiency calculus: if avoidable death and injury represent an infinite cost, then allocative efficiency will be optimal only when such undesirables are eliminated.

Distributive efficiency is revealed in three ways. Firstly, where at least a unit cost price is charged in a situation where unit cost is considerably greater than marginal cost (for example, in provision of a stand-by service), because users are paying for universally enjoyed option value as well as their own use and option value, distributive efficiency is sub-optimal. The PCC is a schedule of such cost-price points. Secondly, where an insufficient amount of resources is allocated to the ambulance sector and the result is differential availability of service, distributive efficiency is affected and aggregate welfare is reduced. This is reflected through the position occupied along the avoidable death-injury axis and the point reached on the SBS. Thirdly, the degree of orderliness and co-ordination in the use of resources and the resulting degree of universal availability of care also will determine the level of distributive efficiency, notwithstanding the fact that the amount of resources mobilized may satisfy the allocative efficiency criterion. This also is reflected through avoidable death and injury and the resulting social burden calculation on the SBS.

These dimensions of efficiency also can be expressed in terms of the four basic criteria of this paper. Price efficiency is partly determined by technical efficiency, and has distributive efficiency implications as follows. The level of cost depends upon technical

efficiency and price depends upon the level of cost. Further, where price differs among users, distributive efficiency is affected.

Adequacy of output is determined by allocative and distributive efficiency in terms of the adequate amount of resources being allocated and distributed according to the relative needs of people. Additionally, since price can affect use or the speed of use, and a high price may have deleterious effects upon use and well-being and, further, since price depends partly on technical efficiency, adequacy depends also upon technical efficiency. Finally, adequacy is determined indirectly by technical efficiency through its effect on cost efficiency--if poor organization of production hampers availability or quality, well-being is affected.

The equity criterion is determined by distributive efficiency through the latter's effect upon the relative distribution of output: differential distribution of output may be fairer to some users than others. The equity criterion is indirectly determined by technical efficiency in that the charging of differing prices to users based on differing costs may violate equity conditions.

The model has shown not only how different factors will bring about different levels of quality in terms of avoidable death and injury, but, in fact, that different quality optima are conceivable and need to be considered in devising social policy toward the ambulance industry. Further, it has hypothesized the shapes and behavioural tendencies of the various curves representing costs to firms and the industry and costs and benefits to people, which will determine

distributive, allocative, and technical efficiency levels generally and, in turn, the implications of these latter three orders of efficiency for the criteria of cost and price efficiency, adequacy of output, and equity.

3. A Note on Market Failure

This section will be a timely introduction to the concept of market failure as it might apply to an ambulance industry; the discussion will be continued in Part II.

What is it we mean by "market failure"? Typically, at least in allocation theory, we mean the failure of a more or less idealized system of price-market institutions to sustain "desirable" activities or to estop "undesirable" activities¹. (The footnote states: "activities" broadly defined to cover consumption as well as production.) The desirability of an activity, in turn, is evaluated relative to the solution values of some explicit or implied maximum-welfare problem.

It is the central theorem of modern welfare economics that under certain strong assumptions about technology, tastes, and producers' motivations, the equilibrium conditions which characterize a system of competitive markets will exactly correspond to the requirements of Paretian efficiency². (Footnote ignored.)...

.....

Many things in the real world violate such correspondence: imperfect information, inertia and resistance to change, the infeasibility of costless lump-sum taxes, businessmen's desire for a "quiet life", uncertainty and inconsistent expectations, the vagaries of aggregate demand, etc.²²

Although the quotation contains a reference to competitive markets generating Paretian efficiency, this paper is not studying a perfectly competitive market situation nor does it hold as the objective

22. Francis M. Bator, "The Anatomy of Market Failure", Quarterly Journal of Economics, Vol. 72, No. 3 (August, 1958) p. 351-379, p. 351-352.

of public policy formulation the attainment of Paretian efficiency. Rather, a collection of criteria which apply to the market situation under examination was outlined in Chapter I; by coincidence, some of the requirements of these unique criteria correspond to the requirements of Paretian criteria.

Of those factors restricting an optimal adjustment, imperfect information, inertia, and businessmen's desire for a quiet life are most relevant to an ambulance industry and can affect public welfare. Receipt of emergency ambulance care is urgent, there has been minimal regulation of the industry, businessmen operate to make a profit, and consumers know neither their true preferences nor the nature of the service (the latter assertion is defended in Chapter III). In other words, factors are operative in the market for ambulance care which might hinder the attainment of an optimal level of avoidable death and injury as well as the other optima presented in criterion form in Chapter I.

4. Summary

Preserving the public well-being is the concern of any responsible government. Ensuring public well-being is also the function of any good ambulance system. In respect of well-being, therefore, the goals of the public sector and of ambulance services are, theoretically, the same. In this way, also theoretically, ambulance services are an instrument of public policy. Upon inspection of an ambulance system, if it is found that private commercial interests are the only real concern at the expense of public well-being, then ambulance services must become

the target of public policy so that their theoretical role of being an instrument of public policy in the furthering of the public well-being can be rendered a real rôle. As a target of public policy, the industry may experience regulatory action, forms of financial support, or the provision of various guidelines of performance. As an instrument of public policy, the system will be required to generate primarily the preservation of physical well-being, but also the encouragement of efficient operations and a market structure fair to all parties.

The performance criteria put forth in Part I are clearly public interest goals and, accordingly, call for an ambulance service to be an instrument of public policy. Part II examines the extent to which such public interest goals are being pursued or attained by the present ambulance system and Part III develops the dimensions of a comprehensive public policy toward the ambulance system so as to bring its performance in line with what public interest policies would require.

PART II

THE INDUSTRIAL ORGANIZATION

CHAPTER III

MARKET STRUCTURE

1. The Concepts of Market Structure, Conduct, and Performance

Firms function in three capacities. As purchasers, they enter factor markets to buy productive resources. As administrative units, they control their entire productive process by organizing inputs, managing their use, and choosing the techniques of production and channels of finance. As sellers of their goods or services, firms determine the level of output and price, establish the nature of the product, and make a series of adjustments to the entire market environment. The resulting performance of this market is important and interesting.

The "how" of market performance is one dimension of its importance; the other is "why" the market performs in a particular way. Answering these questions will help to identify the determinants of performance and to understand how variations in these determinants lead to changes in performance. The formulation of meaningful public policy is predicated upon such knowledge.

There are two basic market performance determinants. Firstly, market structure--the nature of enterprises and the nature of the environment within which they function--sets parameters of firm activity and

influences performance. Secondly, market conduct--the policies, tactics, and general behaviour of enterprises in adjusting to market structure--also influences the nature of market performance. Part II identifies and examines the market structure and market conduct of the ambulance industry in Winnipeg in order to reveal patterns of causal relationship between structure and conduct on the one hand, and between these and performance on the other.

2. Market Structure Defined

In industrial organization analysis, the topic of market structure suggests the entire environment within which both firms and buyers function. Such an environment determines how firms behave as well as resulting market performance, and consists of institutional factors such as public provision, regulation and support, psychological factors such as consumer preferences and entrepreneurial attitudes, and the technical constraints of cost to the firm and industry.

3. Nature of the Service

There are eight smaller firms in the ambulance industry in Winnipeg and two somewhat larger and older ones. There were ten public ambulance vehicles, however, one was discontinued in mid-1972 and another is functioning more on a part-time basis than before; two others are dual purpose police and first-aid station wagons. All ambulances provide a similar service by similar means, however, the quality of service varies considerably from one to another. Annually, a rather

small clientel is served (less than 25,000 out of a population at risk of more than 500,000) which consists largely of an uninformed group of persons in need of an essential service.

Two types of ambulance care are provided in Winnipeg: elective and emergency. Elective service is comprised of calls which state the need for ambulance transportation at some future time. Ambulance companies are able to accumulate and organize the elective demands placed upon them and set out a work load which is convenient. For example, the firm may satisfy all elective calls during a certain time of the day or during certain days of the week. Emergency calls, on the other hand, which may come at any time of the day or night, must be answered when received. In order to be able to answer whatever emergency arises, the ambulance service must be available at all times--men and equipment may sit idle for long periods between emergencies. Emergency service is the "critical" output of the ambulance industry and must be administered as quickly and as adequately as possible. The time-lag in reaching an emergency is one very important index of the adequacy of the service and is determined by the ready availability of vehicles and attendants. A greater variety of equipment and a higher level of first-aid and rescue knowledge are required to deal effectively with such calls. Because of its relative importance, emergency ambulance care will receive primary attention in this paper.

When an emergency occurs, a caller may contact an ambulance company directly, a police or fire department, or, more commonly, the central 999 emergency dispatch centre. If a call to 999 originates in the Inner City, a police ambulance, dual purpose police vehicle, fire

rescue truck, or one firm which has arranged to answer all non-fire-police calls will be dispatched. The police ambulance usually attends calls that are "to a place to which the public normally has access"²³. There is a charge only for the service provided by the private firm. If the call originates outside Inner City, the 999 centre attempts to determine the nature of the need and transfers the call to the police department in the particular area. If this police department owns an ambulance which is available at the time, or, if a fire rescue truck is available, one of these will be dispatched free of charge. Otherwise, the police department calls the closest available private ambulance. This process takes time; the private ambulance charges its usual fee.

4. Institutional Factors

Public Provision

Inner City, East Kildonan, St. James-Assiniboia, and Fort Garry operate public ambulance services. The reasons for this policy are not entirely obvious. The public ambulance facilities answer calls which, before their introduction, were answered by private enterprise.

The Inner City Police Department provides 24-hour emergency ambulance service in its jurisdiction, the service not normally being available elsewhere. The police department maintains one ambulance and two dual-purpose patrol and first-aid station wagons. All vehicles are

23. The Ambulance Service Committee, G. L. Pickering (Chairman), p. 59.

staffed by policemen; all First Class Constables are eligible for ambulance duty. The Inner City Fire Department possesses three fire rescue vehicles and one stand-by vehicle, the main purpose of the service being to provide auxillary vehicles to the Department, carrying special apparatus for the rescue and treatment of smoke and fire victims. Originally, this rescue facility was not intended for general ambulance use, but gradually was drawn into such duty, responding to calls from the Inner City area 24 hours per day. Four firemen and one lieutenant staff each vehicle.

The St. James-Assiniboia Police Department operates one ambulance vehicle responding only to emergency calls. The East Kildonan Fire Department operates an ambulance-and-rescue vehicle staffed by two firemen. Twenty-four men are eligible for ambulance duty and are rotated on a regular basis. The Fort Garry Fire Department provides a one-vehicle ambulance-and-rescue service, responding to calls originating within Fort Garry.

Throughout the public ambulance service, the cost of vehicles varies from \$6,000 to \$23,000 per vehicle and each community operating an ambulance claims it compares well with those privately owned. In all cases the service is provided only within the particular locality and no charge is required. Staffing ranges from two to five men per unit, all men are trained in St. John first-aid, and in each area several men are available for ambulance duty on a regular rotation basis. Salary costs range upward from \$700. monthly. Emergency service only is provided.

Regulation and Support

Public support of private ambulance enterprise is minimal in Winnipeg. The only direct support consists of free training courses offered by the Manitoba Health Services Commission to any ambulance operator who has the time and desire to partake of the program. Autopac, by publicly insuring ambulance costs arising from automobile accidents, has provided, by coincidence, some indirect financial support to ambulance companies which otherwise face the danger of unpaid private bills.

An account of legislation during the past few years concerning the ambulance industry, including points from the Winnipeg By-laws, The Highway Traffic Act of Manitoba, and the new Manitoba Regulation 8/71, is presented in Appendix A.

Regulation prior to February, 1971, was sparse. This is surprising since the ambulance industry, while a "public safety" industry, is a private, profit motivated one. During the very genesis of the present industrial structure, there was no regulation or control of procedure and development. Clearly there has been a minimal effort on the part of government to safeguard the public interest. Any furthering of public welfare by the ambulance industry must have originated within the industry, not from without by regulation. However, in February, 1971, a more realistic approach was taken to scrutinize service standards with the filing of Manitoba Regulation 8/71. The Regulation exhibits both advantages and deficiencies.

Much of the document is directly in the public interest, specifically Sections 5, 9, 12, 13 subsection 1, and Schedules A and B. These passages emphasize standards for vehicles and equipment, continuing inspection of such facilities, training and character of personnel, and procedure, including adequate insurance and detailed reporting of calls to the Manitoba Health Services Commission. Standards for both vehicle and equipment are fully set out in Schedules A and B of the Regulation. In general, there is increased protection for recipients of ambulance care.

Conceivably, whenever new and more stringent requirements are imposed upon any group of firms, some would fail to satisfy all requirements. This has been partially true of the ambulance industry in Winnipeg. As a result, a proviso allowing firms to change-over gradually to compliance with the new regulations is desirable. Sections 14 and 15 of Manitoba Regulation 8/71 permit this. The policy is advantageous: if one firm fails to satisfy the requirements immediately while another is in accordance with them when introduced and, further, if there is little time allowed for change, the operator of the less adequate service would be obliged to discontinue operations until he could meet the standards; competitive discrepancy would result. Further, some firms might be more able than others to acquire the funds needed to improve their services and, in fact, some might be obliged to leave the industry. Section 15 (1) of the Regulation allowed nine months during which adjustment may take place; Section 15 (2) provides for an extension of the time period where justified.

Finally, the Regulation sets out to improve the body of knowledge about ambulance services and fulfills the more general purpose of focussing attention on a previously ignored industry.

On the debit side, the Regulation ignores some of the key problems of the present industry. An emergency ambulance service is one of great urgency and the total number of vehicles available throughout Winnipeg is an important determinant of adequacy of output. If this number were to fall below a certain specified minimum at any time, a serious problem might result. If an operator were to leave the industry suddenly, reducing the number of vehicles available and limiting coverage, the problem would need to be remedied quickly, and the economic forces of entry and exit do not work sufficiently fast. The Regulation does not require ambulance operators to notify the Commission in advance of their leaving the industry so that remedial steps might be taken. The discontinuing of operations temporarily or the alteration of hours of service are equally important problems. The Regulation provides no guarantee to the public that the industry will be stable and dependable.

A problem that has long plagued ambulance operators is that of unpaid bills. In the provision of any non-urgent good or service, payment is usually assured before the service is rendered; when the service is emergency in nature, there is no time to debate remuneration. The Regulation makes no attempt to provide assistance or direction to operators in covering unpaid bills and, therefore, does not provide the public with any safeguard against atrocities that might arise where a life-and-death matter is reduced to a monetary transaction.

While the Regulation is intended only as one step toward more comprehensive legislation, it fails to approach organizational problems and problems of standards in the public service. Organizational factors include primarily the geographical dispersion of ambulance units throughout the city, the categorization of hospitals by the ambulance attendants according to what health matters each hospital specifically treats, and the call and dispatch procedure. The problem of staff rotation and its implications for accumulation of experience by the men involved is important in the public ambulance service: in each community providing public ambulance care, several men are available for duty on a rotation basis-- by the time any one man is next on the list for ambulance duty, his skill and technique are very likely to have deteriorated.

There is one point in the Regulation which is interesting. The Manitoba Health Services Commission has become a barrier to entry into the ambulance industry. Section 6 (1) states that the Commission will grant a licence to an applicant only if the ambulance service is "required". The entry of a firm into the industry has implications for market shares, unit costs, price, profit, and adequacy of output with respect both to user and option demand, and it is interesting that the Commission has taken upon itself to determine all these variables simultaneously, especially since it has not fully researched the industry.

In general, the ambulance industry still is not strictly guided by the public sector. Over time, self-induced changes and improvements have taken place. The newest regulations, with one exception, only call for maintenance of the status quo and the industry continues to function within a market structure of minimal legal

constraints. The exception is that the Manitoba Health Services Commission has become a barrier to new competition.

4. Barriers to Entry

In 1963 there were six firms and 14 vehicles in the ambulance industry.²⁴ The volume of business was approximately 18,350 calls, both emergency and elective. Today there are ten firms and 17 vehicles receiving a total of 21,208 calls, emergency and elective. Therefore, in nine years, the volume of business has increased by 15%, the number of firms by 66%, and the number of vehicles by 21%. No firms have left the industry and none has expanded. There are two larger older firms, neither of which has increased in size over the past nine years. Four new firms have entered and satisfied the increased demand. Although conditions of entry appear to have been favourable, four barriers to new competition are conceivable; a fifth and more effective one has recently been imposed.

Regarding legal barriers, ambulance operators always have had to be licenced in Winnipeg; regulations, both old and new, are listed in Appendix A. It is apparent from the rules operative prior to November, 1971, that the potential operator did not have to satisfy any stringent requirements--he needed a first-aid certificate and "any privately owned vehicle equipped or used for transporting the wounded, the injured, or the sick"²⁵. This requirement was not specified.

24. The Ambulance Service Committee, Report on Ambulance Services, Province of Manitoba.

25. Winnipeg By-law 18613, Section 40A.

Manitoba Regulation 8/71 is more detailed but not rigorous or unreasonable. Further, it does not affect the entry of the firms presently operating.

Collusive barriers to entry have not been significant. The members of the ambulance industry, on more than one occasion, have tried without success to establish some form of agreement or association through which organizational and standards-of-service policy might be developed. But at present there is no visible machinery by which new firms might be excluded through the use of economic power; predatory and exclusionary tactics are not employed. The reasons for this type of behaviour are discussed in the following chapter on conduct.

In many industries, starting-up costs are usually a major obstacle to new enterprise. However, in the ambulance industry, prior to the new regulations, there were no specific requirements governing ambulance vehicles or equipment; it was during this time that the industrial structure was born. Under the present Manitoba Regulation 8/71, these service components are more closely scrutinized. However, a potential ambulance operator still can set up a complete business with an outlay of less than \$8,000. This is not a prohibitive barrier to entry.

Expectations about the availability of a share of the market will be an important determinant of whether or not a potential firm will enter any industry; scarcity of business is usually a significant barrier to entry.

A firm's ability to gain a share of the market consists of two factors: its ability to "steal" business from other firms and its

ability to create new business. The first ability depends upon the strength of consumer preferences which are flexible, the existence of contracts which are not flexible in the short run, and the ability of the newcomer to cut price. Preferences, in turn, depend upon product differentiation, contracts upon past and, therefore, exogenous considerations, and price cutting is predicated on the existence of financial resources upon which the newcomer might rely until his position in the market has been established. The difficulty of stealing a market share is aggravated by the fact that the ratio of the optimal size of the firm to the size of the market might be high. If the existing firm or firms have had time to reach this optimal size, the newcomer not only will face a large entrenched market share which he must erode, but the unit costs of his rivals will be such as to hinder his charging the going price for a given type of service (assuming it is competitive) not to mention his charging a lesser price. With persuasive product differentiation by the new firm, however, these obstacles could be rendered unimportant.

The second ability, the creation of new business, depends upon the elasticity of demand and supply to the industry. Analytically, for a given rightward shift of any upward sloping supply curve of given shape, the increase in output will be greater the more elastic is demand. This increase will normally be spread among all firms in an industry and the ability of any one firm to obtain a greater portion of it or all of it will depend upon its differentiation of product. For a given demand curve of a given downward sloping shape, a shift in an upward sloping supply curve will result in a greater increase in output the greater is

the elasticity of supply. However, indications are²⁶ that the ambulance firm and industry supply curves are a series of downward sloping curves, less steep than demand. Therefore, new business cannot be created by a new firm. In fact, demand to firms might become scarcer. The process of firm behaviour and development is discussed in a later section and in Chapter IV.

The newest and only truly effective barrier to entry is the Manitoba Health Services Commission. It instituted Manitoba Regulation 8/71 wherein the most important proviso for entry is that "The public convenience or necessity require the proposed ambulance service."²⁷ In other words, the government is to decide if demand merits more ambulance units. This constitutes a solid barrier to entry. If the statement is to be interpreted to mean that a firm will be permitted entry if conditions of demand require it, i.e.: that there must be a potential market share for the new firm, then the policy reduces to one of compliance with the forces of supply and demand which would function without the regulations. This is not invariably in the public interest. Or, if the statement means that a firm will be admitted if increased ambulance availability is desired irrespective of effective demand, then scarcity of business would result in eventual exit of the new firm or some other firm and the Commission's intention of bolstering the availability of ambulance care fails. Also, the entry policy is passive: if no candidates apply to enter, none will enter, whether the "public convenience or necessity" require it or not.

26. See Section 6 of this chapter.

27. Manitoba, The Public Health Act, Manitoba Regulation 8/71 Section 6, Sub-section (1) (a), February 4, 1971.

There has been no expansion by firms in the ambulance industry; new demand has been met by new firms. The ease of entry has probably been a barrier to expansion in the past while the new regulations will encourage it. There also has been no exit of firms from the industry since 1963. This can only indicate a comfortable market situation for firms since there are no apparent barriers to exit from the ambulance industry (labour is not immobilized due to highly specific skills, there is a ready market for used vehicles and equipment both in new entrants and in the rural and northern area of the province, and there are no rules governing exit).

Although there is only one formal barrier to entry in the usual sense, there do exist some unusual hindrances to entry which are neither legal nor economic. Because of their behavioural origin, these entry obstacles are best discussed in the following market conduct chapter.

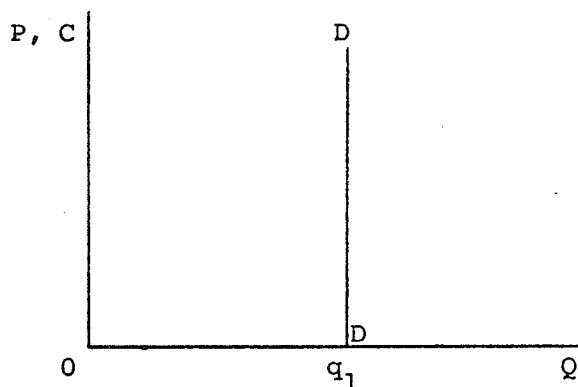
6. Demand

The nature of demand in this particular industry study is complex. Demand comes in many forms from many sources and conclusions about the resulting demand "curve" are, at best, conjectural. The demand curve is that schedule which relates the quantity of output in terms of ambulance trips to the price charged for each trip. Analysis of demand can be approached on three levels: demand to the industry, demand to the firm, and demand characteristics of the public. Demand will be either emergency, elective contract, or elective non-contract in nature.

The Industry

The argument of this paper is that demand to the industry for emergency care is zero elastic. Clearly a true "emergency" call is one in which price and quantity demanded are not choice variables: one does not choose trauma and its ensuing treatment on the basis of price and, since there are no acceptable substitutes for the service, demand for emergency service must be zero elastic. The demand curve to the industry for emergency calls will appear as in Figure 7.

FIGURE 7



Price and cost in dollars are measured on the vertical axis, the number of calls for service on the horizontal axis.²⁸

The demand curve in Figure 7 will be vertical at the number of emergency cases treated in the relevant time period; it will be further to the left the greater is the supply of public ambulance services.

28. This explanation is applied to all following diagrams in the paper unless otherwise specified.

The factors affecting demand at any time are exogenous to the ambulance system and include the incidence of sudden illness, the need for urgent transfer of patients between hospitals, and the occurrence of accidents, disasters, and other traumatic experiences.

Elective demand, whether contract or not, originates mainly from the elderly, convalescents, invalids, pregnant mothers and, in general, persons who are not urgently ill but require special transportation from one point to another and can afford an ambulance.

In some instances, the users of ambulance facilities are insured against the expense; once insured, their demand for the service will be inelastic. Infrequent users of ambulance service will have been out-of-touch with price levels and will not be able to discern readily any price alterations by the industry. For frequent users of ambulances, demand will be one of necessity and inelastic.

In general, therefore, the industry receives a zero elastic demand component in the form of emergency demand, and a largely inelastic demand component in the form of both elective contract and elective non-contract demand. In the aggregate, the industry faces a demand which is inelastic.

The magnitude of present emergency and elective calls in Winnipeg can be calculated according to old data that are available and current estimates. A study conducted in 1965²⁹ estimated elective and emergency calls to both public and private ambulance services in 1963. The findings are presented in Table 1.

TABLE 1
EMERGENCY AND ELECTIVE AMBULANCE CALLS, 1963

1. Total ambulance calls, both emergency and elective, hospital and non-hospital	22,419
2. Portion answered by public ambulance services (emergency)	4,069
3. Total ambulance hospital trips	18,067
4. Total emergency trips	9,300

Source: The Ambulance Service Committee, G. L. Pickering (Chairman), Report on Ambulance Services, Province of Manitoba, 1965.

Since public ambulances answered 4,069 emergency calls, the percentage of total emergency calls not available to private firms was 43.7%. Since all ambulance calls totalled 22,419 and all emergency calls totalled 9,300, total elective calls equalled 13,119 or 58.9% of total calls; total emergency calls equalled 41.1% of all calls. Total current demand to all ambulance services, public and private, is approximately 25,000 cases³⁰. Based upon 1963 percentages, total present emergency demand equals 41.1% or 10,275 of the total, and elective calls, 14,725.

29. The Ambulance Service Committée, G. L. Pickering, 1965.

30. Manitoba Health Services Commission, unpublished data, 1972.

In 1963, the public ambulance service included six vehicles; today there are ten. The total volume of ambulance calls for all police and fire departments during 1972 was 3,792³¹. Subtracting this from total emergency calls, 6,483 emergency calls remain for the private sector. Therefore, the estimated demand to the ambulance industry during 1972 amounted to 14,725 elective calls and 6,483 emergency calls. There are presently ten firms in Winnipeg and the average market shares are 1,472.5 elective calls per firm and 648.3 emergency calls per firm. Total calls per firm are 2,120.8 on the average. Total daily calls equal 5.8.

"Effective" or "user" demand is under discussion. It is the only demand recognized by ambulance operators and it alone helps determine output and price. However, there is another demand called "option demand" which is exerted, although covertly, for the option of having a good or service available for consumption even though consumption may seldom or never take place. Option demand and option value have little practical importance, especially to businesses, but do become significant if pricing policy and taxation are being considered with regard to the ambulance industry. Because option value is not recognized in the market, no price is charged and yet a value is realized. This is discussed further in Chapter V.

The Firm

Several components originating from different sources may comprise the total demand to the firm for emergency service. There are

31. Evidence from the respective departments, 1972.

at least four conceivable sources of demand which an ambulance firm might face.

Firstly, there can be orders from users directly. The ambulance companies in Winnipeg are listed and advertized in the Winnipeg Telephone Directory. Users of an ambulance service or someone acting on behalf of the user may call the firm of his choice directly. The decision of the caller may be based on chance, advice from others, or upon personal opinion about which company is best. The caller may have to make his decision at the time of an emergency or he may come to a conclusion about the best firm prior to the need for one, relying upon the above variables and price. But, clearly, price will not be important at the time of an emergency; only chance and/or product differentiation will enter the decision.

Demand to a firm will also come from police departments and R.C.M.P. detachments. A call for emergency ambulance service may go to the 999 centre instead of the company; the 999 procedure was discussed in Section 1 of this chapter. The 999 centre relays calls to police departments nearest the emergency. In turn, the police may do one of two things: send out a public vehicle or summon a private ambulance to attend the call. There are several influences that may prevail upon the demand exerted by police departments.

Location of the private ambulance firm in relation to the emergency is frequently cited³² as the main determinant of demand by the police. If one firm is closer than all others from which the police might choose, it will be called to the emergency. If the firm

32. Testimony of police departments in Unicity.

does not have an available vehicle, the next closest firm will be called. Demand to the closest firm will be zero elastic with respect to price; neither price nor product differentiation (other than location) will enter the decision. The demand curve will be vertical.

Hypothetically, price might affect demand based on location; the demand by police in this case may be discontinuous. For example, a particular firm might be the only one commonly called by a police department. If price were raised by this firm only, quantity demanded may remain the same until a point is reached where this firm's services are replaced by another's if price is raised further. However, since the police are not the users of the service and do not pay for it, their demand will be insensitive with regard to price.

Demand will depend also upon product differentiation. This concerns only that product differentiation representing an attempt by the producer to attract the user through advertizing, name, courtesy, convenient payments, and so forth. Location and quality which are also elements of product differentiation are discussed separately.

In this case, the demand curve must be less than infinitely elastic and it may or may not have discontinuities or irregularities. Product differentiation may also take the form of consistent direction of business to one firm for no clearly objective economic or medical reason; this is not uncommon. A demand schedule zero elastic with respect to price results.

Finally, quality will help determine demand. If only one firm among the set of feasible firms to be called by the particular police department meets the standards of service quality required by police, then it will receive the calls regardless of price, location, or

any other factors. Where service quality (training, equipment, vehicles) of available firms is similar, the other determinants will become operative.

Several factors have been observed, each of which may help determine the nature of the police component of emergency demand going to ambulance firms. Theoretically, the price elasticity of this demand will depend upon the effect on demand of each of the determinants and which determinant or determinants dominates the total demand from the police. However, because location of firms and quality of service are the main concern of police, demand will not be price sensitive. This entire demand is only one component of the total emergency demand that a firm faces.

Thirdly, demand to a firm will consist of orders from hospitals. Ambulance services are used to transport patients among hospitals. It is conceivable that the demand from hospitals might be determined by the same factors which affected the demand by police. However, all but three hospitals choose ambulances on a rotation basis, only those firms being placed on the list which satisfy certain quality standards. Consequently, product differentiation and availability affect the inclusion of an ambulance on the list, but once this occurs, those not chosen receive no business from hospitals and demand to those on the eligibility list is zero elastic with respect to price.

Finally, demand will come to a firm through grantors of contracts. Part or all of the demand facing a firm may come through a contractual arrangement with a particular source. In Winnipeg, there are seven contracts for ambulance services: United Health Insurance, Care Services, Victoria General Hospital, Misericordia General Hospital, Inner City Welfare, Deer Lodge Hospital, and the Department of National

Defence. Each contract is reviewed annually and a price is set. In all cases, price was the overriding consideration in letting the contract, quality of service receiving much less attention. In 1972 contracts constituted 41% of total demand.³¹

In summary, emergency demand to the firm will be zero elastic with respect to price. The elective contract demand schedule will be horizontal, and the price elasticity of the remainder of elective care will lie between these two levels. Different firms will, of course, face different demands depending upon their location, whether they hold a contract, and user preferences. A discussion of firms' behaviour toward the various types of demand they face is presented in the following chapter on conduct and a theory of demand segmentation and discriminatory pricing is developed.

Demand Characteristics of the Public

Ambulance services, at any given point in time, are not considered to be one of the most desirable consumer purchasables. In the same way that individuals normally do not wish to use hospital facilities or purchase medical appliances, they do not particularly savour transportation by ambulance. Because of this basic reluctance on the part of the public to seek ambulance care, demand has tended not to fluctuate over time in response to price or product differentiation. Since 1963, demand has increased at an average annual rate of 1.7%.

31. See the following section entitled "Private Provision and Cost Conditions".

Another feature characteristic of the public with regard to ambulance services is "consumer incompetence". This is defined to be the difference between the results of the purchase choices that a consumer makes under a given set of market parameters and the results of purchase choices that he would voluntarily make under a different (optimal) set of market parameters. An important parameter is information and it can affect other parameters like tastes, i.e.: preferences are based largely on knowledge and if this is incomplete or incorrect, there is reason to believe that preferences might be altered by the rational consumer in light of new additions to knowledge. For example, false advertizing may attract customers who otherwise would not have "preferred" the good in question. The fact that the consumer voluntarily makes a different decision rules out the problem of "merit goods". Note that by "incompetence", nothing is implied about a fundamental inability of the consumer to judge what is best, but that one's judgement is only as good as one's information. In any case, the consumer does not have an accurate picture of his true indifference map. The following factors account for this.

An ambulance service is unusual in that it is difficult for the user to know or to find out what the service should entail. The processes of tatônnement, trial and error, and testing are not operative in this particular market. In the event of emergency use of ambulance care, the purchaser or "market signaller" and the patient are usually different people and the user is not able to observe the quality of service received, whether or not he knows what to look for. Inspecting an ambulance prior to the contingency of needing one is not practicable.

All vehicles would have to be inspected and the operators may not cooperate. Also, ambulances are not always available for inspection--time taken to inspect all vehicles would be great. Given that scrutiny of this nature were practical, one still must know how to evaluate and be able, when the time comes, to choose among firms voluntarily; neither of these is likely. If no firm provides an adequate service, an individual knowledgeable of quality throughout the industry has little basis upon which to make a rational choice.

It is conceivable that a person is indifferent toward ambulance services: he may never have used an ambulance and his contrived probability of future use is zero; thus he has no incentive to seek reform. However, the fact remains unaltered that if an ambulance is needed, the individual has a positive probability of dying avoidably or being injured avoidably, and knowledge of this should affect his attitude.

The nature of the service is comparable to that of a doctor or dentist--unless one is a doctor or dentist, one does not know how to judge adequacy. However, in their case, these professions are guided by an internal code of ethics whereas the ambulance industry is not.

It might be argued that consumers as a group could achieve reform by delegating someone to inspect ambulances, ascertain the relative standards of service, and on that basis call for regulation. This, however, is subject to three difficulties.

Firstly, establishing collective action implies extensive knowledge and community consciousness of the problem. An argument was presented to show that this probably does not exist at present nor is likely to come about.

Secondly, even if knowledge could be diffused throughout the community, the task of coherently organizing a group of people becomes increasingly difficult as the group becomes larger. The fundamental question in this regard is: who would be interested? Those who have never used an ambulance service would have little incentive. Those who have been taken to hospital by an ambulance in an emergency and survived would have only praise for the service. As for those who die unnecessarily, it is unlikely they will have any say in the matter.

Finally, as a group or singularly, consumers have no power to bargain when demand for a good or service is zero elastic. It has already been shown why a single consumer has limited bargaining power; a group of consumers is subject to the same restrictions.

A factor called "contemporary consumer mentality" also shapes the attitudes of the public toward ambulance care. This term refers to the tendency of consumers to expect that all goods and services available on the market, and all producers and distributors responsible, have been carefully inspected and evaluated by "government" and any danger has been removed. People know that if cyclamates cause cancer in rats or colour television picture tubes emit harmful radiation, the government, in its great wisdom, will find out and let them know. People think they are universally protected in this manner. This problem is a reality in an age when the complexity of goods and services and the industrial organization behind them is far beyond the understanding of an average person. Such detachment on the part of the consumer is a way of life and applies equally well to ambulance services: by placing itself in the hands of the "health authorities", whoever they might be, the public thinks it will be taken good care of.

In summary, the user may not be aware of a social burden and will not be inclined to take action against possible problems. In the model of Chapter II, the Social Burden Schedule may not exist for him. And if the user were knowledgeable of the social cost, because of the urgent and involuntary nature of demand for the service, it is unlikely he would be able to bring any pressure to bear upon the industry.

7. Private Provision and Cost Conditions

The firms in the ambulance industry are not identical. Some are older than others, some more prosperous, there are both new vehicles and vehicles in need of replacement, and staff number and expertise vary somewhat from one firm to another. The diversity is not so great, however, as to preclude the construction of an "average firm" to be representative of the firms in general for purposes of adding actual cost data to the analysis.

Presented in Table 2 are ambulance company details including location, vehicles, patterns of staffing, wage payments and dispatching, rent, and basic prices. It is clear from Table 2 that diversity among firms is not great. The largest firm uses three vehicles, the smallest use one. Most firms employ two full-time attendants, one of whom is always the owner, and a relatively larger number of part-time staff. Several firms economize on dispatching and rent costs by using the owner's residence as a part- or full-time office and having a family member answer telephone calls. The basic emergency price is \$25 while, for elective calls, six firms charge \$20 and four charge \$25. The average elective basic price is \$22.

TABLE 2

AMBULANCE COMPANY DETAILS

	Location	Vehicles	Staff ^a		Payment		Dispatching	Rent	Basic Price	
			F	P	F	P			Elect.	Emerg.
Firm A	Inner City	2	2	3	\$525	\$2/call	Attendant on hand: \$91.80 ^b per firm family mem- ber: \$91.80	\$125/mo. jointly home: ^d \$17/mo.	\$20	\$25
Firm B	Inner City	1	2	3	\$525	\$2/call			\$20	\$25
Firm C	Inner City	1	2	3	\$525	\$2/call			\$20	\$25
Firm D	West Kildonan	2	2	2	\$390	\$2/call			\$20	\$25
Firm E	West Kildonan	2	2	2	\$360	\$2/call	T.A.S. ^c	\$150/mo.	\$25	\$25
Firm F	St. Vital	1	2	1	\$400	\$2/call	T.A.S.	home: \$17/mo.	\$25	\$25
Firm G	St. Vital	3	2	3	\$320	\$2/call	family mem- ber: \$91.80	\$200/mo.	\$25	\$25
Firm H	Fort Rouge	2	3	2	\$600	\$2.50/call	family mem- ber: \$91.80	home: \$17/mo.	\$25	\$25
Firm I	North Kildonan	1	1	3	\$400	\$2.50/call	T.A.S.	home: \$17/mo.	\$20	\$25
Firm J	North Kildonan	2	2	2	\$500	\$2/call	family mem- ber: \$91.80	home: \$17/mo.	\$20	\$25
Totals		17	20	24			\$1740.60	\$7128.00		
Averages		1.7	2.0	2.4	\$454.5	\$2.10	\$174.06	\$712.80	\$22	\$25

a: F--full-time; P--part-time.

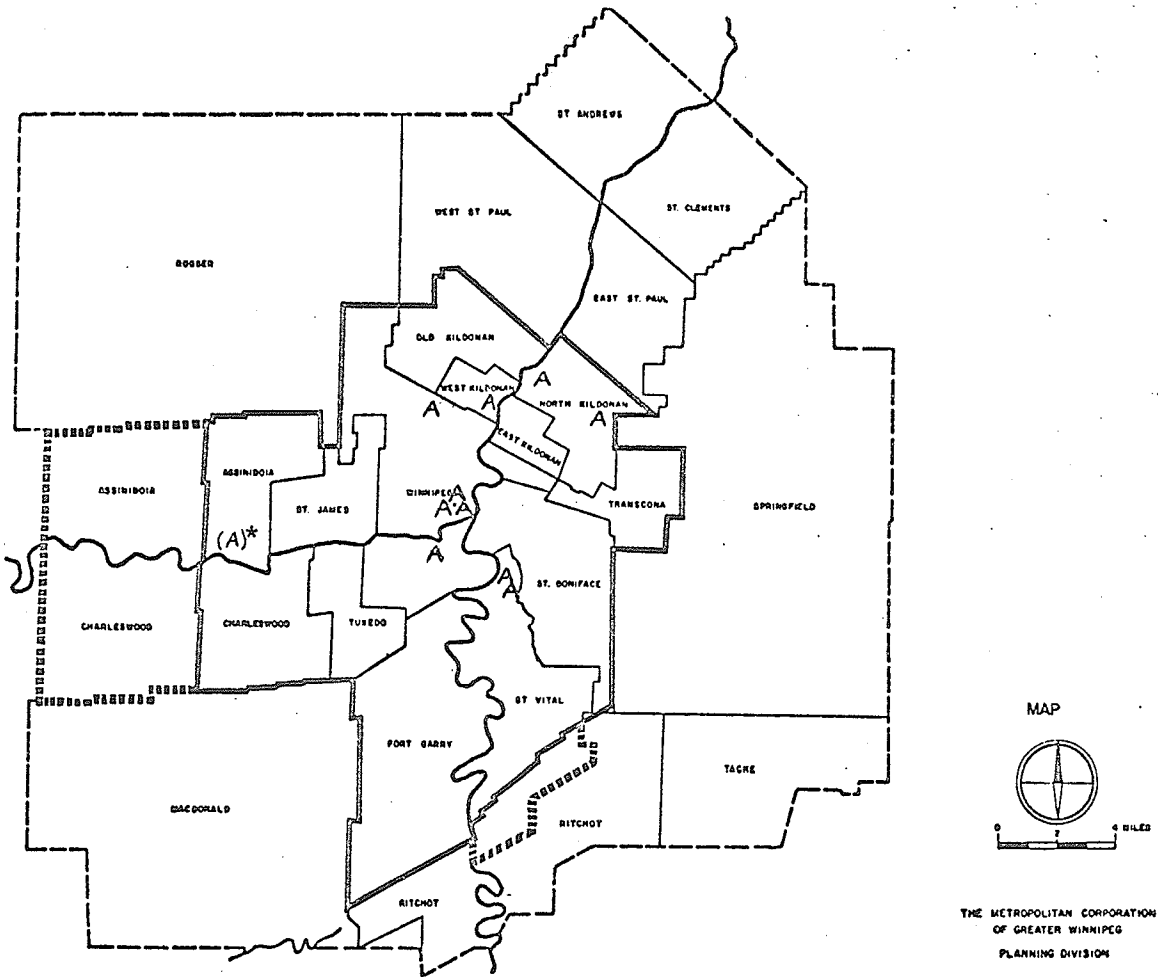
b: Cost of a business telephone.

c: Telephone answering service.

d: Parking charge.

Source: Primary research and Manitoba Health Services Commission unpublished estimates, 1972.

FIGURE 8



* Auxilliary Ambulance Location

LEGEND:

- Boundaries of area under former Metropolitan Corporation of Greater Winnipeg.
- Additional areas included under "Unicity."

Figure 8 presents a map of Winnipeg and the locations of ambulance firms are designated by the letter A's. The need for ambulance care can occur anywhere throughout Winnipeg and periphery. Sources of concentrated demand such as hospitals and nursing homes also are widely scattered geographically. Ambulance firms, however, are concentrated in West and North Kildonan, St. Vital, Fort Rouge, and Inner City, and are not located with any particular relation to population.

TABLE 3

REPRESENTATIVE FIRM

1. Number of vehicles	1.7
2. Total invested capital	\$23,800.00
3. Total capital cost	\$31,995.63
4. Average annual capital cost	\$ 3,999.45
5. Staff, full and part time	2F; 2.4P
6. Annual salaries, commissions, C.P.P. contributions	
(a) Salaries	\$10,908.00
(b) Commissions	\$ 2,226.00
(c) C.P.P.	\$ 188.89
(d) Total	\$13,322.89
7. Annual rent	\$ 712.80
8. Insurance	\$ 765.00
9. Telephone	\$ 174.06
10. Advertizing	\$ 900.00
11. Maintenance	\$ 962.50
12. Gasoline	\$ 1,855.00
13. Oxygen, laundry, bandages, and other supplies	\$ 3,180.00
14. Annual total cost	\$25,871.70
15. Average annual number of calls by type	2,120
(a) Elective	1,471.3
(b) Emergency	648.7
16. Average daily number of calls	5.8
17. Average price	\$ 20.08
18. Total gross revenue	\$42,569.60
19. Default at 20% of total gross revenue	\$ 8,513.92
20. Total revenue	\$34,055.68
21. Annual rate of return	34%
22. Total cost per call	\$ 12.20
(a) Fixed	\$ 8.77
(b) Variable	\$ 3.43
23. Marginal cost per call	\$ 3.43
24. Total revenue per call	\$ 16.06
25. Profit per call	\$ 3.86

Source: Research based on data from Government of Canada, Canada Pension Plan; Manitoba Health Services Commission unpublished material; Manitoba Telephone System; communications with ambulance operators. All data for 1972.

Based upon Table 2 as well as primary research and unpublished estimates from the Manitoba Health Services Commission, Table 3 presents a "representative firm". The methodology is as follows:

1. Number of vehicles: There are 10 firms and 17 vehicles; the average number of vehicles per firm is 1.7.
2. Total invested capital: An average ambulance vehicle costs \$14,000. Therefore, the amount needed to purchase 1.7 vehicles is \$23,800.
3. Total capital cost: Over an eight year period, a chattel mortgage loan of \$23,800 at an annual interest rate of 8.5% neglecting changes in the prime rate, amounts to \$31,995.63. Principal and interest payments are made monthly.
4. Average annual capital cost: The total capital cost was averaged over eight years.
5. Staff, full and part time: The 10 firms employ 20 full time attendants and 24 part time attendants with an average of two full time and 2.4 part time employees per firm.
6. Annual salaries, commissions, and Canada Pension Plan contributions: Salaries: the average monthly full time salary per firm employee is \$454.50 totalling \$10,908 annually for the firm. Note that the entrepreneur's earnings as a staff member are included. Commissions: 25% of all calls are attended by commissioned employees. The average commission is \$2.10 per man which, applied to 530 trips annually, totals \$2,226 for the average firm. Average commission per trip equals \$1.05 (where commissioned trips are averaged over all trips). Canada Pension Plan Contribution: for salaries, the formula is (earnings of \$10,908) -

(exemption of $(2 \times \$600 = \$1,200)$) = $(\$9,708) \cdot (1.8\%) = \174.74 . For commissions, (earnings of $\$2,226$) - (exemption of $(2.4 \times \$600 = \$1,440)$) = $(\$786) \cdot (1.8\%) = \14.15 . The total annual employer contribution is $\$188.89$. The total wage bill is $\$13,322.89$.

7. Annual rent: Three firms rent premises at a total annual rental rate of $\$5,700$ collectively. Seven firms use owner residences: here a $\$10$ parking fee monthly is imputed. Collectively these firms pay $\$1,428$ annually for rent on this basis. The overall average rental payment per firm annually is $\$712.80$.

8. Insurance: At $\$450$ per vehicle, the total insurance charge annually for the average firm is $\$765$.

9. Telephone (dispatching): Three firms use a telephone answering service at $\$30.50$ per month per firm totalling $\$1,098$ annually for the group. Seven firms utilize only an additional business telephone at the residence of the owner, costing $\$7.65$ per month per firm totalling $\$642.60$ for the group. The total overall cost is $\$1,740.60$ and the average per firm, $\$174.06$.

10. Advertizing: Most advertizing consists of telephone directory coverage costing $\$75$ per month on the average which totals $\$900$ annually for the average firm.

11. Maintenance: This category includes oil, tuning, cleaning, and uninsured repairs. Oil costs are based on an oil change every 2,000 miles, total mileage of 29,680 (see 12. below), 15 changes a year, $\$7.50$ per change, and a resulting total of $\$112.50$ annually. Tuning, repairs, and cleaning cost approximately $\$850$ for 1.7 vehicles. The total annual maintenance bill is $\$962.50$.

12. Gasoline: The average ambulance trip is 14 miles; based on 2,120 calls in a year, the annual mileage is 29,680. At 8 miles per gallon, 3,710 gallons of gasoline are required, costing \$0.50 each and \$1,855 in total. The gasoline cost per call is \$0.88.

13. Oxygen, laundry, bandages, and other supplies: This cost component averages \$1.50 per trip, totalling \$3,180 for 2,120 trips.

14. Annual total cost: The sum of all previous cost components.

15. The average annual number of calls by type was established in the earlier section on demand.

16. Average daily number of calls was established by averaging 2,120 calls evenly over 365 days.

17. Average price: This value was calculated by weighting the various prices charged in Table 4. Such an "average price" is useful in calculating overall revenues, profits, and rate of return accruing to the average firm, even though prices charged differ somewhat by service.

TABLE 4

AVERAGE PRICES

Elective (69.4% of total calls):

<u>Source of Payment</u>	<u>Number of Calls</u>	<u>Price Per Call</u>
United Health Insurance*	3,681.25	\$20.00
Care Services	1,200	\$ 5.50
Victoria General Hospital	528	\$10.00
Misericordia General Hospital	300	\$10.00
Inner City Welfare	546.9	\$12.00
Deer Lodge Hospital	500	\$12.00
National Defence	83.3	\$12.00
Client	7,885.55	\$22.00

Weighted average elective price: \$18.71.

Emergency (30.6% of total calls):

<u>Source of Payment</u>	<u>Number of Calls</u>	<u>Price Per Call</u>
United Health Insurance*	1,620.75	\$20.00
Autopac	-	-
Inner City Welfare	241.1	\$12.00
National Defence	36.7	\$12.00
Client	4,584.45	\$25.00

Weighted average emergency price: \$23.19.

Weighted average emergency-elective price: \$20.08.

* Estimated at 25% of total.

- Data not available.

Source: Research based upon personal communications and Manitoba Health Services Commission unpublished estimates, 1972.

18. Total gross revenue is the product of total calls and average price.

19. Default is estimated at 20% by private operators and the Manitoba Health Services Commission.

20. Total revenue is the difference between total gross revenue and default.

21. Annual rate of return is the difference between total revenue and cost, divided by \$23,800.

22. The total cost per call is the total annual cost divided by the number of calls in a year. The fixed component is total cost less commissions, gasoline charges, and oxygen, laundry, and bandage costs. The variable cost component is the difference between total and fixed cost.

23. Marginal cost per call equals variable cost based on the assertion supported in the next few pages that the variable cost for this service is constant.

24. Total revenue per call is total annual revenue divided by 2,120 calls per year.

25. Profit per call is the difference between cost and revenue per call; it includes both normal and excess returns to investment.

The cost items of insurance, maintenance, gasoline, oxygen, and other supplies, salaries, and capital costs, are not unusual. Although rent and telephone expenses are relatively low, this is not altogether surprising for family firms. There are, however, some striking features which become clear in Table 3.

For a 24-hour operation, the number of calls per day of 5.8 seems small. Conceivable capacity of a crewed ambulance vehicle in a 24-hour period is 20 calls. A more realistic capacity, given the fact that calls are not evenly distributed throughout the entire day is 12 calls per vehicle, or approximately 20 calls for the representative firm.

Stemming from this stand-by operation is the preponderance of fixed or overhead costs which represent 72% of total costs, and the relative insignificance of variable costs. This cost pattern indicates a "decreasing cost" situation which is characterized by the potential for unit costs to fall as fixed resources are spread over a greater volume of output. Therefore, greater output is more efficient than less (up to a point) because wastage of fixed resources as excess capacity is avoided. Theoretically, changes in unit variable cost could counter or reinforce the decreasing cost tendency of unit fixed cost. However, variable cost will be shown below to be constant.

Two factors other than small market shares and dominant fixed costs indicate a decreasing cost situation. Firstly, time trend evidence since 1963 is supportive. In 1963, the total volume of demand to the private sector of the ambulance industry was approximately 18,340 calls, the annual calls per firm were 3,058, and the average number of calls per day per firm was 8.3. Based on present cost patterns, fixed cost per call in 1963 was \$6.14, compared to \$8.77 today. However, in 1963 the average firm had 2.3 vehicles, 37% more than today. As a result, the fixed cost to today's firm is 8% lower than in 1963 in terms of capital costs which constitute 22% of total fixed cost, and 3% lower

in terms of maintenance and insurance costs which constitute 9% of total fixed cost and were 35% higher in 1963. In total, fixed costs to the average firm of 1963 were 11% higher than today plus a marginal adjustment upward for salary costs (in today's dollars). Therefore, fixed unit costs have increased from approximately \$6.82 to \$8.77 in nine years, a change of 29%, accompanying a decline in market shares of 44%. In summary, the entry of new firms in greater proportion than increased business has caused ambulance market shares to move leftward and unit costs to move up along downward-sloping unit cost curves.

Secondly, contract pricing shows that firms experience lower unit costs when guaranteed an increased market share. All contract prices listed on page 85 are lower than the basic emergency or elective prices; the Care Services contract is the best example. During 1972, one firm held the contract which assured an increased market share of 1,080 calls³² or 51%; a charge of \$5.50 was negotiated, 72% lower than that firm's basic elective price. The addition to total cost of undertaking the contract was \$5,690.60³³ while the net addition to total revenue was \$6,600; profit totalled \$909.40. Unit cost on all calls fell from \$12.20 to \$9.86, a change of 24%.

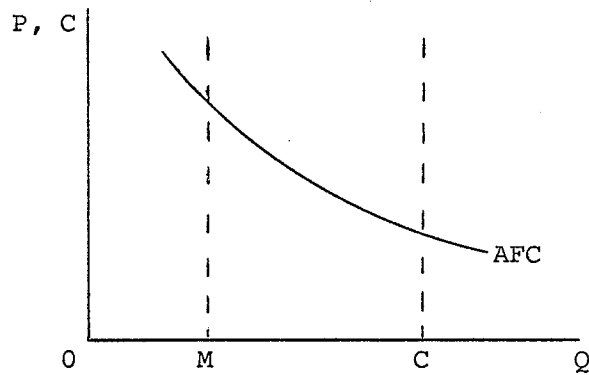
The pattern of costs to the firm can be shown graphically.

Figure 9 shows fixed cost to a firm with one vehicle, including, from Table 3, item 14 less items 13, 12, and 6 (b).

32. The aggregate of 21,208 calls which was divided by 10 to obtain the average firm share of 2,120, included the 1,200 calls attributable to the Care Services contract. Therefore, the firm's new market share is $(2,120) - (120) + (1,200) = 3,200$, and its actual change in market share is 1,080 calls.

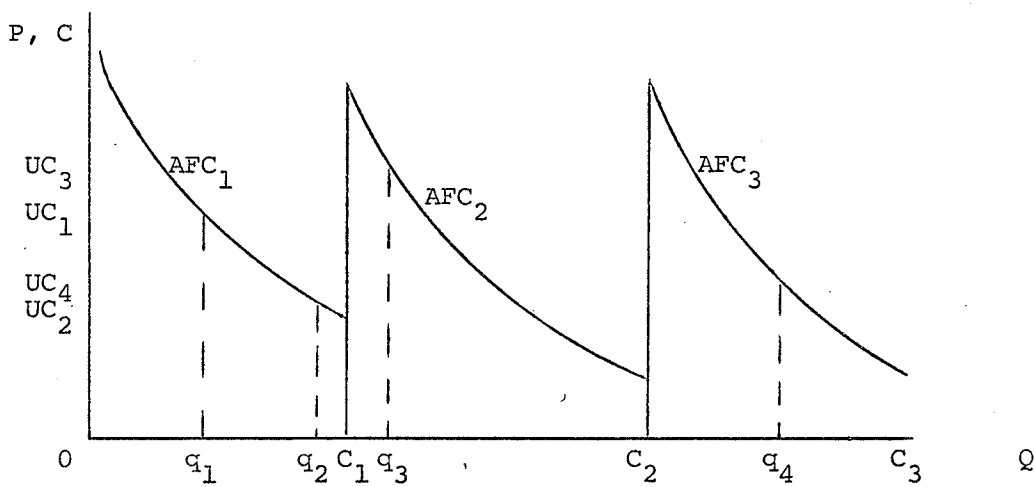
33. Supplies: \$1,620; gas: \$945; oil: \$56.70; commissions: \$1,134; Canada Pension Plan: \$7.22; plus a loss of 120 calls priced at \$20.80.

FIGURE 9



The average fixed cost curve, AFC , is a rectangular hyperbola indicating greater efficiency in the use of fixed resources as more units of output are produced up to capacity, C . Figure 10 shows average fixed cost for a firm with three vehicles.

FIGURE 10

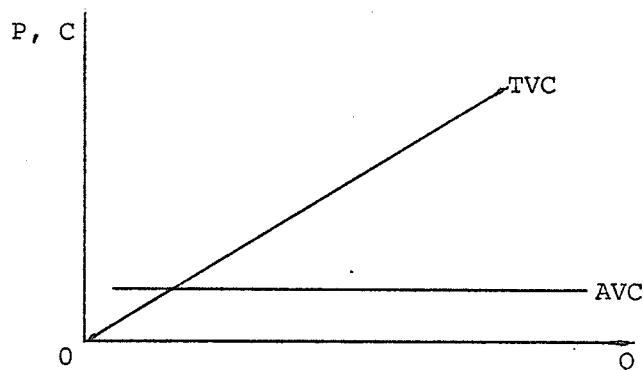


The addition of units of equipment and their fixed resource complement (rent, insurance, salaries) will produce a new average fixed cost schedule for each unit of expenditure (AFC_1 , AFC_2 , AFC_3). In Figure 10, the vertical lines C_1 , C_2 , and C_3 indicate capacity of each vehicle--12 calls per day. The average fixed cost structure takes on a "saw-back" appearance. Such indivisibilities in production render long- and short-run average cost curves the same. Certain fixed resources such as rent, salaries³⁴, or telephone will not need to be added for every new vehicle but only for groups of two or three. Accordingly, in Figure 10, AFC_2 and AFC_3 are lower than AFC_1 by the unit amount of these cost components. The market shares, $q_1 \dots q_4$, and unit costs, $UC_1 \dots UC_4$, are introduced to show that large firms may have large unit costs because of small shares rather than different cost structures and vice versa. In other words, this will occur if the ratio of the percentage increase of market share to the percentage increase in scale of plant is less for the large firm.

Figure 11 shows total and average variable cost to the firm, including items 6 (b), 12, and 13 from Table 3. TVC is total variable cost; AVC is average variable cost. Constant returns are assumed at this point for purposes of demonstration.

34. Most firms hire two full-time salaried staff for one or more vehicles. Additional vehicles, in turn, are covered by commissioned staff. See Table 2 on page 79.

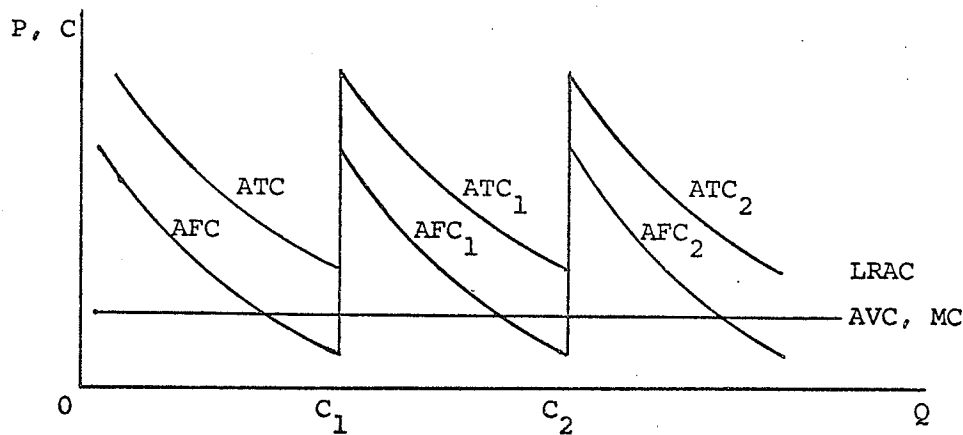
FIGURE 11



Variable cost increases as output increases, but may increase at different rates. If it increases by equal increments as equal increments in output are produced, returns to scale are constant; if the rate of increase is less than unity, economies of scale in variable cost are present; if the rate of increase is more than unity, diseconomies are present. Marginal cost will coincide with a horizontal average variable cost schedule (AVC in Figure 11), lie above a rising one, and below a falling one. Marginal cost becomes vertical at capacity and resumes its position when a new unit is added.

Figure 12 presents fixed and variable costs and long- and short-run average costs to the firm. ATC is short-run average total cost, AFC being short-run average fixed cost. LRAC is long-run unit cost and AVC is short- and long-run average variable cost and marginal cost (if returns to scale are assumed constant). It is technically efficient for market share to occur as near as possible to the "troughs" in the long-run unit cost schedule.

FIGURE 12



The cost conditions described may vary according to economies of scale. Regarding horizontal integrative economies, as any firm grows, greater division of labour is possible, however, there is limited scope for such specialization in the relatively simple enterprise of ambulance care. Some economies would occur as a team of attendants worked together more frequently, providing a greater volume of service and co-ordinating its actions. Specialization of machinery may complement the greater division of labour if ambulance vehicles and attendants were specialized to treat strictly poison cases, cardiac cases, or automobile accidents. Such minor cost savings would occur only in fixed cost since labour (as well as machinery) is regarded as a fixed cost in this analysis. However this is not the orientation of the present industry, and currently no such potential savings are captured.

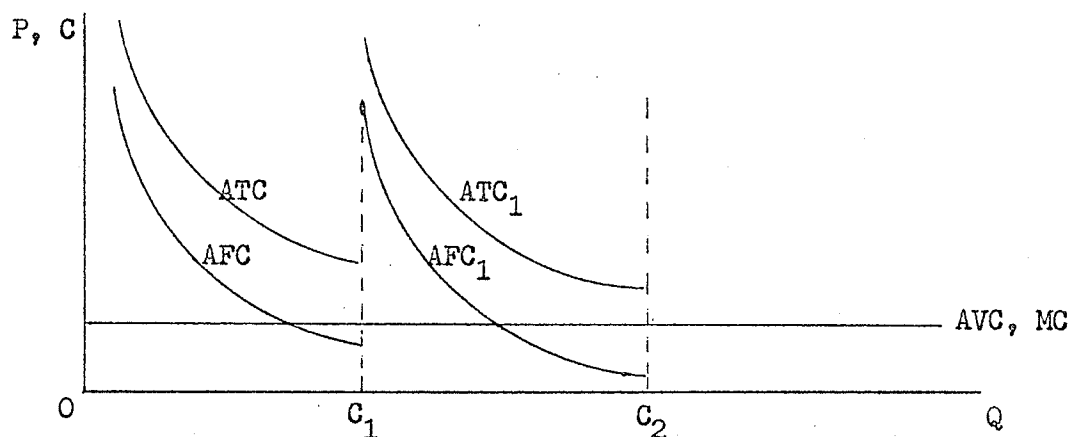
Theoretically, as firms become larger, they may experience economies of large-scale management, attracting better managerial talent to organize operations more efficiently. If so, fixed and variable cost

components can be reduced as duplication and cross-purposes are removed. In the case of ambulance care, units can be more strategically located so that jurisdictions may be efficiently serviced. External pecuniary economies of scale in both fixed and variable costs can also be the product of any horizontal firm expansion that might take place. Again, in the case of ambulance enterprise, vehicles, equipment, materials, and maintenance are the only examples of components which, if bought in quantity, may become slightly cheaper. The extent of this saving will depend upon internal technical economies experienced by suppliers. In actuality, however, such economies are negligible. In Winnipeg a firm may buy one new vehicle every eight years: fleet discounts are out of the question for single firms. Under present organization, the variable cost items of gasoline, commissions, and supplies such as laundry provide no scope for economies. Gasoline constitutes the largest expense and everyone pays the same price for this commodity. Even under a centralized organization, there still will be few if any economies in supplies--the only variable cost items. And furthermore, while such central purchasing might be able to get the total package of inputs for less, incremental increases in the size of the package would not cause lower purchase prices because the increments are too small for the negligible pecuniary economies to have any effect; in the community there are many buyers for commodities such as gasoline and laundry services. Therefore, the overall variable cost-marginal cost schedule might be lowered by the creation of a one-firm industry, but the schedule will remain horizontal as unit variable costs remain constant.

Regarding vertical integrative economies, efficiency of large scale management and avoidance of duplication of activities may be gained by absorbing suppliers and/or distributors. The only vertical integration which might achieve greater efficiency in ambulance enterprise is that designed to eliminate payment to suppliers of profit in excess of the interest return on the added investment, specifically the purchase of a staffed service station in order to save on maintenance and repairs. This might be practicable for a centrally owned industry.

No firms are presently realizing any economies of scale mentioned above except for the downward trend of unit cost in a fixed cost dominated enterprise. Cost curves will therefore appear as in Figure 12 above. Figure 13 shows the change in cost curves conceivable with centrally directed purchasing.

FIGURE 13



The vertical lines, C_1 and C_2 , indicate effective capacity of ambulance units. The average fixed cost schedules (AFC) are successively lower because of external pecuniary economies of bulk buying of equipment. The average variable cost schedule (AVC) remains horizontal. Total unit cost schedules (ATC) will slope downward to the right; the trend of the planning curve is moderately downward to the right.

8. Summary

Emergency care, which is urgent in nature, is the "vital" output of the ambulance industry. The value of this care lies in its being provided under conditions of high quality and minimal time consumption. In a sense, emergency service is a perishable good: if it must be transported over great distances or if excessive time is consumed in reaching the source of demand, the service may be rendered useless. On this basis, relative buyer and seller concentration should be synchronized, and the care needs of people identified.

Ambulance care in Winnipeg is provided by a mix of public and private enterprise. Public ambulance activity bears no relation to nor co-ordination with the other operations. The public service is provided free of charge, staffing is markedly different from that of private firms, and the vehicles and equipment are, in most cases, different from that found in the private sector. In other words, within one system of emergency care delivery, there are two distinct forms of organization, one competing with the other for no apparent good reason. Further, there is effectively no public support of the private ambulance service.

The private ambulance industry in Winnipeg is a unique group of ten small firms, mostly family firms, differing somewhat from one another in terms of size and quality of service. Because of small firm size and absence of co-ordination within the industry, none of the conceivable economies of scale are attained. The Manitoba Health Services Commission provides regulations which effectively prohibit entry, place few stringent or new requirements upon existing operators, and develop no performance indicators. The result is a small group of firms functioning in a market, on the one hand protected by a legal barrier to entry, while, on the other, unhampered in terms of price, quality, and organizational provisos.

There are various sources of demand for elective and emergency care, each unique in its own way. Through the development of a set of prices and other promotional gimmicks, the firms attempt to tap every source in order to maintain market shares. By and large, the demand side of the market has not displayed skill at pursuing its own interest either because of an inherent inability of the user to scrutinize a service he knows nothing about or because of apathy. The trend of demand over time has been stable upward.

Ambulance enterprise is, unavoidably, a stand-by operation. Overhead costs are dominant and unit costs are high for small market shares. Unit cost to an average firm is some 103% greater than capacity unit cost, while marginal cost to the average firm is 28% of unit cost. The private enterprise price must be adequate to cover high unit costs to all sellers.

The dimensions of overall market structure including the institutional, geographical, technological, and psychological characteristics of buyers and sellers, and the framework within which both operate, will generate a particular market conduct and market performance. Conduct and performance in the ambulance industry are discussed in the following two chapters.

CHAPTER IV

MARKET CONDUCT

1. Introduction

In Winnipeg, the ambulance industry is comprised of small scale capitalists who function as owner-manager-attendants. Mainly, the firms are family firms and, with regard to returns, the owners tend to be more concerned with the amount of interest than with the interest rate. That is, a given interest rate is not always the signal to expand in a particular area of the market; where the ambulance owners can maintain a comfortable living, they tend to become quite unprogressive. Ease of entry as well as fear of increased public involvement in ambulance care provision cause owners to be conservative. A new firm can enter and set up in the industry as easily as an existing firm can expand.

The purpose of this chapter is to explain these and other features of firm behaviour and development within the market structure of the ambulance industry in preparation for evaluating market performance. Market conduct is discussed in terms of entry, exit, and expansion of firms, innovation and progressiveness, interaction of firms through joint effort, and the nature of market sharing and competition.

2. Entry

Free entry into any industry is important because it permits supply to meet demand in a smooth and unrestricted way. The clearest effects of restricted entry on welfare maximization are that price may be higher than necessary, output lower, there may be limitations on the quality of output, and, generally, consumer welfare is replaced by excess profit and inefficiency. Both consumers and excluded producers suffer.

Where a firm in any industry is competing vigorously with its rivals, if demand to that industry increases, the new intersection of demand and supply to the industry results in higher price and output. Excess profits appear and will remain if a barrier to entry holds the number of firms constant. If the barrier were removed, new firms, attracted by excess profits, would enter, normally supply would increase and price would fall, and excess profits would disappear. An optimal situation, ceteris paribus, is restored. Expansion of the firms already in an industry, alternatively, would permit supply to increase to a degree. However, as firms become larger, they gain control over output and price.

Chapter III stated that there have been no effective economic barriers to entry into the ambulance industry. Although there are no economic barriers as such, there do exist non-economic barriers to entry. Firstly, when lives are placed in someone's hands, a great moral responsibility is assumed by that person; moreover, that individual is exposed to considerable grief and suffering that few people would care to witness. Secondly, physical fitness is mandatory for any first-aider, particularly for purposes of ascending stairs while laden with equipment, and descending

with a patient in a stretcher. Most rescue procedures are, physically, quite demanding. Thirdly, employment as an ambulance attendant can be dangerous, especially where rescue from a flammable or explosive situation is involved or treatment of drug or alcoholic cases is necessary. Finally, a "knowledge barrier" to entry into the ambulance industry has developed. In Winnipeg, ambulance firms have been successful at convincing the public as well as potential entrants that they are able to eke out only a meager living, although this is not really the case.

These factors all point to one select group as candidates for entry--ambulance attendants who currently work for a family firm either on a commission part-time basis, or for a low salary. These individuals have viewed the industry from the inside and yet, in a sense, they are outsiders because they do not belong to the family owning the firm. Because of their experience, they have assumed moral responsibility, they have been able to meet the physical demands of their occupation, they know and accept the danger, and they, better than anyone outside the industry, know that ambulance enterprise is a profitable endeavour. Because economic-legal barriers have been negligible, entrants into the ambulance industry come from this unique group.

The dynamics of the entry process tend to be as follows. The largest firm will employ several part-time or full-time employees, any of which could be an entry candidate. This firm will be experiencing somewhat less idle time than some other firms because of its reputation and position in the market. For this reason as well as the fact that emergency calls are not distributed evenly over time, the employees will see business being turned down or avoided. The employee-entrants see an

avenue to "eliminate the middle man"--their employer--and venture out on their own. Their objective is to catch some of the overflow business they saw when they worked for the larger firm, and attract some other business through location, artificial product differentiation, and, to an extent, contract bidding. The large firm does not prevent its employee-entrants from re-entering the industry as owners for two reasons: it cannot halt their activities through exclusionary tactics (Chapter III pointed to the lack of co-operative endeavour in the industry) and it likely does not care about new entry provided that shares do not fall precipitously or, if they do decline, that mark-ups will continue to generate an adequate income³⁵. The owner-managers attempt to maintain a fixed mark-up and thereby to maintain constant total revenues, responding more to the amount of interest than to the interest rate. Essentially, the owner-managers react to share behaviour and the resulting absolute earnings; these are the two stimuli which evoke a response. A new firm attempts to make its name known and capture a portion of demand. Once this is achieved, the company growth policy becomes conservative: because firms are family firms and usually occupy family-owned property not far from home, they grow to fill their space and there the growth process ends. Like the corner grocery store or the local shoe-repair shop, ambulance firms do not move to "bigger and better" locations, or initiate second and third outlets. Fear of increased ambulance service by fire and police departments, an omnipresent feature of the market structure, is also a deterrent to further expansion.

35. Upon entry, a firm automatically becomes known to the 999 centre and is placed on hospital rosters if it meets their criteria. This will cause shares generally to level-off or decline.

3. Innovation, Progressiveness, and Interaction

Gains in efficiency and quality of output can be achieved through advancing the state of the art by innovating and interacting. Technological advance for any single ambulance firm would normally occur in terms of vehicle design, sophistication of equipment, and the development of first-aid and rescue technique. To progress in this manner, a firm must maintain a careful watch over vehicle and equipment markets and over its own first-aid methods, and proceed to assess its particular need for improvement in relation to the type of service it provides. In Winnipeg, ambulance attendants meet only the basic requirements of first-aid skill. The cost to a firm of voluntary increased training and drill for all staff would be considerable and there is neither market incentive nor legal requirement to do so. Increased training is not an effective form of product differentiation since it is an "invisible" component of the service provided. In summary, above-basic training is costly and holds no promise of a compensating return to the firm within the present market structure.

There is also the question of pre- versus post-crewing procedure. At night, ambulances are post-crewed. This means that, when a call is received by a firm, one attendant drives the ambulance to the residence of the second, and both proceed to the emergency. Because payment is on a commission basis for calls actually answered, this arrangement is relatively cheap for the ambulance owner. Pre-crewing, where attendants are on continual stand-by, is costly and, like better training or equipment, affords no competitive advantage to the firm. Pre-crewing would cost a firm several thousand more dollars per month and yet would not be matched by a change in demand since location is the main criterion for calling an ambulance in an emergency.

The problem of inertia in skill development and procedure improvement applies also to the acquisition of sophisticated equipment. Over the years, little change has taken place in equipment and design. There is, however, a product differentiation incentive to enhance the appearance of or replace ambulance vehicles--the most visible component of the service. Vehicle innovation, although not widespread or substantial, has been manifested recently in the appearance on the streets of a few truck- or van-type ambulance vehicles, boasting more head room, improved entry, greater stretcher capacity, space for more equipment or personnel if needed, and increased ruggedness, all distinct advantages over conventional white-hearse type ambulances.

Interaction in terms of joint effort by some or all firms can also enhance the efficiency of operations and quality of output of an industry. Advancing the state of the art for the ambulance industry in general or for any part thereof may take place in terms of developing a zone approach for ambulance coverage of the city, a communications network with shared dispatchers mutually financed, or, in general, the establishment of an association for purposes of maintaining rapport among firms, sharing ideas, and governing standards of service quality and procedure. Such co-operation for purposes not of stifling competition, but of eliminating tendencies toward anti-efficiency and destructive rivalry, would benefit both the provider and recipient of ambulance care.

There does exist a vestigial ambulance association in Manitoba which, however, achieves little more than to attract some firms to annual meetings where items of minor importance are discussed. Three Winnipeg firms belong to the association. The only other evidence of interaction

and joint effort has been the grouping together of three firms, in a casual manner, to share both co-operative dispatching services and calls. In summary, because firms basically are not close, because they do not realize or care about the public interest advantages of interaction, and because they hold a healthy distrust of one another, there has been minimal co-operative effort in the ambulance industry.

4. Market Sharing and Competition

There are three markets for ambulance care and firms discriminate among them to the extent that each market is exploitable. The markets are those for emergency care, elective non-contract care, and elective contract care. Not all firms, however, enter all three markets, either because of inconvenience or inability.

Emergency demand to the firm is zero elastic with respect to price. It can vary to a small degree, however, depending upon the location of a firm and upon whether the firm has established a friendly relationship with police departments and R.C.M.P. detachments. All firms receive emergency demand because, for the greater part, it is doled out randomly (i.e.: according to where the emergency happens to occur in relation to an available ambulance) by sources such as 999 dispatch, hospitals, bystanders, and police. Firms can do little more than sit and wait for this demand to be expressed. Moreover, users or those acting on behalf of users are not price sensitive: in emergency care, a "third party wedge" is driven between user and provider, and no mutual price determination takes place. Firms, therefore, do not cut price for they stand to lose if they do so. In fact, firms raise price for emergency care

in order to squeeze as many dollars out of this source of demand as possible.

There are, however, constraints upon price hikes. Firstly, the concept of a just price contributes to a sort of equilibrium--firms do experience the problem of unpaid bills; outlandish prices would aggravate this problem and perhaps generate a poor public image. Secondly, if a client feels that a price is grossly unfair, he may lodge a complaint at the Manitoba Health Services Commission. A series of such complaints could eventually cost a firm its licence. Thirdly, United Health Insurance has entered into an agreement with all Winnipeg ambulance firms to pay a basic price for policy holders in need of ambulance care. This price can be raised only through negotiation. In summary, these factors notwithstanding, the price for emergency ambulance care varies from twenty-five dollars upward depending upon the nature of the call.

Elective demand which is non-contract in nature is less exploitable than emergency demand for several reasons. Some users will choose to interact with firms to set a price which is favourable and, on the average, lower than the emergency price. Essentially, this is a profit reducing factor. Other factors are largely cost reducers: usually, elective calls can be answered at the firm's convenience; there is no driving speed involved nor the accompanying danger and wear and tear; when the basic emergency demand market share which all firms face is augmented by an elective care component, unit costs will fall because short-run unit cost schedules are downward sloping. There are other factors as well. Through dialogue with a potential client, the firm can better determine whether

to expect full payment for services rendered and, if not, it can refuse to answer the call without undue hardship being imposed upon the caller. Because many people are insured and can make this known to the firm prior to actual utilization, payment will be guaranteed and price can be lower. In summary, the elective non-contract demand price will be lower only to the extent that buyer-seller interaction, guarantee of payment, and progressively lower unit costs are factors. The market remains more sensitive to artificial product differentiation than to price or quality. Price ranges from fifteen to twenty-five dollars.

Elective contract demand is a demand that only some firms face since the other firms, usually older firms, are content with their market share and the earnings it generates. Contract demand is attractive to new entrants who require a market share at any price; the marginal gain to an established firm of moving into this market is less than the effort involved. This market is the most sensitive to price because bidding and bargaining take place. The market is sensitive also to quality because the grantors of contracts consist of the Provincial Government and three Winnipeg hospitals. Like elective non-contract demand, there is guarantee of payment, convenience in care provision, and the lower unit cost effect of augmenting the basic emergency care component. This market is the least exploitable and its prices are always the lowest, ranging from approximately six to twelve dollars.

Abnormal profits are present in the ambulance industry because firms attempt to extract the highest fees possible from users and tend to collude tacitly in the process. This is made possible by the lack of any formal regulation of price and by the fact that users are largely insensitive

to price, two important features of market structure. Because there are only modest gains to be realized through price competition, firms leave prices high and attempt to get or maintain shares through the alternate route of product differentiation. Firms compete in terms of appearance of vehicle, appearance and manner of staff, speed of delivery, smoothness of ride, and being visible to the public frequently on major thoroughfares. All firms advertize in the Yellow Pages of the telephone directory, in many cases with a firm using several names in order to attract a greater market share. Although data are not available on relative market shares, this strategy is probably effective where the artificial names used are names of different areas of the city such as "St. Boniface" or "North Winnipeg" giving the impression that a vehicle is stationed and readily available in such areas.

Fire and police departments provide ambulance service free of charge within their particular jurisdictions, resulting in public-private competition in ambulance care. The Communities of St. James-Assiniboia, East Kildonan, Fort Garry, and Inner City operate public ambulance services in spite of the fact that there already is a surfeit of private ambulance vehicles. As demonstrated in Chapter III, such unmatchable rivalry reduces the market share of the ambulance industry as a whole by 17.6%.³⁶

There has been considerable entry into the ambulance industry but this has not reduced profits. Most of the owners of the newer firms once worked for the larger older firms and they have carried with them

36. See Chapter III, Section 5.

knowledge which is available only on the inside: they know that the public can be exploited; they know that contract work always can be relied upon if shares are inadequate; and they also know, having once been apprentices, that conditions in the industry will be most comfortable and lucrative if no waves are made. Like law graduates, they have served their time and society owes them. Entry causes average shares to retract, but at least a constant return has been maintained. The larger firms have been leaders in conserving the status quo.

Profits, entry, and redundant plant are able to persist for the following reasons. Firstly, existing firms are not able to exclude entrants from the industry and regulations have not been a barrier. Secondly, once firms are in the industry, that portion of demand which can be bid away through predatory pricing is not great enough to endanger the new firm's viability--only a small portion of demand is price sensitive. As a result, it has become a routine measure to raise price as shares fall or as the rate of share increase falls, and rely on product differentiation to attract whatever business is available. In other words, firms neither are able to drive out rival firms because price competition is not an effective tool nor are they desirous of doing so if their own positions are adequate or soon to become adequate through this natural growth process of waiting for a share. So, in nine years, growth of industry size has exceeded by a wide margin the growth of demand to the industry. Unit costs and prices have moved steadily upward. Firms and their profits have remained.

There has been no exit from the industry because firms have been able to achieve their objectives--first to attract enough business and then to settle back satisfied with a constant and comfortable return.

Firms have never been growth oriented. Growth orientation in this industry is a necessity rather than a luxury. That is, if it is necessary for survival that a firm push out its competitors, take their business, and push up its size, then any firm will, of course, follow that path of development. But if an owner of a firm can achieve what he wants in terms of income and security without supplanting his rivals, then any growth in excess of what he has achieved to that point becomes superfluous. This has been the pattern of development in the ambulance industry.

5. Conclusion

Conservative small-scale capitalists comprise the ambulance industry in Winnipeg. The oldest firms lead the industry in maintaining profit margins through fixed mark-ups and in attracting shares through artificial product differentiation. An apprenticeship-entry-limited growth sequence constitutes firm development: an ambulance attendant will work for a family firm as an apprentice, when the time is ripe he will enter the industry as a separate firm, and, finally, reach a size limit. In this way, the ease of entry has not altered the prevalence of excess profits. Nor has the existence of excess capacity had an effect on profits. A new firm relies on basic emergency demand which, once captured, is not normally competed away. This, coupled with price collusion and universal maintenance of mark-ups as shares fall, has permitted excess entry and plant redundancy to exist alongside excess profits.

While there are three markets for ambulance care, each with its own price configuration, costs of providing care are more-or-less uniform across these markets. Although convenience and assurance of payment make

certain markets more attractive than others, the main reason for differential pricing is the differential ability of the industry to exploit different users.

Demand insensitivity not only has permitted price discrimination, but it also has engendered an environment in which minimal obligation is imposed upon firms to provide a service better than regulations require; and regulations are not adequate.

Artificial product differentiation is very important in the ambulance industry. Although no advances in the quality of care arise from this form of rivalry, as a competitive tool, it serves to provide an eventual market share to apprentice-entrants and to ensure maintenance of mark-ups throughout the industry.

Finally, there has been minimal explicit co-operative effort by the firms in this industry. Although the "live and let live" policy is advantageous to firms, any benefits that might accrue to the public through better co-ordination and interaction within the industry are lost.

CHAPTER V
MARKET PERFORMANCE

1. Introduction

The topic of market performance can be approached in terms of goals and their achievement. Present private goals are to maintain rigidly the status quo in terms of absolute real earnings, mark-ups, and shares, to avoid "getting involved", i.e.: to regard ambulance enterprise as a purely commercial endeavour, not as an essential service to people, and to run an efficient firm. These goals are easily attained in the present market structure of minimal regulation, tacit collusion, and consumer incompetence. Present public orientation is to extend the empire of public ambulance care provision, provide token regulation and support, hoping the public will continue to remain as ignorant about ambulance services as it has been in the past, and to carry on pretending that the private ambulance system does not exist. This attitude also has been established and maintained very easily in a market structure comprised of fire and police departments anxious to extend their responsibility beyond their competence, and of a public which brings no pressure to bear upon an insensitive government.

The important question is, are such goals appropriate? Well, there is no doubt that firm survival by way of efficient operation and share maintenance is an appropriate goal for any business enterprise whether or not the public well-being is ensured. However, a responsible

public sector, on the other hand, should have attitudes and goals different from those mentioned above: if there is some type of problem in ambulance care provision, then there should be a policy to solve it--the government has no such comprehensive policy; if there is no problem, then the public sector should provide a rationale for any involvement it may initiate--at present, the public sector cannot justify its presence in the industry and it does not even know whether or not there is a problem. The performance of a market can be examined within the framework of such existing goals or it can be examined within the framework of ambulance care provision as an instrument and, therefore, a target of public policy (an instrument of public policy in that the overriding public concern for safeguarding the well-being of the population is supported through improved ambulance care provision; a target of public policy in that the nature of care provision is altered by the formulation and implementation of specific public policies toward the organization of ambulance services). To the latter end, some present goals are quite inappropriate.

Although the criteria or goals of Part I view ambulance care as an instrument of public policy, they do not assume that the optimum can be reached only by eliminating the private service. Nor do they assume that the criteria can be satisfied by leaving the present system intact. In point of fact, nothing is assumed about the private (or public) sector except that if there are problems to be solved, then the entire market structure and the conduct it encourages must be analyzed to determine cause, effect, and remedy. The criteria of Part I are not totally incompatible with all those goals involved in present ambulance

care provision. However, because the performance criteria outlined in this paper are wide-ranging and directed toward the end of social good, it is simply the case that pursuit of existing goals will never bring about a level of market performance even remotely comparable to that which satisfied criteria of Part I would generate. Demonstration of this fact is the purpose of Chapter V.

2. Cost and Price Efficiency

The trend of the long-run average cost schedule of the ambulance industry, if control of the industry were centralized, is presumed to be moderately downward indicating economies of scale. These economies are well beyond the scope of the present firms in their disaggregated and autonomous form. Short-run cost shows decreasing cost characteristics, and because the number of firms (and vehicles) is excessive, attained unit costs are higher than those attainable³⁷. In the past nine years, the estimated volume of business to the private ambulance sector increased by 15%, the number of firms by 66%, and the number of vehicles by 21%. A capacity operation of 20 calls per day would generate a unit cost of \$6.02 compared to a unit cost to the average firm of \$12.20, a difference of over 100%. Marginal cost to the average firm is \$3.43, 57% of capacity unit cost and 28% of estimated attained unit cost.

37. Excess capacity and stand-by service are different things. The criterion of ten vehicles will generate enough stand-by service to cover any peak period foreseeable; no excess capacity would be generated. The present number of seventeen generates not only stand-by capacity but excess capacity and therefore is "excessive" as stated above. Ironically, the excessive number of vehicles does not permit a smaller time lag in reaching emergencies--features other than abundance of vehicles cause the system to be slow in response. These are discussed below under "Adequacy of Output".

Noting the criteria of Part I, specifically those regarding availability of ambulance care, these cost features cannot and should not be changed radically. Regarding the position along the unit cost schedule, criteria suggest 10 to 12 vehicles to be the optimal number, not far different from the present situation in Winnipeg. The upshot is that the service is inherently a stand-by operation, and a unit cost which is some 250% greater than marginal cost is more or less "normal". The only scope for change, aside from a reduction in the number of vehicles, lies in efficiency gains through reducing the height of the unit cost schedule. It is here that the industry is to be most severely faulted and remedial action implicates policy toward poor geographic and managerial organization of an over-expanded industry, lack of co-ordination, and general disaggregation and decentralization of activity.

The public ambulance service is equally inefficient. In addition to the inefficiency that results from poor deployment of vehicles throughout the city, the staff are underemployed as firemen or policemen when on ambulance duty and are, accordingly, over paid as ambulance attendants. Also, the fire rescue vehicles and their staff complements are underemployed as ambulances since they are designed for fire rescue use and manned by five men, including a lieutenant.

Regarding price efficiency, marginal cost pricing would call for a charge of \$3.43. The overall average of the various prices charged by the representative firm is 485% greater than marginal and variable cost. Where average cost pricing is pursued, price will be relatively high due to the attained position along the unit cost schedule; the unit cost price for the average firm would be \$12.20. Present pricing,

at an average of \$20.08 results in profit of \$3.86 per call or a return on investment of 34%³⁸. As a result, some users are excluded from the market and resources are not allocated efficiently among those who remain.

3. Adequacy of Output

Introduction

Adequacy has two dimensions with regard to output--qualitative and quantitative. Elective business can be restricted both in a quantitative (units of output) and qualitative (standards of service) manner. In the present case, due to inefficient price and reduction of quality due to destructive competition, elective output has been restricted. Emergency output cannot be reduced by inefficient price because demand is zero elastic, but quality of service is important and will be lacking where firms are concerned only about the maximum difference between unit cost and price. The number of firms and vehicles, due to features of market structure and conduct, is large enough that confusion, duplication, and disorganization hamper availability of emergency service. Moreover, while the selling side of the market is expert at pursuing its own interest, the buying side is not. The market structure has not been conducive to the development of a solution to this problem.

Some General Problems

The payment mechanism in the market for ambulance service is,

38. See Chapter III, Section 6, Table 3.

fundamentally, fee-for-service in nature. Ambulance operators are, first and foremost, profit-conscious entrepreneurs; all other considerations including the well-being of the patient are secondary. Ambulance operators have on occasion demanded payment before rendering service. (In other cases, the patient or his relatives are harrassed for payment immediately after the service has been rendered.) Additionally, insured persons frequently must provide proof of insurance. In any event, to the detriment of the patient, valuable time will elapse as responsibility for payment, if not actual payment, is established. At the same time, however, operators face considerable abuse, in terms both of disagreements at the scene of an emergency, and unpaid bills. The circle is completed and both sides lose.

The call mechanism for ambulance services in Winnipeg is far less efficient than is commonly thought. A person may call a firm directly or may call the 999 dispatch centre. In the case of the former, the firm may not be available for some time and another may need to be called. It might, in fact, be very difficult to find an ambulance which is available. In addition, the separate telephone numbers must be known or found out (a universal number is more easily remembered). The 999 procedure also is slow: if a call originates in a particular locality, the 999 control will, in turn, contact the police department in that area which then must find an ambulance both nearby and available--two very important requirements. Again, to the detriment of the patient, time is wasted.

There are jurisdictional problems. Not only may two or more private ambulance operators disagree about who should convey a

patient to hospital once they have arrived at the emergency, but public and private vehicles may conflict. Public vehicles are also confined to limited areas. For example, the Fort Garry Fire Ambulance works only within that community and can transport patients only to Victoria Hospital notwithstanding their possible need for different hospital facilities.

The hospital emergency unit is an important stage in the treatment of emergencies and yet few hospitals have highly co-ordinated or versatile emergency programs. Moreover, the emergency branches of different hospitals are equipped and staffed in different ways which renders them suitable for handling completely only certain types of medical need.

Stability and dependability of ambulance services is important. Although there has been no exit of firms from the industry in nine years, in Winnipeg firms may leave temporarily or permanently or alter the nature of their service without being immediately responsible to anyone for their actions.

The location of ambulance vehicles is sub-optimal in terms of the location criterion of Part I. Comparing the map of Chapter III, Section 6, with the map of Chapter II, discrepancies in ambulance access become apparent--the outer reaches of the city are underserved, with a particular dearth of availability in residential areas such as Transcona and the general North-East segment of the city, the Charleswood area, and the far south parts of Winnipeg. Large numbers of vehicles are concentrated in relatively small areas.

Disorganization in terms of communications also prevails. Although most ambulances are radio equipped, they communicate only with

their own dispatcher and not with hospitals or other ambulance vehicles in the system. This adds to the problem of individualism and isolated operation by firms in the provision of a service requiring integration and the blending of separate resources in achieving one end.

Staff qualifications are minimal and inadequate, although satisfying all legal requirements. St. John first-aid training, which falls short of the training criterion of Part I, is all that is required--no drill or regular examination and revitalization of skills are called for. Training, although of primary importance in administering adequate treatment, is only one facet of staff abilities and knowledge. Driving skills must be well developed, but apparently it is assumed that anyone can drive an ambulance effectively and safely³⁹. Attitude in terms of action and speech on the part of the attendant also are important to a patient who is injured and frightened. Good physical fitness is prerequisite to providing good care. None of these factors is stressed in regulations or training.

There is still considerable scope for vehicle and equipment replacement or improvement. Many vehicles are in use which have limited stretcher capacity, headroom, and ease of entry. Some vehicles have logged excessive mileage and have reached the limits of reliability. Rules about equipment are flexible and permit wide variations in equipment used and in quality of service.

The "post-crewing" procedure mentioned in Chapter IV is quite undesirable since it militates against minimizing the time-lag and providing a quality service generally. Usually, staff take vehicles home

39. Accidents involving ambulances have not been uncommon in Winnipeg.

with them at night. To answer a 3:00 a.m. call, for example, one attendant must awake, drive the vehicle to the residence of the second attendant, awake him, and proceed to the location of the emergency. Not only is this procedure costly in terms of time, but ambulance attendants cannot function properly on just a few spasmodic hours of sleep in a night. Neither is conducive to the well-being of the patient. It does not pay a firm to pre-crew. It is more expensive and yields no return over post-crewing.

The public ambulance services cannot be considered better than the private service. Vehicles have been acquired on the criterion of whether or not they could be afforded, not according to the existing availability of other vehicles nearby, whether public or private. As a result, ambulances are not distributed according to need. Moreover, equipment utilized publicly is no more sophisticated than that used by the private sector. The most striking fault of the public service, however, is its staffing policy. In each case where a fire or police department operates an ambulance, several men are licenced as ambulance attendants and ambulance duty is rotated among all regularly (for example, the St. James-Assiniboia Police Department has 70 men licenced as ambulance attendants). It is impossible for any one man to maintain his skills and ability when ambulance duty is an occasional experience.

All of these features will have important implications specifically for the consumption of time in treating emergencies and for the well-being of the user in general. The problems prevail throughout the industry and would need to be approached on an industry-wide basis; that is one reason why their remedy is not within easy reach of the average

person and the problem of "consumer incompetence" arises. A measure of the loss due to consumer incompetence for each consumer was presented in Chapter II.

When consumer incompetence is combined with a privately owned, unregulated industry supplying those consumers, whatever adjustment does occur, it will not be to the detriment of the producer. The nature of the service in this market structure is such as to almost preclude knowing what constitutes a good service and what constitutes a bad service. This has generated a consumer psychology of either apathy or false security based on ignorance. The secondary result is that the market does not generate what people want because they do not know what they want. The institutional factor of regulation does not require anything more of the market; the competitive structure does not engender self-regulation. On the one hand, the consumer has neither the power, the ability, nor the inclination to force reform, while, on the other hand, the industry may provide whatever quality of service it wishes. These are the factors which cause avoidable death and injury and preclude the elimination of such atrocities. Neither the user, the firm, nor the industry is aware of the possible economies in social benefit to be derived from improving the organization of ambulance services.

Social Burden

Lack of data makes it effectively impossible to know the relative slopes of the social burden schedule and the production cost curve and it is only such knowledge which will yield an accurate answer about the explicit economic optimum. However, it is important and useful

to know the state of the current situation, i.e.: the absolute value of the social burden at some point, and to know the direction in which it is moving or might move, whether increasing or decreasing. All that can be said in answer to these questions is that the social burden is greater than zero and limited information exists to indicate how it might be changing over time. It is obvious the present position does not satisfy the overall economic criterion of zero social burden.

The model of Chapter II was presented in a purely theoretical context, abstracting from actual data on social burden. The above discussion, however, has brought output adequacy, particularly that of emergency output, into serious doubt. This section will bring the analysis closer to the real world with an estimation of the actual magnitude of the social burden in terms of explicit economic costs. The studies by Dr. Bruser, W. O. Geisler et al., and by the National Institute of Neurological Diseases and Blindness into avoidable death and injury do not furnish an entire schedule of results attributable to each level of quality, but do supply information which can be used to establish one point on the social burden schedule encompassing the economic costs to society of avoidable death and injury in terms of lost production, transfer payments, and the utilization of scarce medical resources. Details of the calculations are presented in Appendix B.

If a person dies avoidably in any given year because of the ambulance system, the explicit cost constitutes a part of the social burden as it is here conceived. "The major purpose of health programs is to save lives and reduce illness....There are no special problems which relate to the estimate of the costs of such programs, and the special problem of

quantifying their effects is a matter for engineers and doctors rather than for economists. The interest of the latter is thus concentrated on the problem of valuing the benefits per life saved or per illness avoided..."⁴⁰

Death avoided means that, among other things, a loss of production may be avoided. Therefore, the present value of this production is an economic benefit to be credited to the measure responsible for saving lives. To determine this economic value, one must ascertain what the average person whose life is saved will earn over the rest of his life. This depends upon a consideration of the following:

- (a) Age at death: Where actual information is lacking, this can be assumed to equal the average of all those who die from whatever cause, unless the proposed lifesaving expenditure obviously discriminates among age groups.
- (b) Probability of survival to each higher age: This can be calculated from a life table for the group in question which should be amended to take account of any projected changes in its age-specific death rates.
- (c) The proportion of people at each age who will be both in the labour force and employed and their contribution to production at each age. Participation rates have to be forecast; usually it is agreed that the appropriate unemployment percentage to assume is that corresponding to full employment.
- (d) The earnings of a person are usually taken as a measure of the value of his marginal product, average product being too high. Since

40. A. R. Prest and P. Turvey, "Cost Benefit Analysis: A Survey", Economic Journal, Vol. 75: 883-735 (December, 1965) p. 683-735, p. 721.

concern is with future earnings, the growth trend of such earnings should be allowed for if the study starts with data of current earnings.

Avoidable injury also will impose a cost upon society and contribute to the social burden. If the individual is incapacitated, the explicit cost is computed according to the formula above but includes also costs of medical care. Where a person is not permanently disabled, the medical costs and temporarily lost production are the only explicit cost components.

1. Avoidable Death

The measure used to indicate the explicit economic loss due to avoidable death will be the stream of gross earnings attributable to each dead individual projected over the expected working life of that individual, discounted to the year in which the avoidable death occurred, 1966.

It can be argued that the loss to "society" contingent upon a person's death is that person's production less his consumption--that which the individual pumps into the stream of resources available to society, less that which the individual takes out. But it can also be argued that "society" should be defined to include the individual whom the society is contemplating saving through health expenditure--welfare of the individual is added to aggregate welfare of the community. In this paper, the individual is defined as part of society. Therefore, whatever the individual does not consume of his own gross earnings is available to society, and the loss to himself and society upon his death is equal to earnings.

Note that this is not intended to be a measure of lost utility or welfare to society, but only lost production.

Of the 119 deaths studied by Dr. Bruser, 25 were preventable on his criterion, 3 were due to unavoidable conditions of climate and, therefore, 22 were relevant to the ambulance system. Unfortunately, only those working papers dealing with 11 of the 22 cases are accessible; of these 11, 5 were from Winnipeg. As a result, the costs presented below will be an understatement.

Neither the names nor occupations of the individuals are known; a very arbitrary estimation of their earning power is made. It is not known from where in Canada these persons may have come, nor if they planned to leave for a different part of Canada. Therefore, in calculating life expectancies, mortality tables for Canada as a whole were used (1965-67). Also, it is not known if these people had been suffering from any particular health problems, such as cancer, tuberculosis, or heart disease. Therefore, the normal life table for the appropriate group was not revised in any way.

Since no information was available regarding education, training, or occupation of the individuals in question, earnings are estimated at a flat annual average for the working life of the individual--no allowance is made for growth trends. The retirement age is assumed to be 65 years and a projected employment rate of 96% is used. It is further assumed that earnings are paid twice monthly. An arbitrary discount rate of 5% is chosen.

The total lost stream of earnings resulting from avoidable death and attributable to the ambulance industry discounted to 1966 was

\$100,959.91⁴¹. The lost years of life attributable to the ambulance system totalled 91.7 years.

2. Paraplegia

A certain number of paraplegic cases occurs yearly. In Manitoba this amount averages approximately 14.4 annually. Of these, approximately 2.6 yearly are treated by professional ambulance facilities from Winnipeg. Data from 1966, a fairly representative year and one which corresponds to the year in which Dr. Bruser conducted his study of avoidable death, are used.

The total stream of costs resulting from paraplegia and directly attributable to the ambulance industry discounted to 1966 was \$24,149.98.

3. Social Burden

The explicit economic social burden imposed upon Winnipeg in 1966 as the result of inadequate ambulance facilities was \$125,109.89. Moreover, lost human life years totalled 95.6 and lost productive life years totalled 38. The human costs are incalculable.

In conclusion, an estimation of one real point on the social burden schedule has been made. Other real points cannot be estimated because the ambulance system exists in a given state and any studies of avoidable death and injury upon which cost calculations must be based,

41. Due to problems of estimation, this value abstracts from the fact that such individuals, had they lived, may not have generated an economic value of this magnitude because of incapacitation or altered life expectancy caused by the initial emergency. Therefore, the figure may be somewhat inflated.

would concern a given state of an ambulance system. Without knowing the nature of the entire social burden schedule and production cost curve, it is not known if the point meets the explicit economic criterion. The zero avoidable death and injury criterion, however, has not been achieved.

In this section, discussion has centred upon the empirical aspects of avoidable death and injury and the methodology of the model in Chapter II. Due to the present structure and conduct of the ambulance industry in Winnipeg, people are dying or being injured and significant dollar costs, as well as psychic costs, are being incurred. The market performance criterion of Part I states that avoidable death and injury be zero. Clearly, this standard has not been met and another deficiency is revealed in the present ambulance service.

4. Problems of Equity

There are equity considerations to be noted in the present ambulance system; both providers and users are affected.

Equity Among Firms

1. Private Competition

Some ambulance operators have expressed concern about competitive advantages on the part of a few with the result that revenues are faltering. There is a series of factors which tends to produce, in the ambulance industry, a situation where competitive discrepancies and, in fact, significant inequities can occur. The factors are: lack of regulation, consumer incompetence, free enterprise, and non-homogeneity of ideals among operators.

There has been minimal regulation of the industry until late 1971. Consequently, almost anyone has been able to start up an ambulance company and the formal requirements for training and equipment have not been demanding or adequate.

Potential users are not likely to know what to expect of an ambulance service. This is not unusual where there is no natural or ready means of testing or evaluating the product or service. Further, demand for emergency ambulance care is zero elastic. The result is that, while operators are free to provide a good or bad service, the user is not able readily to choose among operators.

Moreover, the market structure has been characterized by free enterprise and, at the same time, the moral convictions of the operators with regard to consumer welfare are not uniform. The profit objective may be coloured by the ideals of particular operators--some feel obliged to provide a service under better standards of quality consistent with financial survival, while others are content to secure profits by minimizing expenses where possible. Ultimately, the more conscientious operators face a dilemma and may suffer at the expense of those concerned only about earnings; an inequitable situation arises for no justifiable reason.

2. Public-Private Competition

Competition between public ambulance services and private firms for emergency calls is unfair to the private operators. The situation is as follows. Ambulance operators, both existent and potential, survey the prospects for extending, continuing, or creating their businesses, and do so if conditions appear to be favourable. When

the public authority in one or a few communities sets up a partial ambulance service in a police or fire department or both, competition results and an unexpected turn of events occurs for the private operators.

There is no sound rationale for the public service. One explanation might be that a better quality service is desired and a start can be made toward this by introducing "high-quality" units. However, the quality of public service vehicles is, on the average, no better than that of private ambulances. Moreover, standards could easily be introduced without reverting to public provision. Another reason might be that it was a desired policy objective to compete down the price charged by private operators. Chapter IV showed this to be a fallacious argument.

The most logical explanation relates to overall adequacy of the private system in providing enough ambulances to minimize time consumption. Private concerns will set the number of ambulances they employ in accordance with effective user demand and costs. If government decides that the minimal number of ambulances consistent with public safety is greater than the number currently provided privately and, further, that the firms cannot profitably employ more than that number, public vehicles are introduced to "take up the slack". However, if it is the sole purpose of the public vehicles to provide an adequate number of ambulances, they should function purely as an "over-flow" service, coming into operation only when the private system is being used to a predetermined capacity; this is an economically sensible policy. However, the public services

do compete with private operators for emergency calls in spite of the fact that the number of vehicles in the private sector alone is excessive. The efficacy of such public policy and the effects on those firms which leave or suffer reduced market shares and revenues is questionable.

Equity Among Consumers

Discrepancies in treatment of different users of ambulance services may result from five factors; three are price considerations and two are quality considerations.

1. Price

(a) There is no charge for public ambulance care while private firms require payment for their work. Thus, if a person is sick or injured and someone calls an ambulance for him, he may receive the service free if a public vehicle attends, or he may have to pay a price of \$20 or more depending upon the firm and the distance travelled. However, it is possible when calling 999 to specify, within limits, whether a public or private vehicle is wanted and thereby to avoid the expense of a private service. Unfortunately, knowledge of this option is not universal and different people incur different expenses for the same service.

(b) It is expected that, as the market share going to the ambulance industry is reduced due to public competition, the price privately charged will rise. This aggravates the problem mentioned under point (a): the difference in expense incurred by different users

is increased. This is particularly unfortunate since the savings are distributed in a haphazard way. A utilitarian would contend that if some are to receive the service free of charge and others not, that the distribution of ultimate payment should be progressive. It is quite possible, however, that the distribution of payment is, in fact, regressive, if one supports the position that the higher one's income the greater are one's information-getting resources.

(c) The third problem derives from the lack of regulation. Some firms charge different prices depending on the extent to which certain situations and patients can be exploited. Where a person dials 999 for an ambulance, a private firm answering the call may charge any price and, in some cases, it is largely a matter of chance whether the client pays a high or low price.

2. Quality

(a) Due to the lack of regulation, different firms give different standards of service; for the same reasons as above, different patients will receive better or worse care depending upon who happens to attend the emergency. Another cause of quality heterogeneity is the fact that both public and private services exist side by side in an unco-ordinated way--standards of quality between these two groups differ.

(b) Sometimes, an emergency will occur in stages, beginning with a serious but not dangerous condition and then degenerating into a panic-stricken situation. Frequently, a caller may summon two ambulances, first a private firm during the early stages of need

and later, if this ambulance is slow and a deteriorated condition causes panic, another ambulance, usually a public vehicle through 999.

These are the problems of equity, most of which arise from a market structure housing both public and private providers of ambulance care in competition with one another. The only apparent advantage of the public service is that, where more ambulances are needed, it is an easily implemented alternative requiring neither legislation, subsidization, nor agreement among the private operators, all of which might be necessary if the firms were to be induced to enlarge their fleets. This advantage could be enjoyed without some of the accompanying disadvantages if the public service avoided competing with the private ambulance sector.

5. Summary

Private commercial interests have been upheld in the ambulance industry; firms have achieved what they wanted to achieve. The public sector, being uninformed and misdirected, has achieved its limited goals as well. But it is there that the achievement ends. None of the public interest goals has been satisfied because a market structure serving mainly private interests exists. And during the very genesis and maturation of this structure which determines the physical well-being of the public, the public sector has had effectively no policy whatever.

In ambulance services, large scale of plant and an oversized industry have generated technical inefficiency in terms of excess

capacity resource wastage. The operation of the industry, characterized by confusion, path-crossing, public-private competition, as well as an inept call mechanism and inappropriate payment procedure, has generated technical inefficiency in terms of duplicative resource wastage and distributive inefficiency in terms of unevenly and inappropriately dispersed resources.

There is inaccess to ambulance care because of both abundance and paucity of ambulance facilities. This results in allocative and distributive inefficiency: the allocation of resources has not been such as to match that collection of outputs provided with that collection of outputs which will maximize aggregate welfare; because some individuals are able to get proper care and others not, that collection of resources allocated to the ambulance sector has not been distributed among the members of society so as to maximize welfare.

The prices charged, while reflecting technical inefficiency, give rise to distributive inefficiency: recipients of ambulance care are paying a price which represents consumption of resources greater than that amount for which they are responsible.

Finally, the public well-being is reduced. This has efficiency implications with regard to the economic use of human resources; it has moral implications with regard to loss of life and limb.

The market fails for several reasons. Those very factors which are part of perfect competition theory such as absence of regulation, freedom to enter, leave, contract, or expand, ability to differentiate product and compete in terms of price, and a lack of any incentive or inducement to take concerted action, have resulted in a situation

wherein no legal obligation has been imposed upon the ambulance firms, and operators are encouraged to become, first and foremost, profit-maximizing entrepreneurs in the provision of an emergency public safety service. Further, people are not knowledgeable about the service; for them it is both complex and uninteresting. Because there is no requirement, either moral or otherwise, placed upon the industry by the users, the public in general, or arising from within the industry, there is no effective force to govern the quality of ambulance services or the efficient use of resources. As a result, firms proceed unrestrained in pursuing what any rational businessman pursues--an acceptable profit margin--and the public interest, which is equally important, is forgotten in the confusion and frenzy of normal, everyday business.

PART III

THE CHOICE AMONG ALTERNATIVES

CHAPTER VI

PERSPECTIVE

1. Introduction

The study has discussed the present ambulance system, its problems, and their implications. It also has outlined the criteria of output adequacy, price and cost efficiency, and equity, which are put forth as the social objectives of an ambulance service. The purpose of Part III is to ascertain how supply and demand can be organized best to fulfill the objectives specified.

The present form of ambulance industrial organization in Winnipeg involves most market organization alternatives. There is public provision in terms of fire and police ambulance vehicles providing care at no charge; there is joint public-private venture, for example, where the 999 emergency dispatch centre is provided by the public sector and private ambulance firms receive calls through it; there is public-and-private provision of the same service in that both entrepreneurs and police and fire departments operate similar ambulance services; finally, there is public regulation and support of private provision through Manitoba Regulation 8/71 which stipulates certain requirements of ambulance enterprise and through the Manitoba Health Services Commission which provides a basic voluntary training program from time to time at no charge. Pure private provision has not existed for many years.

It is this milieu of organizational forms which has resulted in substandard market performance and, in some cases, atrocities. Most importantly, there is avoidable injury and death attributable to grossly inadequate skills, mediocre equipment and procedure, a total lack of rational distribution of ambulance locations, and an incomplete communications network. A further contributing factor to this breach of the public well-being is a lack of responsibility which in turn derives from a lack of meaningful regulation and scrutiny. The most apparent symptom of irresponsibility is destructive competition in terms of public-private rivalry and wasteful inter-firm rivalry, resulting in small market shares and high unit costs and prices. The public sector has been equally irresponsible by providing neither comprehensive regulation, scrutiny, nor support.

There is technical inefficiency due to an excessive number of vehicles and firms and poor overall organization, manifested in duplication of effort, path-crossing, poor locations, consumption of resources in wasteful competition, and the realization of too few economies of scale. Regulation has been inadequate to build a system free of such defects.

Prices are high because cost schedules are high. Moreover, when a private enterprise which is inherently stand-by in nature charges at least an average cost price, as it must, price will be high; there has been no regulation of nor support for a marginal cost (or variable cost) price. In the absence of regulation, private pricing policy has been conservative.

Finally, there are problems of equity in the present system. Somewhat different prices are charged for the same service. There is free provision of public services for those who happen to get it. A lack of regulation requiring all to uphold certain minimum standards permits unscrupulous firms to compete on an unfair basis and, at the same time, there is a lack of financial support to guarantee homogeneous standards of service quality.

In tracing the causes of poor performance of the ambulance industry as an instrument of public policy, both here and in the previous chapter, recurring themes emerge: location of vehicles is very important; co-ordination through better communication and organization is vital; the issue of public-private competition is pressing; regulation and support are necessary but deficient. The alternative or mix of alternatives chosen for the provision of a good ambulance service must meet the threat that these problems pose, a threat which, to date, has gone unchallenged.

2. The Alternatives

In general, there are four alternatives for ambulance service provision.

Public Provision

One feasible alternative for the provision of an ambulance service is public provision. This means that ambulance services would be part of the public sector's activities just as fire or police protection are. The unit of authority could be the community, city, or

province. Standards of performance determined by the public authority would prevail. Further, ambulance care could be a "public good"--this is not necessarily implied by "public provision". As a public good, ambulance care would be provided to everyone free of charge. General tax revenues or an insurance premium added to the Manitoba Health Services premium could be used as the means of finance. In other words, public policy can affect both the demand and supply side of ambulance care provision. Alternatively, some sort of user charge might be imposed, varying from a mere deterrent fee to an average cost price. Of course, the demand side of the transaction might be ignored in public policy, allowing users and potential users to pay a price when necessary or to insure themselves against the expense.

Private Provision

Another service alternative is private provision. In that case, all equipment, materials, and facilities are owned, and all personnel hired by entrepreneurs; the entrepreneur is responsible to himself and his employees. Standards of performance will be governed by competition (or lack of it) among firms and scrutiny by users where the public at large is actually able to oversee and to evaluate the performance of the industry. A price adequate to cover long-run average cost, including at least normal profits, would be charged of the user. Supply may come from many firms, a very few, or one. A co-operative might be formed for purposes of setting market quotas, purchasing centrally, and bargaining collectively.

Public-Private Provision and Joint Venture

Public-private provision may appear in several forms. One form entails a public service and a private service which operate in a manner insulated from one another in terms of co-ordination or common procedures but do in fact compete. The public service may be a public good while the private sector charges a fee for service. Alternatively, there might be a "public-and-private" type of service wherein both sectors provide the service but each serves the appropriate part of the market and complements rather than competes with the other. Finally, public-private provision might take the form of "joint venture" where certain levels or types of a service are provided by a different authority. For example, the well-being of firemen and policemen could be safeguarded by fire and police ambulances while private ambulances serve the general public. On the other hand, the activities of the public sector may be confined to the provision of a communications system somewhat like the present 999 network or the provision of a payments system through insurance or taxation, rather than actual delivery of ambulance care.

Private Provision with Public Regulation and/or Support

Where an uncontrolled private system does not generate an optimal ambulance service in terms of public interest criteria, public policy designed to bridge the gaps is in order. This is the fourth alternative to be discussed. Public policy can be formulated to regulate various dimensions of an ambulance service with the objective of making it a service which satisfies chosen public interest criteria. However,

regulation alone may not be an adequate solution for two reasons. Firstly, universal rules may impose discrepant burdens upon heterogeneous ambulance operators and, therefore, violate equity principles and perhaps drive some firms out of business. Secondly, the regulations may not be entirely workable. For example, a maximum price may be regulated along with specific quality controls, but this may preclude coverage of average cost by all firms. Consequently, public policy is needed to provide financial support to the private sector in its endeavour to meet the regulations.

Competitive practices can be regulated in terms of price, entry, agreements, expansion, salaries, vehicle speed, piracy of calls, and others. Such measures may require support in terms of salary and price subsidies, and encouragement to enter or expand. Location can be regulated and, at the same time, public support would compensate for expenses related to moving and losses due to business volume differentials. Requirements of vehicles and equipment may entail financial aid or a more efficient purchasing procedure. If compulsory ambulance attendant training programs were provided, the public sector might pay the opportunity costs of the trainees during the training period.

Finally, a provision alternative may envelope certain facets of all the alternatives discussed.

3. Summary

Ambulance care, as the target of public policy, may be delivered under any one of the four organizational formats discussed in this chapter, each capable of being set-up through a public policy initiative and each, in turn, involving a set of specific public policies. Certainly,

some forms of ambulance service organization will serve as more satisfactory instruments of public policy in furthering social well-being than others. For example, it might be that the alternative of private provision will contribute most to advancing the social good. In that case, public policy would involve the general move of announcing and legislating private provision to be the method of care delivery as well as the specific policies of phasing-out fire and police ambulances, of selling the communications system to private interests, and, over time, of initiating whatever policy is necessary to ensure the continuance of private provision. Also, hypothetically, it might be that public provision is the alternative which will further the public good more than any other form of organization. In that case, public policy would establish such a system. In turn, policy toward price, operations, efficiency, quality control, and finance, would need to be formulated.

It is in this way that the provision alternatives developed in this chapter represent conceivable avenues of public policy formulation and implementation in setting-up ambulance service as a policy instrument of the public sector. The process of developing an alternative, presented in Chapter VII, must take into account these possibilities in answering the basic question: which alternative, as a manifestation of public policy, will alter market structure and encourage change in market conduct so as to generate market performance which is consistent with the public interest norms outlined in Part I?

CHAPTER VII

CHOOSING AN ALTERNATIVE

1. Introduction

Public policy toward the ambulance industry consists of altering components of the industrial organization format so as to engender a specified level of performance by that industry. In some cases this means changing an institutional factor such as public regulation of private enterprise, i.e.: the changing of one existing policy of the public sector; or it might imply reaffirmation of a form of ownership such as private ownership; or it may mean the introduction of incentives such as public financial support of certain entrepreneurial endeavours to encourage better industry performance. The thrust of Chapter VII is to develop the public policy toward ambulance services, public and private.

It became clear in Part II that specific factors were responsible for specific levels of attained performance. No speculation is required to identify the public policy which will influence in a predictable way these causal factors. So, the method of Chapter VII is, case by case, to build up a comprehensive public policy to remedy all ambulance service deficiencies revealed in Part II. This is different from an approach emphasizing examination of a series of alternate and hypothetical public policies in an attempt to determine which ones might

be most effective in bringing about optimal performance. Examples of most public policies in terms of market structure variations already exist in the organizational format of ambulance services, and developing a policy is really a case of sorting out those existing policies, substituting the good ones for the bad, and introducing new policies. In this way, a market organization alternative is developed.

In choosing an alternative for ambulance care provision, the philosophy adopted in this paper is to "work with what you have" wherever possible. As stated above, the present system contains examples of most alternatives. Further, the terms of reference for this analysis, as set down in the Introductory Remarks, called for evaluation of provision alternatives in terms of the performance criteria in Part I. Therefore, what follows is an evaluation of the feasible alternatives "implicitly" as the manifestations of them to be found in the present organizational format are examined. The following steps are taken: firstly, to isolate and retain the most desirable features of the present organizational mix, then to discard the undesirables, and, finally, to bridge gaps in the organizational format and to embellish those desirable features which, as yet, remain incomplete. Properly used, this formula would render attained performance consistent with performance criteria.

2. Features to be Retained

Public and private provision of direct ambulance services should be retained. Although public provision in the past has been drawn into areas of involvement beyond initial terms of reference, it

performs well the functions for which it was originally intended, i.e.: the provision of an ambulance service to policemen and firemen in their line of duty and a highly specialized rescue service. Private firms are covering a large segment of the market and are providing a needed service different from public services and for that reason, at least, should be retained. In this regard, present facilities which are appropriate should remain: several of the private sector vehicles and their equipment are quite reliable for the task at hand; most of the public vehicles, except the police dual purpose station wagons, are reliable.

In addition to direct provision of care, the public sector provides an embryonic communications network à la 999 which should be retained as a foundation for a more complete system. It constitutes a service not only to the public but to the firms as well. Also provided publicly, through the joint effort of the Manitoba Health Services Commission and St. John Ambulance, is a voluntary and partial training program. The inauguration of this policy was a move toward improvement and it should be maintained.

To the extent that present location of ambulance vehicles is appropriate to the task of adequate coverage of a large urban area, good locations should be held. Several private ambulance locations, specifically those in Fort Rouge, St. Vital, and East Kildonan, are appropriate; the private sector has not been totally inept at distributing ambulances in a demographically rational manner.

Although the public sector has been remiss in performing its function as regulator of a life-saving service, the regulations which have appeared recently represent a basically sound nucleus for the

formulation of public policy toward ambulance services and demonstrate significant scope for further regulatory development. The philosophy and substance of the regulations should be retained.

Those aspects of the present system of payment, including direct user charges initiated by the private sector, pre-paid insurance, also privately initiated, and payment by the Department of Health to aid those who cannot pay and have no insurance, demonstrate merit. The value of and orientation toward pre-payment and user charges, which have been privately and publicly initiated, should be recognized and developed in further finance policy.

3. Features to be Avoided or Discarded

Inadequate public sector goals have been the result not of malice but of ignorance on the part of government. In going beyond its initial terms of reference, the public sector has been responsible for competition with the private sector and is to be faulted accordingly. All such competition should end and public provision, aside from specialized fire, police, and rescue services, should enhance the efficacy of private operations through providing a support system rather than rivalling the intents of ambulance companies. As well as ending undue public-private competition, any attempts at extending the boundaries of public sector responsibility should be stopped. The fire and police departments are more than adequately endowed to perform their prescribed functions. This avoids the attempt by government to capture the market through exclusion rather than through competition; neither is justified. Although public vehicles are pre-crewed, their staff rotation feature should be eliminated

through specialized duty or mitigated through continuing training and frequent rotation, since its primary effect is to erode the expertise and confidence of those on ambulance duty, and pose a threat to the public well-being. No private vehicles are pre-crewed because of cost barriers, and such a policy has not been required universally by legislation. Post-crewing, used by the present industry, should be discarded in favour of a pre-crewed service. Finally, excessive and inappropriate vehicles should be removed from the system and replaced accordingly. This amounts to about six vehicles in the short-run and all in the longer-run.

The present communications network permits firms to pirate the calls of other firms and of the public service through radio monitoring. This should be avoided since it causes resource wastage, speeding, and danger. The present procedure of the 999 system initiating second party and ensuing third party calls should be terminated in favour of a faster and more effective call mechanism.

Most of the private ambulance locations are inappropriate since they tend to be concentrated in the core of the city and a few other areas. The private sector rationale for this is that family-owned property is used for convenience and rent minimization. Such locations should be abandoned for more population-specific outlets which provide for adequate coverage of the city--such is a public well-being criterion, not a private enterprise criterion. This would serve to minimize the time elapsed in reaching emergencies and also reduce the need for speed and excessive driving time in heavily travelled areas.

The present variety of payment procedures as such is confused, unpredictable, and to the detriment of both the provider and user of the service. This is to be expected from an unco-ordinated group of

autonomous competitors and an unorganized public. The procedures should be discarded in favour of a homogeneous and rational system of payment. This is within the reach of the present system, provided some direction is publicly induced. Present price scheduling also should be abandoned. Regarding user charges, in most cases the price includes excess profit; in all cases the price includes universal option value for which the user should not be obliged to pay as a user charge component. Public services are provided free and the distribution of such free service is not uniform.

All telephone directory advertizing should be prohibited. Advertizements in both the Yellow Pages and the emergency service cover page can lead to confusion and delay in times of an emergency. Yellow Page listings only are in order for purposes of elective ambulance calls.

4. Scope for Improvement

The vehicle of improvement with the greatest potential in ambulance reform is regulation. All the areas both of deficiency and of desirability can be changed through public regulation. Present regulations, although pointed in the right direction, are far from complete and can be improved in several contexts.

A joint public-private endeavour in terms of direct delivery of care (specialized police, fire, and rescue services on the one hand, and general ambulance care provided privately on the other) should be enforced in order not only that there be a co-ordinated division of

labour but that there exist also mutual back-up systems. Further, joint venture is called for in communications. A centralized city-wide communications network is feasible only as a public undertaking. Private firms, however, would be able to link up with such a network, purchasing the appropriate equipment to do so. This would constitute significant improvement within the existing institutional framework.

In Winnipeg, not all private firms are well located. Such firms could be required to relocate, for example at hospitals or other strategic locations, and cover the city on a zone basis. Public financial support would be needed to compensate for moving cost and lost business not only as assistance for the absolute expenses but as assistance for a burden which will not fall in a uniform manner upon firms. In other words, public direction and support are in order but control would be retained by the private sector.

The vestigial course in first-aid training presently offered by the Manitoba Health Services Commission should be geared up to a three month compulsory training program in cardio-respiratory resuscitation, intensive care unit experience and hospital experience in general, proper treatment of paraplegia, treatment of hemorrhage, immobilization of fractures, and other critical aspects of first-aid. Annual in-service training and examination should be mandatory, with senior St. John Ambulance training being prerequisite to the entire course. Regulations on this point have been relatively absent in the past, but it is only through public concern that such upgrading of abilities for the private sector can take place. Moreover, public financial support would be needed to pay the opportunity costs of the trainees where they are already employed as ambulance attendants.

At the same time that standards of training and procedure are being regulated upward, more stringent requirements would be placed upon the nature of vehicles and their number. There should be fewer vehicles of higher quality, but at present there is no incentive for private firms to incur heavier financial burdens for that purpose. Financial support may be needed in the purchase of new vehicles to meet rising standards. In addition, such vehicles should be pre-crewed on a 24-hour basis rather than post-crewed. In this regard, some salary responsibilities may have to be assumed by the public sector.

Pricing and costing are presently unacceptable, this being an upshot mainly of private sector operations. Ambulances are not active all the time. This "idle time" is available and valuable to everyone and it is inefficient that a person who happens to need an ambulance is obliged to pay not only the cost of his own use of the service but also the option value costs which provide a benefit to everyone (not to mention excess profits). This is the best that private pricing policy can achieve--the entrepreneur's only source of income is effective user demand. Public pricing is usually or, at least theoretically, aimed at efficient allocation of resources. If a marginal cost price can be charged for a service and the remainder (average cost minus marginal cost) paid out of general revenue, a more efficient adjustment will be achieved. Finance should entail a user charge coupled with either a consolidated revenue payment or a prepaid insurance scheme, public or private, to permit coverage of both marginal cost and option value. A fee could be negotiated with the ambulance operators. Public financial support would also be needed to pay indigent accounts.

Costing is inefficient for reasons mentioned in Chapters V and VI. These can be remedied through better overall organization as proposed in this chapter, but also through some system of central purchasing of cost components. With regard to manpower, a larger buying unit can eliminate many imperfections in the market for labour; it can more successfully seek out the best personnel for the lowest price. This approach also applies to equipment, particularly vehicles. Bulk buying for the entire industry would be most efficient. In addition to fleet discounts in equipment and vehicles, premises and insurance might be rented and purchased on a group basis, and fixed costs could be lowered accordingly. In some cases, explicit public involvement is mandatory, in others, only a passive role in encouraging co-operation and unified action within the private sector is needed.

Presently there exist no incentives nor mechanisms for "progressiveness" in the private sector in developing new methods and moving ahead in technological achievement. This is not unusual when an industry consists of a group of small sellers exhibiting no unified effort in any particular direction. Progressiveness reduces to research and development and the dissemination of knowledge which, in the present case, could be carried out best through the public sector. Firms (as well as public ambulance services) would be required to maintain statistical accounts of their activities in terms of volume of service, nature of calls, methods used, and survival rates. The information, in turn, could be used centrally to determine the relative efficacy of new methods and the organization of care delivery. In Ontario, the Ontario Ambulance Services Information System (OASIS) has been instituted by

the public sector as both a standardized field information reporting system and a centralized computer based management and research information system. The end result of the processing system is a year-to-date computer file which contains the complete record of each ambulance call that has passed all accuracy and reasonability checks. In collecting data on demand distributions by time, space, or urgency, and changes in availability in response to changes in fleet size and shift patterns, the goal of OASIS is to provide information which will lead to improvement in the care of patients and the efficiency of the ambulance service in general. In Winnipeg, the capabilities of Phoenix Data Ltd. might be utilized in this area of centralized research and development activity.

The role of public financial support has been stressed throughout "Scope for Improvement". Those health services which are insured and shareable with the federal government by provincial governments tend to be acute or "vital" services, i.e.: hospital care and physician services. Less vital services such as dental care, provision of drugs and appliances, optometric care, chiropractic care, home care, and nursing home care, are not insurable or shareable⁴². It is not unreasonable that, over time, vital services should be insured first if all services cannot be insured. However, it is illogical that emergency ambulance care, one of the most vital (although not the most expensive) of acute health services, has never been insurable or shareable. Ironically, non-emergency ambulance care in the form of inter-hospital

42. Nursing home care will become insurable and shareable in July of 1973.

transfers is federally shareable and insured but not vital. Federal-provincial negotiations should be actively pursued in order to render ambulance care and research shareable.

5. Summary

A general alternative has emerged which can now be classified: essentially it is private provision with public regulation and support. Included also are elements of joint venture as well as public-and-private provision except that, in the latter case, the two are no longer at cross purposes.

The choice excludes two other alternatives, that of complete private provision and of complete public provision. Private provision is ruled out for what are considered obvious and defensible reasons (see Chapters III and V). With regard to public provision, in comparison with the choice under review, it is true that there is nothing the chosen alternative can do that public provision cannot do in terms of providing an ambulance service. However, the public provision option carries with it certain debits which have little to do with actual ambulance care.

The phrase "government takeover" still grates upon the ear of many; there is a stigma attached to it, at least on this continent. According to the chosen alternative, ambulance operators maintain autonomy and a good deal of pride in something they have been doing for a long time and are knowledgeable in; they are afforded scope and credit for making decisions.

Also, there are efficiency advantages to maintaining private ownership. As the entrepreneur gains experience in running his business, he will develop "techniques" for economizing in various aspects of his operations; these will be methods that only can be learned through trial and error. As the two men who normally attend an ambulance work together regularly, they will be able more readily to co-ordinate their actions, both mentally and physically, improving their service. Further, ambulance firms are usually family operations. Therefore, it is expected that the incentive to economize is stronger than in government.

An advantage in terms of budgetary flexibility is realized through maintenance of private ownership. Frequently, when government sets out to change something, its vehicle is a full-blown and immediate program. Two examples under the present administration are Unicity and Autopac. But sometimes a budget constraint may dictate the ranking of needs and the introduction of the components of the whole spectrum of change over time. In ambulance care delivery, components of the total care package can be introduced and modified on an experimental basis; expenditure need not be an all-or-nothing phenomenon as would be the case if an existing essential service were to be eliminated and replaced.

Administration can be left to the private sector. The Manitoba Health Services Commission or the Department of Health would be required to gear-up somewhat for increased administrative burdens but to a far lesser degree than if complete public provision were chosen. It is logical, and in this case desirable, to "fine tune" an existing situation by examining it, screening it, and rebuilding its defects, rather than to obliterate it and start anew according to a master plan which

may or may not succeed. When the formulation and imposition of public policy toward an industry is inevitable, there is merit to affording a group of individuals who comprise that industry the opportunity of re-organizing and redeploying their resources collectively or as single units, and presenting to the public authority a "new deal", rather than eliminating completely the industry as a viable entity and replacing it with a bureaucratized machinery intended to perform the same function better. After all, the public sector has made no demands in the past, written or unwritten, legal or moral, of the members of the ambulance industry and it would be inconsistent for that authority now, in a sudden and unexpected show of concern for the public interest, not to give the existing structure the above option.

So, in summary, complete public provision and the chosen mixed alternative would generate equally satisfactory results in terms of public well-being, but over and above that, the public option carries with it certain undesirables which, on balance, show a mixed alternative to be the superior choice. Although the alternative chosen remains a mixed organization, it is a concerted mixture of activity directed toward a single end.

CONCLUDING REMARKS

The task of this paper was to examine the impact upon the public of a public safety service--ambulance service. Impact is expressed not only in terms of the physical well-being of people, but in terms of the number of dollars they must pay for the service, the time they must wait, the degree of efficiency in the use of factors of production by the industry, and the extent to which availability of service is uniform. Another word for impact is market performance. The unique structure of this market will influence heavily the behaviour or conduct of firms, and both conduct and structure will determine performance.

This paper asserted that ambulance services should have a certain type of impact. This norm was expressed in a set of performance criteria in Part I. Particular indices of market performance exist because of particular forms of market conduct. In turn, the behaviour of firms is determined by certain market structure parameters. Where a gap exists between the performance the industry should have achieved and that which it did achieve, as demonstrated in Part II of this paper, the structure and conduct will need to be altered. As market structure parameters are changed, there is no reason to believe that the same conduct will be encouraged. In fact, parameters can be mixed and matched in ways so as to induce a pre-determined behaviour which will generate the market performance desired. This is the essence of public policy toward the ambulance industry developed in Part III.

The lack of any meaningful regulation in the market structure permitted a market conduct characterized by irresponsibility, absence of co-operative endeavour among firms and, generally, an obsession with purely private commercial interests. The unjustified presence of public ambulances in the market led not only to an inequitable situation for private firms, but caused all firms in the industry to be extremely reticent about changing their mode of operation, whether it be expansion or contraction of the size of the firm, or alteration in their quality of service. The continuing presence and unpredictability of the public sector caused existing firms to be fearful and, therefore, stagnant. Consumer detachment, on the one hand, and the inefficacy of inter-firm price competition, on the other, helped form a market framework in which it was in a firm's best interest to use artificial product differentiation to capture and maintain a market share and to categorically avoid improving the quality and relevance of its service. Additionally, this type of conduct was permitted not only because of a lack of appropriate regulation, but because the public sector ambulance service was certainly no good example to firms of what an adequate public safety service should be.

The low level of performance by this market is not surprising in view of its loose structure and irresponsible conduct, and should come as a great embarrassment to the public sector. Users are being exploited through high prices charged by private ambulance firms and are receiving only a great risk for their money. Avoidable death and avoidable injury have occurred in Winnipeg, and public as well as private ambulance services are at fault, for they both provide a similar quality of service. The industry is inefficient because it is oversized, underworked, and

disorganized. Public policy to alleviate any of these problems has been totally absent.

It has been shown that a fundamental market structure of publicly regulated private enterprise with selective joint public-private provision of ambulance care will go further than any other public policy alternative in solving the problems of the present ambulance system in Winnipeg.

APPENDICES

APPENDIX A

Presented below are regulations, past and present, governing the ambulance industry.

A. City of Winnipeg By-law 18613, Section 40A.

40A. Ambulance Driver or Attendant - #18613

- (1) In this by-law, "ambulance" means any privately-owned vehicle equipped or used for transporting the wounded, the injured or the sick.
- (2) No person shall drive or serve as attendant of an ambulance without first having obtained a licence from the City to do so.
- (3) No licence shall be issued to a driver or an attendant of an ambulance without the applicant for the licence having first obtained from the Health Officer of the City and filed with the Inspector of Licences a certificate that the applicant has an adequate knowledge of first aid.
- (4) It shall be sufficient compliance with Sub-section (3) of this Section if the applicant produces to the Inspector of Licences a current St. John Ambulance first aid certificate issued to the applicant and which will not lapse or expire before the end of the licence year.
- (5) Every applicant for a licence under this section shall file with his application two prints of a recent photograph of himself of a size designated by the Inspector of Licences, and the Inspector of Licences shall attach one of the prints to the licence and file the other with the application.
- (6) A licensee shall keep the photograph of himself attached to his licence and any licensee who defaces, removes or obliterates the photograph or any official entry made upon his licence shall be liable to have the licence revoked.

Licence fees as established under By-law No. 18121 are \$10.00 for the proprietor and \$5.00 for each driver or attendant.

This ruling was repealed when the Manitoba Regulation 8/71 was filed February 4, 1971.

B. "The Highway Traffic Act", Revised Statutes of Manitoba, 1970;
Chapter H60, and amendments thereto.

Section 2, Subsection 14:

- (14) "emergency vehicle" means, subject to subsection (4) of section 2, a vehicle used
- (i) for police duty; or
 - (ii) by a fire department; or
 - (iii) as an ambulance; or
 - (iv) for purposes related to maintenance of a public utility and designated as an emergency vehicle by a traffic authority; or
 - (v) under the authority of a municipality, as a fire-pumper.

Section 99:

- 99(1) Notwithstanding anything in this Part, but subject to subsections (2), (3), (4), and (5), the driver of
- (a) an emergency vehicle; or
 - (b) any other vehicle being operated in an urgent emergency and driven by, or escorted or accompanied by, a peace officer:
- when responding to, but not when returning from, an emergency call or alarm, or when in pursuit of an actual or suspected violator of the law, may
- (c) exceed the speed limit;
 - (d) proceed past a traffic control signal showing a red light or a stop signal without stopping;
 - (e) disregard rules and traffic control devices governing direction of movement or turning in specified directions; and
 - (f) stop or stand.
- 99(2) Subject to subsection (3), the driver of a vehicle to which subsection (1) applies shall not exercise the privileges granted under that subsection unless
- (a) he is sounding an audible signal by horn, gong, bell, siren, or exhaust whistle; and
 - (b) the vehicle, if equipped therewith, is showing

- (i) a flashing red light; or
 - (ii) a white light emitted by the headlamps which are lighted alternately and in flashes; or
 - (iii) both such flashing red light and alternately flashing headlamps.
- 99(3) Subsection (2) applies only in a case where compliance therewith is necessary in the interest of the public or of safety.
- 99(4) The driver of a vehicle to which subsection (1) applies, when exercising any of the privileges granted under that subsection, shall drive with due regard for safety having regard to all the circumstances of the case.
- 99(5) Without restricting the generality of subsection (1), the driver of an ambulance, a vehicle used for police duty or a vehicle to which clause (b) of subsection (1) applies, shall be deemed to be responding to an emergency call or alarm if it is being used to transport or escort a patient of injured person in an urgent emergency justifying a rate of speed in excess of any maximum speed permissible under this Act.
- 99(6) The driver of an ambulance or other vehicle to which reference is made in subsection (5) shall be deemed to be responding to an emergency call or alarm from the time he receives the call or hears the alarm.

C. Manitoba Regulation 8/71, being a Regulation under The Public Health Act respecting Ambulance Service.

1. In this regulation

- (a) "ambulance" means any motor vehicle that is used, or intended to be used, for the transportation of patients, and that is specifically designed, constructed, and equipped for that purpose, and includes a dual-purpose police patrol vehicle, a rescue fire vehicle, and a funeral coach or hearse;
- (b) "ambulance service" means the business of transportation of persons by ambulance;
- (c) "commission" means Manitoba Health Services Commission;
- (d) "attendant" means a person who is fully qualified under this regulation to attend and assist a patient requiring transportation by ambulance, and who is licensed as an attendant under this regulation;
- (e) "attendant-driver" means a person who is both an attendant and a driver;
- (f) "driver" means a person who is fully qualified under this regulation to drive an ambulance, and who holds a valid and subsisting chauffeur's licence under The Highway Traffic Act;

(g) "dual-purpose police patrol vehicle" means a motor vehicle operated by a police department and that is also equipped as an ambulance;

(h) "health officer" means the Director of Public Health Services appointed under The Department of Health Act, and includes any person who, under that Act, The Public Health Act, or The Health Services Act, is, or is appointed as, a medical officer of health or as medical director of a local health unit;

(i) "hospital" means a hospital as defined in The Hospitals Act;

(j) "owner" includes any person carrying on the business of operating an ambulance service;

(k) "patient" means a person who is sick, injured, wounded, incapacitated, or in need of medical attention and requires transportation.

2. Except as provided in this regulation, no person, by himself or by an agent or employee, shall

(a) operate, conduct, maintain, carry on or purport to carry on, advertise or otherwise hold himself out as carrying on, an ambulance service;

(b) drive or operate, or cause to be driven or operated, any ambulance;

(c) attend upon, or assist in, the transportation of a patient by ambulance; unless he holds a valid and subsisting licence issued by the commission.

3. Section 2 does not apply to

(a) the Government of Canada or any agency thereof; or

(b) any person who, without compensation, attends or assists in the transportation of a patient by ambulance at the request of a police officer, medical practitioner, or person in charge of the ambulance; or

(c) any person who uses a motor vehicle to provide or assist in providing ambulance service arising out of a civil disaster or a war emergency proclaimed under The Emergency Measures Act; or

(d) a taxicab licensed under The Taxicab Act.

4. Each owner of an ambulance

(a) shall apply to the commission for a licence for the operation thereof;

(b) shall file with the commission such information in respect of the application as the commission may require;

(c) shall pay a fee of five dollars;

(d) shall not operate the ambulance or allow it to be operated unless he has a licence for an ambulance service.

5. (1) Each owner of an ambulance shall

(a) maintain the ambulance in good and safe mechanical condition and repair;

(b) comply with the standards of construction and equipment for an ambulance set out in Schedule A;

(c) carry in the ambulance the first aid equipment set out in Schedule B;

(d) provide such other equipment and supplies for the care, comfort and safety of patients as the commission may require;

(e) place on the ambulance the word "Ambulance" in legible lettering, in addition to the owner's identification;

(f) ensure that clean linen is provided for each patient carried in the ambulance;

(g) ensure that the ambulance and the equipment therein is disinfected as required by a health officer;

(h) carry insurance in respect of each ambulance for not less than three hundred thousand dollars inclusive coverage, in respect of liability arising from bodily injury to, or the death of, one or more persons, including the passengers and patients carried in or on the ambulance, in respect of liability arising from loss or damage to property.

(2) The Commission may require the owner of an ambulance to ensure that it is equipped with a heater, independent of vehicle source, capable of maintaining adequate temperature for the interior of the vehicle.

6. (1) The commission may issue a licence to an owner in respect of an ambulance service upon being satisfied that

(a) the public convenience or necessity require the proposed ambulance service;

(b) the ambulance service and the equipment for each ambulance are in compliance with this regulation;

(c) the applicant is, in the opinion of the commission, a responsible and proper person to receive a licence;

(d) only duly qualified and licensed drivers, attendants, and attendant-drivers are employed in the operation of the ambulance service.

(2) Where the commission refuses a licence, it shall, upon request, give the applicant reasons for refusal of the licence and the applicant may appeal against the decision of the commission in the manner set out in subsection (8) of section 13.

(3) Subject to subsection (4), a license issued under subsection (1) is valid for a period expiring on the thirty-first day of December of the year in respect of which it is issued.

(4) Subject to section 13, the commission may suspend or revoke a licence for the ambulance service for non-compliance with this regulation.

7. (1) An applicant for a licence shall file with the commission at the time of making the application, evidence that the insurance required under clause (h) of subsection (1) of section 5 is carried.

- (2) The commission shall not issue a licence for an ambulance service unless the owner complies with clause (h) of subsection (1) of section 5 and subsection (1) of this section.
 - (3) The owner of an ambulance shall immediately on becoming aware of the cancellation of an insurance policy in respect of the ambulance notify the commission of the cancellation.
 - (4) Upon cancellation of an insurance policy or reduction in the amount of insurance required under clause (h) of subsection (1) of section 5, the licence of the owner shall be automatically revoked unless he satisfies the commission that another insurance policy in compliance with clause (h) of subsection (1) of section 5 was in effect at the time of the cancellation or reduction.
8. Each application for renewal of a licence shall be deemed to be a new application; and the applicant shall comply with clause (h) of subsection (1) of section 5 and subsection (1) of section 7.
9.
 - (1) The commission
 - (a) shall, on application for a licence for an ambulance service, or renewal thereof, cause to be inspected each ambulance used in the operation thereof, and the equipment in the ambulance and the premises in which the ambulance is kept; and
 - (b) may cause to be inspected at any time any ambulance and the equipment therein.
 - (2) Following an inspection under subsection (1) the commission shall cause a copy of the report of the inspection to be delivered or mailed to the owner of the ambulance.
 - (3) The commission may revoke or cancel the licence of any person who obstructs the inspection of, or supplies false or misleading information relating to, an ambulance.
10.
 - (1) The owner shall ensure that the driver of each ambulance operated in connection with the ambulance service has an adequate supply of "Information and Dispatch" forms to record the information required in Schedule D.
 - (2) The driver of an ambulance shall complete an "Information and Dispatch" form (Schedule D) in duplicate as soon as practicable after each call; and shall file both copies with the owner.
 - (3) The owner shall make available the record obtained by him from the driver under subsection (2) for inspection by the commission, or its duly appointed representative at any reasonable time; and shall file one copy with the commission within seventy-two hours of receipt of the request thereof from the commission.
 - (4) The owner and the driver of each ambulance shall comply with subsections (1), (2), and (3), as the case may be, insofar as they apply to him, even though the patient dies before being transported therein, or dies at any time after the ambulance is summoned but prior to the delivery of the patient to the hospital.

11. (1) Each person who is employed or engaged as, or assists in the operation of an ambulance as, a driver, attendant, or attendant-driver shall apply to the commission for a licence; and shall file with the commission such information in respect of the application as the commission may require.

(2) The application shall be in the form set out in Schedule E; and the applicant shall supply with the application two affidavits as to his character from persons who have known the applicant for at least two years immediately preceding the date of the application.

(3) The applicant shall keep the commission notified of any change of his address.
12. (1) The commission, upon the approval of the application for a licence under section 11, may issue a licence to the applicant if the commission is satisfied that
 - (a) the applicant is not addicted to the use of intoxicating liquors or narcotics, and is not otherwise unfit to hold such a licence;
 - (b) in the case of an attendant or attendant-driver, that he is in possession of a valid and subsisting certificate of the St. John Ambulance first aid course, or an equivalent certificate acceptable to the commission; and
 - (c) he has an adequate knowledge of
 - (i) the location of hospitals in the area in which he will be operating the ambulance;
 - (ii) the geography, including the highway and street systems of that area;
 - (iii) laws and regulations relating to traffic;
 - (iv) emergency hospital procedure;
 - (v) the use of radio dispatching equipment.
(2) Subject to section 13, a licence issued under subsection (1), is valid for a period expiring on the thirty-first day of December of the year in respect of which it is issued.
13. (1) Subject to subsections (2) and (6), the commission may, suspend or revoke a licence at any time for non-compliance with this regulation, or for any other cause that, in the opinion of the commission, might adversely affect the safety and proper care of a patient.

(2) Where the commission is considering the suspension or revocation of a licence, it shall, at least ten days before determining the matter serve a notice upon the person whose licence may be affected; and the notice shall state a time and place at which that person may appear in person and have the opportunity to make any representation as to why his licence should not be suspended or revoked.

(3) A notice under subsection (2) may be served personally upon the person whose licence is affected or it may be sent to him by registered mail addressed to him at his address as it appears on the records of the commission.

- (4) Where, after an inquiry, the commission is satisfied that cause has been shown that the licence should be suspended or revoked, it may
- (a) suspend the licence for such period of time and subject to such conditions as the commission may deem fit; or
 - (b) revoke the licence.
- (5) Where a licence is suspended or revoked, the commission shall forthwith notify in writing the person whose licence is suspended or revoked by registered mail addressed to him at his address as it appears in the records of the commission setting out the reasons for the suspension or revocation.
- (6) The commission shall not suspend or revoke a licence unless the licensee has had the opportunity to appear before the commission and be heard in the matter as provided herein.
- (7) Where, after an inquiry, a licence has been suspended or revoked by the commission, the person affected by the decision of the commission may appeal against the decision to the minister.
- (8) A person appealing to the minister against the decision of the commission under subsection (4) shall, within ten days of the receipt of the notification of the decision of the commission, serve on the minister and the commission by registered mail a notice of appeal.
- (9) The minister may
- (a) confirm; or
 - (b) quash;
- the decision of the commission; or
- (c) vary any conditions relating to the suspension of the licence; or
 - (d) reduce the time for which the licence has been suspended;
- and the commission shall carry out the order made by the minister.
14. Subject to clause (h) of subsection (1) of section 5 and to subsection (3) of section 6, the commission may, where it deems it to be necessary in the interest of public health or public safety, issue a provisional licence to the owner of an ambulance notwithstanding that the ambulance does not comply with clause (b) of subsection (1) of section 5.
15. (1) The owner, driver, attendant, and attendant-driver of an ambulance already operating in the province when this regulation comes into force, shall comply with this regulation within nine months from the date on which it comes into force.
- (2) The commission may, in any particular case where it considers that compliance with subsection (1) will cause any unnecessary hardship, grant an exemption for such period as the commission deems reasonable.

APPENDIX B

1. Avoidable Death

A common discounting formula to be applied to a stream of returns is:

$$V = \frac{R}{i} \left[1 - \frac{1}{(1+i)^n} \right],$$

where:

V = present value of a stream of returns

R = returns per year

i = the discount rate

n = the number of years over which the stream of returns occurs.

However, this approach assumes the returns to appear at the end of each year. With regard to some types of earnings streams, it is conjecture as to when the returns might emerge, but in the case of earnings from labour, the assumption of payment twice monthly is reasonable. Therefore, the following formula, which allows for this modification, will be used:

$$\frac{1}{(1+i)^{P-1}} \cdot R \cdot \frac{a}{np},$$

where:

$$\frac{a}{np} = \frac{1}{i} \left[1 - \frac{1}{(1+i)^{np}} \right]$$

np = the number of years.

The term "life expectancy" refers to the average number of years an individual can expect to live from the age which he has currently attained, based on the mortality rate for his particular group; it is designated as e_{x}^{on} and read: the expectation of life or average remaining life of individual n at age x. In this appendix, e_{x}^{on} may at times be followed by (N) indicating that it is the normal life expectancy as opposed to a revised (R) life expectancy which may be relevant where the mortality rate for the group in question has been altered by an exogenous variable.

TABLE A-1

FIVE AVOIDABLE TRAFFIC DEATHS IN
METROPOLITAN WINNIPEG, 1966

(Age in years)

Case	Age	Sex
1	67	F
2	66	F
3	68	M
4	24	F
5	62	M

Source: Dr. David Bruser, "Some Thoughts on the Emergency Care of Accident Victims", Unpublished working papers, Manitoba, 1966.

(a) Case 4.

(Only those cases in which the victim was under 65 years of age are considered relevant in terms of lost production.) Case 4 was a female aged 24 years with average expected earnings estimated arbitrarily at \$6,000.00 per year in real 1966 dollars. Allowing for a 4% probability of unemployment, her earnings will be \$5,760.00 annually.

$$e_{24}^{o4}(N) = 53.49 \text{ years}$$

End of working life: age 65 years.

Number of working years remaining: 41.

The stream of total lost earnings discounted to 1966 =

$$\frac{i}{(1+i)^{p-1}} \cdot R \cdot \frac{a}{41} = \frac{.05}{(1.00203499)-(1)} \cdot \frac{5760}{24} \cdot 17.294368 =$$

$$\frac{.05}{.00203499} \cdot 240 \cdot 17.294368 = \underline{\$101,981.441016}.$$

Therefore, total lost human life years = 53.49, and total lost productive life years = 41.00.

(b) Case 5.

Case 5 was a male aged 62 years with average expected earnings estimated arbitrarily at \$8,000.00 annually in real 1966 dollars. Allowing for the appropriate expected employment rate, earnings will total \$7,680.00 per year.

$$e_{62}^{o5}(N) = 15.49 \text{ years.}$$

End of working life: age 65 years.

Number of working years remaining: 3.

The stream of total lost earnings discounted to 1966 =

$$\frac{1}{(1+i)^{p-1}} \cdot R \cdot \frac{a}{3} = \frac{.05}{(1.00203499)-(1)} \cdot \frac{7680}{24} \cdot 2.723248 =$$

$$24.57 \cdot 320 \cdot 2.723248 = \underline{\$21,411.266058}.$$

Therefore, total lost human life years = 15.49, and total lost productive life years = 3.00.

(c) Case 1.

$$e_{67}^{01}(N) = 15.24 = \text{total lost human life years.}$$

(d) Case 2.

$$e_{66}^{02}(N) = 15.97 = \text{total lost human life years.}$$

(e) Case 3.

$$e_{68}^{03}(N) = 11.91 = \text{total lost human life years.}$$

(f) Summary.

1. The total lost stream of earnings attributable to avoidable death discounted to 1966:

Case 4:	\$101,981.441016
Case 5:	<u>21,411.266058</u>
	\$123,392.707074

However, as was noted in Chapter I, only 81.82% of this amount fairly can be attributed to inadequacy of the ambulance service. Therefore, the total lost stream of earnings attributable to the ambulance industry discounted to 1966 = \$100,959.9128674.

2. Total lost human life years attributable to avoidable death:

Case 1	15.24
Case 2	15.97
Case 3	11.91
Case 4	53.49
Case 5	<u>15.49</u>
	112.10 years

Therefore, total lost human life years attributable to the ambulance system:

$$(112.10) \cdot (81.82\%) = 91.72022 \text{ years.}$$

3. Total lost productive life years attributable to avoidable death:

Case 4	41.00
Case 5	<u>3.00</u>
	44.00 years.

Therefore, total lost productive life years attributable to the ambulance industry:

$$(44.00) \cdot (81.82\%) = 36.0008 \text{ years}$$

2. Paraplegia

A certain number of paraplegic cases occurs yearly. In Manitoba, this amount tends toward an annual average of approximately 14.4. Of these, only a certain number are dealt with by professional ambulance facilities from Winnipeg; this number tends toward an average of approximately 2.6 yearly. This information is provided in Tables A-2 and A-3 below.

TABLE A-2

MANITOBA: NEW INJURIES^a

	1964	1965	1966	1967	1968	1969	1970
Quadriplegia	3	10	10	4	2	10	9
Paraplegia	<u>14</u>	<u>6</u>	<u>10</u>	<u>7</u>	<u>2</u>	<u>6</u>	<u>8</u>
Total	17	16	20	11	4	16	17

Average: 14.42

^aThe listings under "New Injuries" in this table and in Table A-3, refer to traumatic injuries only. They do not include cord tumors, congenital malformations or malignancies affecting the spinal cord.

Source: Canadian Paraplegic Association (Central Western Division) Winnipeg, 1971.

TABLE A-3

METROPOLITAN WINNIPEG: NEW INJURIES

	1966	1967	1968	1969	1970
Quadriplegia and Paraplegia	3	2	1	3	4

Average: 2.6

Source: Canadian Paraplegic Association (Central Western Division) Winnipeg, 1971.

Data from 1966, a fairly representative year and one which corresponds closely to the year in which Dr. Bruser conducted his study of avoidable death, are used.

The incidence of paraplegia imposes costs upon society. The percentage of paraplegics caused by inadequate ambulance care has been estimated to be 6.51%⁴³. Therefore, all direct and indirect explicit costs resulting from each of the three paraplegic cases are calculated, and 6.51% of this amount is attributed to inadequacy of the ambulance industry. This should constitute a reasonably acceptable estimate of the avoidable injury component of the social burden.

The utilization of medical resources is estimated as the discounted stream of medical expenditures attributable to each paraplegic case. Lost production is estimated as the discounted stream of gross earnings that an individual was prevented from earning. In order to calculate these values, knowledge of the life expectation of the cases

43. See Chapter I, page 16.

under study is necessary: the life expectancy of paraplegics and quadriplegics tends to diverge from the norm of the population generally.

Doctors Jousse, Wynne-Jones, and Breithaupt⁴⁴ have studied 965 patients suffering from traumatic transverse myelitis over the past years to determine their life expectancies; four age groups, 20, 30, 40, and 50 years, were studied.

The mortality rate in patients with traumatic paraplegia seen at a rehabilitation centre (Lyndhurst Lodge, Toronto) varies with the extent of the disease. In partial paraplegics it is almost the same as the expected mortality rate; in partial quadriplegics it is almost twice the expected rate; in complete paraplegics it is almost four times the expected rate; and in complete quadriplegics it is almost twelve times the expected rate.⁴⁵

Conclusions were based on the 1965 Mortality Tables for Canada.

Of the three cases studied below, two are complete quadriplegics and one is a complete paraplegic. Therefore, the two mortality rate alterations of 12 times and 4 times respectively are relevant. Calculation of the life expectancy was carried out in the following manner. The age at the time of injury was noted. The corresponding l_x (number surviving out of 100,000 life births) and q_x (probability of death in each successive year) were also noted. Then the q_x 's at each successive age were revised according to the higher mortality rates of 12 times and 4 times, the resulting values in each case being subtracted from 1 to yield a revised p_x for each age (probability of life in each successive year). The revised p_x 's, i.e.: $p_x, p_{x+1}, p_{x+2} \dots p_{x+n}$ were, in turn,

44. A. T. Jousse, M.D., F.R.C.P.(C), Megan Wynne-Jones, M.D., and D. J. Breithaupt, M.D., "A Follow Up Study of Life Expectancy and Mortality in Traumatic Transverse Myelitis", The Canadian Medical Association Journal, Vol. 98 (April 10, 1968) p. 770-772.

45. Ibid., p. 772.

used to calculate new l_x 's for each successive age by multiplying the l_x 's by the corresponding p_x 's, i.e.: $p_x \cdot l_x = l_{x+1}$; $p_{x+1} \cdot l_{x+1} = l_{x+2}$; ...; $p_{x+(n-1)} \cdot l_{x+(n-1)} = l_{x+n}$. Carrying the calculation to the end of the life table, the $l_{(x+n)}$'s were totalled. In turn, the total $l_{(x+n)}$'s were multiplied by the reciprocal of the l_x corresponding to the starting age. When $\frac{1}{2}$ was added to this value, $e_{x, on}$, or the complete expectation of life for individual n at age x, was attained; this is less than that for the standard group. The data must be viewed with the minor qualification that, while the ages of the people involved were 18 years and 56 years, the categories of the study by A. T. Jousse et al. did not correspond exactly, their categories being 20, 30, 40, and 50 years.

Paraplegics have a lower life expectancy than normal individuals from the same age group because they are more susceptible to diseases and other problems. This factor accounts for their greater use of medical resources as well. Presented below is a list of the causes of death and illness among paraplegics based upon 94 deaths among 599 paraplegics sampled; the relative importance of each in death is indicated.

TABLE A-4

AILMENTS RELATED TO TRAUMATIC PARAPLEGIA
AND THEIR RELATIVE IMPORTANCE
AS A CAUSE OF DEATH

(In %)

Renal failure	42.5
Cardiovascular disease	9.6
Gastrointestinal tract	10.6
Pneumonia	8.5
Infected pressure sores	7.4
Neoplasm	4.3
Cerebrovascular accident	5.3
Tuberculosis	2.1
Peritonitis	1.1
Pulmonary edema	1.1
Accidental death	1.1
Unknown	6.4
Total	100.00

Source: D. J. Breithaupt, M.D., A. T. Jousse, M.D.,
and Megan Wynne-Jones, M.D., "Late Causes of
Death and Life Expectancy in Paraplegia",
The Canadian Medical Association Journal,
Vol. 5 (July 8, 1961) p. 73-77.

The three paraplegic cases of 1966, designated as Individuals I, II, and III, are discussed and the total explicit economic cost attributable to each is calculated in turn. The costs are then aggregated and corrected for their relevance to the ambulance industry.

Paraplegic victims tend to follow three basic patterns of development. Some are able to re-establish themselves, partially or wholly, as productive members of the community, others remain almost completely dependent upon society, and others, because of complications, unfortunately die. In the present case, Individual I has more or less re-established herself, Individual II is dependent, and Individual III has died.

Individual I

Individual I, a female, was 18 years of age when injured in 1966; her occupation was that of student. The life expectancy for a normal 18 year old female computed from Canadian Mortality Tables for 1965-67 is 59.30 in total. However, Individual I, a complete paraplegic, will have a mortality rate of 4 times the norm, yielding a total life expectancy of 44.16518 according to the formula:

$$e_x^n = \frac{1}{2} + \frac{1}{q_x^n} \left[q_{x+1}^n + q_{x+2}^n + q_{x+3}^n + \dots \infty \right],$$

where:

$$q_{x+1}^n = q_x^n (1 - q_x^n) \text{ and}$$

q_x^n is altered to take account of the higher mortality rate described earlier.

There are at least five basic cost components involved in any paraplegic case: initial hospitalization costs, lost production, medical supplies and other extra-ordinary living costs, welfare payments, and the cost of prolonged hospital care and treatment of ensuing complications common to the paraplegic. Each component is analyzed in turn.

1. Initial Hospitalization.

Basic hospital costs per day range from just over \$60.00 to just under \$40.00 excluding sundry expenses for special drugs, medical supplies, and external consultation. In the cases under review, these latter costs are seldom aggregated to obtain a complete value and the cost payments that have been accounted for, due to their confidential nature, are not accessible. Accordingly, a basic hospital cost of \$50.00 per day will be assumed. Individual I's length of stay in hospital is presented in Table A-5.

TABLE A-5

HOSPITAL TIME

(In Days)

Winnipeg General Hospital	63	(1966)
Manitoba Rehabilitation Hospital	136	(1966)
Manitoba Rehabilitation Hospital	5	(1967)
Manitoba Rehabilitation Hospital	<u>8</u>	(1968)
Total	212	

Source: Canadian Paraplegic Association (Central Western Division) Winnipeg, 1971.

Essentially, Individual I was convalescing until the end of 1968.

The 63 days spent in Winnipeg General Hospital are not part of the calculation of costs due solely to paraplegia because they were spent in emergency and intensive care necessitated by the cause of the paraplegia rather than by the effects of paraplegia. The relevant days in hospital and costs are presented in Table A-6.

TABLE A-6

Year	Time	Rate in Dollars	Cost in Dollars
1966	136 days	@ 50	6,800.00
1967	5 days	@ 50	250.00
1968	8 days	@ 50	400.00

Source: Calculations based on Table A-5.

Discounted to 1966, these costs become:

	\$6,800.00
	238.09
	<u>362.81</u>
Total	\$7,400.90

2. Lost Production.

(a) Opportunity cost while convalescing. It will be assumed that Individual I would be capable of earning \$6,000.00 annually on the average until age 65. At a projected employment rate of 96%, her annual earnings would become \$5,760.00.

(b) Lost production due to death. Individual I's life expectancy has been reduced below that which would permit her to retire at age 65. Consequently, the loss during this time must be accounted for.

These two cost components can be computed in one formula. The relevant information is as follows:

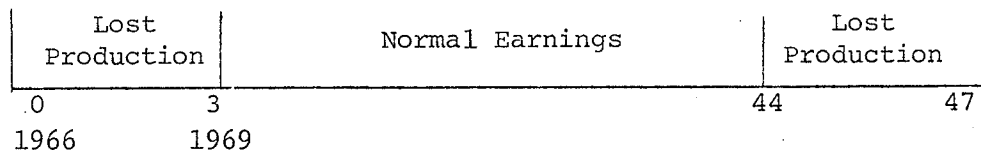
Mortality Rate: $4q_x$ (complete paraplegic)

${}^0e_{18}^{01}(N)$: 59.30 years

${}^0e_{18}^{01}(R)$: 44.16518 years

Consequently, lost production occurs during two periods: from period 0 to period 3 while convalescing, and from period 44 to 47 due to an early death; during the interim, normal earnings are received. This is presented schematically in Figure A-1.

FIGURE A-1



In order to discount the appropriate streams of earnings to 1966, the following formula is used:

$$\left[\frac{i}{(1+i)^{P-1}} \cdot R \cdot a_{\overline{47}|} \right] - \left[\frac{i}{(1+i)^{P-1}} \cdot R \cdot a_{\overline{44}|} \right] + \left[\frac{i}{(1+i)^{P-1}} \cdot R \cdot a_{\overline{3}|} \right]$$

where:

the first bracketted term discounts a stream of earnings from age 18 to normal retirement (0 to 47 in Figure A-1),

the second bracketted term discounts normal achieved earnings from age 18 to early death (0 to 44) and is subtracted from the first term to correct for an overstatement of the costs attributable to paraplegia, and

the third bracketted term discounts a stream of lost earnings from age 18 to 21 (0 to 3) and this is added to the total to correct for an understatement of lost earnings.

The calculation proceeds as follows:

$$\begin{aligned} & \left[\frac{.05}{(1.00203499)-(1)} \cdot \frac{5760}{24} \cdot 17.98011735934 \right] - \\ & \left[\frac{.05}{(1.00203499)-(1)} \cdot \frac{5760}{24} \cdot 17.66277436370 \right] + \\ & \left[\frac{.05}{(1.00203499)-(1)} \cdot \frac{5760}{24} \cdot 2.72324803 \right] = \\ & \left[(24.57) \cdot (240) \cdot (17.98011735934) \right] - \\ & \left[(24.57) \cdot (240) \cdot (17.66277436370) \right] + \\ & \left[(24.57) \cdot (240) \cdot (2.72324803) \right] = \\ & (106,025.1539256) - (104,153.8457232) + (16,058.4488064) = \\ & (1,871.308203) + (16,058.4488064) = \\ & \underline{\$17,929.7570094} = \text{total discounted lost earnings.} \end{aligned}$$

3. Medical Supplies.

Where data about a person's particular living problems and accompanying expenses are not available, it is almost impossible to impute a value. The Canadian Paraplegic Association has not generated such data and so, in this analysis, no attempt will be

made to account for costs over and above those for which reliable information is available.

The total cost of medical appliances and other sundry items for Individual I in 1966 amounted to approximately \$600.00. Assuming, arbitrarily, these items of capital equipment need replacement every 10 years, the cost per year is \$60.00, continuing for 44 years, expenditure taking place every year. The discounted value is computed in the following manner:

$$\left[\frac{i}{(1+i)^{P-1}} \cdot R \cdot \frac{a}{44} \right] = \left[\frac{.05}{(1.050)-(1)} \cdot \frac{60}{1} \cdot 17.66277436370 \right] =$$

$$\left[1 \cdot 60 \cdot 17.66277436370 \right] = \underline{\$1,059.76644} = \text{the total discounted cost to 1966 of medical appliances.}$$

4. Welfare Payments.

Individual I received welfare payments totalling \$1,035.55 from Care Services from 1966 to 1968, an average of \$345.18 per year. The discounted value of this is calculated as follows:

$$\left[\frac{i}{(1+i)^{P-1}} \cdot R \cdot \frac{a}{3} \right] = \left[\frac{.05}{1.00407412-1} \cdot \frac{345.18}{12} \cdot 2.723248 \right] =$$

$$\left[(12.27) \cdot (28.77) \cdot (2.723248) \right] = \underline{\$961.32805815} = \text{the total discounted value to 1966 of welfare payments.}$$

5. Prolonged Hospital Care and Treatment of Ensuing Complications.

Symington and Fordyce⁴⁶ estimate the costs of caring for a

46. D. C. Symington and Wilbert E. Fordyce, "Changing Concepts in the Management of Traumatic Paraplegia," G.P., Vol. 72, No. 3 (September, 1965), p. 140-155.

dependent paraplegic over a 20-year period as \$60,000.00 to \$250,000.00 depending upon the particular case, i.e.: \$3,000.00 to \$12,500.00 annually. The two elements of cost are (1) costs of prolonged hospitalization and (2) the treatment of severe complications which frequently strike paraplegics.

Individual I is only partially dependent and no information is available yet on ensuing complications--however, such ailments are inevitable. Therefore, the expected costs that Symington and Fordyce point out which will be relevant to Individual I will be below this minimum figure of \$3,000.00 annually. It is assumed that the modest figure of \$1,000.00 per year for the life of the patient will be devoted to prolonged care of ensuing complications and will begin after the initial convalescent period is over, i.e.: 1970. This value will include opportunity costs. Therefore:

$$\left[\frac{i}{(1+i)^P - 1} \cdot R \cdot \frac{a}{44} \right] - \left[\frac{i}{(1+i)^P - 1} \cdot R \cdot \frac{a}{4} \right] =$$

$$\left[24.57 \cdot \frac{1000}{24} \cdot 17.6628 \right] - \left[24.57 \cdot \frac{1000}{24} \cdot 3.54595050 \right] =$$

$$(18,079.3983825) - (3,629.5855596) = \underline{\$14,449.8128} = \text{the total prolonged medical costs discounted to 1966.}$$

6. Summary.

The total stream of costs resulting from avoidable paraplegia in the case of Individual I discounted to the year of the injury is presented in Table A-7.

TABLE A-7

Item	Cost in Dollars
Initial Hospitalization	7,400.900
Prolonged Care	14,449.810
Welfare Payments	961.328
Lost Production	17,929.757
Medical Supplies	<u>1,059.766</u>
Total	41,801.561

Source: Previous Sections 1 through 5.

Total lost human life years equal 15.13; total lost productive life years equal 2.83.

Individual II

Individual II, a male and a student, was 18 years of age when injured. His life expectancy data are presented below.

Mortality rate	$12q_x$ (complete quadriplegic)
$e_{18}^{o2}(N)$	53.34 years
$e_{18}^{o2}(R)$	24.33010 years

1. Initial Hospitalization.

TABLE A-8

HOSPITAL TIME

(In days)

St. Boniface Hospital	43 (1966)
Manitoba Rehabilitation Hospital	160 (1966:47; 67:113)
Manitoba Rehabilitation Hospital	31 (1967)
Assiniboine Hospital	100 (1967)
Assiniboine Hospital	166 (1968)
Manitoba Rehabilitation Hospital	26 (1969)
Manitoba Rehabilitation Hospital	<u>8 (1970)</u>
Total	534

Source: Canadian Paraplegic Association (Central Western Division) Winnipeg, 1971.

Essentially, Individual II was convalescing until the end of 1969.

The 43 days spent in St. Boniface Hospital are not part of the calculation of costs due solely to paraplegia--this period of time was spent in emergency and intensive care. Therefore, the relevant days in hospital and costs are presented in Table A-9.

TABLE A-9

Year	Time	Rate in Dollars	Cost in Dollars
1966	47 days	@ 50	2,350.00
1967	244 days	@ 50	12,200.00
1968	166 days	@ 50	8,300.00
1969	26 days	@ 50	1,300.00
1970	8 days	@ 50	400.00

Source: Calculations based on Table A-8.

Discounted to 1966, these costs become:

	\$ 2,350.00
	11,619.04
	7,528.34
	1,122.98
	<u>329.07</u>
Total	\$22,949.43

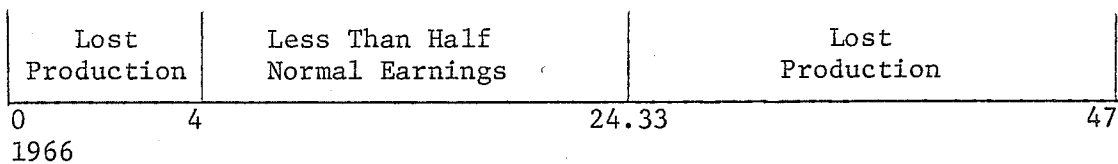
2. Lost Production.

It is assumed that Individual II would have been capable of earning, on the average and over the rest of a normal life span, \$8,500.00 per year in real 1966 dollars. Allowing for a 96% employment rate, this becomes \$8,160.00. However, he is hampered as a quadriplegic in two ways: (1) if he finds employment it is unlikely that he will earn as much as a normal individual; and (2) he has only

a 50% probability of finding employment.⁴⁷

It is assumed that Individual II, as a quadriplegic, would be able to earn \$7,000.00 per year, on the average; allowing for unemployment probabilities this becomes \$6,720.00. However, he has only a 50% chance of earning this, i.e.: he can be expected to earn \$3,360.00 over his remaining life as a quadriplegic. Therefore, his earnings lost while in hospital, 1966-1969, equal \$8,160.00 per year, those lost during his working life equal \$3,360.00, and if he dies before age 65 as a result of paraplegia, he loses \$8,160.00 per year. This is presented schematically in Figure A-2.

FIGURE A-2



$$\text{Therefore, } \left[\frac{i}{(1+i)^{P-1}} \cdot R \cdot \frac{a}{47} \right] - \left[\frac{i}{(1+i)^{P-1}} \cdot R \cdot \frac{a}{24} \right] + \left[\frac{i}{(1+i)^{P-1}} \cdot R \cdot \frac{a}{4} \right],$$

where:

the first bracketted term discounts a stream of normal earnings from age 18 to normal retirement, (0 to 47 in Figure A-2),

the second bracketted term discounts a stream of one-half the lower earnings level resulting from quadriplegia assumed to be earned from age 18 to early death (0 to 24.33), and is subtracted from the first term to correct for an overstatement of the costs attributable to quadriplegia, and

47. Canadian Paraplegic Association.

the third bracketted term discounts a stream of lost earnings during convalescence (0 to 4) and is added to the total to correct for an understatement of lost earnings.

The calculation proceeds as follows:

$$\begin{aligned} & \left[\frac{.05}{(1.00203499)-(1)} \cdot \frac{8160}{24} \cdot 17.98012 \right] - \\ & \left[\frac{.05}{(1.00203499)-(1)} \cdot \frac{3360}{24} \cdot 13.798642 \right] + \\ & \left[\frac{.05}{(1.00203499)-(1)} \cdot \frac{3360}{24} \cdot 3.5459505 \right] = \\ & \left[(24.57) \cdot (340) \cdot (17.98012) \right] - \left[(24.57) \cdot (140) \cdot (13.798642) \right] + \\ & \left[(24.57) \cdot (140) \cdot (3.5459505) \right] = \\ & (150,202.33137) - (47,464.5692) + (12,197.35881) = \\ & (102,737.76217) + (12,197.35881) = \underline{\$114,936.12098} = \text{total lost pro-} \\ & \text{duction discounted to 1966.} \end{aligned}$$

3. Medical Supplies.

As with Individual I, complete data for this cost are not available. The Canadian Paraplegic Association estimates some of the costs as presented in Table A-10.

TABLE A-10

Item	Cost in Dollars
Hand splints	100.00
Electric typewriter	150.00
Wheelchairs	<u>550.00</u>
Total	800.00

Source: Canadian Paraplegic Association,
(Central Western Division)
Winnipeg, 1971.

If it is assumed that these items of capital equipment must be replaced every 10 years, the yearly cost is \$80.00 for an expected

period of 24 years. The resulting stream of costs discounted to 1966 is found in the following manner:

$$\left[\frac{i}{(1+i)^{P-1}} \cdot R \cdot \frac{a}{24} \right] = \left[\frac{.05}{(1.050)-(1)} \cdot \frac{80}{1} \cdot 13.798642 \right] =$$

$$\left[1 \cdot 80 \cdot 13.798642 \right] = \underline{\$1,103.89136} = \text{the total discounted cost to 1966 of medical appliances.}$$

Additionally, \$10.00 per month is spent on non-drug medical supplies, totalling \$120.00 per year beginning in 1966 and continuing for the 24 remaining years of expected life of Individual II. Assuming these costs to occur twice monthly, the stream of such medical supply costs, discounted to 1966, becomes:

$$\left[\frac{i}{(1+i)^{P-1}} \cdot R \cdot \frac{a}{24} \right] = \left[\frac{.05}{(1.00203499)-(1)} \cdot \frac{120}{24} \cdot 13.7986 \right] =$$

$$\left[(24.57) \cdot (5) \cdot (13.7986) \right] = \underline{\$1,695.158} = \text{total discounted medical supply costs.}$$

Therefore, the discounted total of medical supply expenditures upon non-drug supplies and capital equipment equals:

$$\begin{array}{r} \$1,695.158 \\ \underline{1,103.891} \\ \$2,799.049 \end{array}$$

4. Welfare Payments.

Individual II received a disability allowance from April 22, 1967, to December 1, 1969, of \$75.00 per month. These payments totalled \$640.00 in 1967, \$900.00 in 1968, and \$1,000.00 in 1969.

Thereafter, \$175.00⁴⁸ per month were paid and will continue to be paid for the individual's lifetime.

The disability allowance discounted to 1966 equals:

$$\begin{array}{rcl} \frac{640}{(1+i)} + \frac{900}{(1+i)^2} + \frac{1000}{(1+i)^3} & = & \$ \begin{array}{r} 609.52 \\ 816.32 \\ \hline 863.83 \end{array} \\ \text{Total} & & \$2,289.67 \end{array}$$

The continuing welfare payments of \$175.00 per month discounted to 1966 equal:

$$\left[\frac{i}{(1+i)^{p-1}} \cdot R \cdot \frac{a}{24} \right] - \left[\frac{i}{(1+i)^{p-1}} \cdot R \cdot \frac{a}{4} \right],$$

where the first term shows such payments to begin in 1966 and subtraction of the second term corrects for the resulting overstatement of costs. The calculation proceeds as follows:

$$\begin{aligned} & \left[\frac{.05}{(1.00407412)-(1)} \cdot \frac{2100}{12} \cdot 13.79864 \right] - \\ & \left[\frac{.05}{(1.00407412)-(1)} \cdot \frac{2100}{12} \cdot 3.5459505 \right] = \\ & \left[(12.27) \cdot (175) \cdot (13.79864) \right] - \left[(12.27) \cdot (175) \cdot (3.545951) \right] = \\ & (29,629.12974) - (7,614.0433461) = \underline{\$22,015.0863939}. \end{aligned}$$

Therefore:	Disability allowance	\$ 2,289.67
	Continuing payments	<u>22,015.0864</u>
	Total	\$24,304.7564

48. Abstracting from whatever adjustments might occur in fixed transfer payments.

5. Prolonged Hospital Care and Treatment of Ensuing Complications.

Individual II is almost wholly dependent; he is a complete quadriplegic and will be more prone to further disease and physiological malfunction than Individual I. Based on Symington's estimates,⁴⁹ a long-term hospital care cost of \$5,000.00 yearly is assumed, beginning after the initial convalescent stage is over and continuing for 24 years. The costs, discounted to 1966 are:

$$\left[\frac{i}{(1+i)^P - 1} \cdot \frac{5000}{24} \cdot a_{\overline{24}|} \right] - \left[\frac{i}{(1+i)^P - 1} \cdot \frac{5000}{24} \cdot a_{\overline{4}|} \right],$$

where the first bracketted term overstates the cost and subtraction of the second bracketted term corrects for this discrepancy. Therefore, $[(24.57) \cdot (208.33) \cdot (13.7986)] - [(24.57) \cdot (208.33) \cdot (3.54595)] = (70,621.232) - (18,150.547) = \underline{\$52,470.685}$ = total discounted costs to 1966 of prolonged care of complications.

6. Summary.

The total stream of costs resulting from avoidable paraplegia in the case of Individual II discounted to the year of the injury is presented in Table A-11.

TABLE A-11

Item	Cost in Dollars
Initial Hospitalization	22,949.430
Prolonged care	52,470.685
Welfare payments	24,304.756
Lost production	114,936.121
Medical supplies	<u>2,799.049</u>
Total	217,460.041

Source: Previous Sections 1 through 5.

49. See page 180 above.

Total lost human life years equal 29.01; total lost productive life years equal 22.67.

Individual III

Individual III, a male and a labourer, was 56 years of age when injured; he subsequently died at the age of 60 years. His life expectancy data are presented below.

Mortality Rate	$12q_x$ (complete quadriplegic)
${}^o_3e_{56}(N)$	19.64 years
${}^o_3e_{56}(R)$	3.535538 years

1. Initial Hospitalization.

TABLE A-12

HOSPITAL TIME

(In Days)

St. Boniface Hospital	74 (1966)
Manitoba Rehabilitation Hospital	343 (1966:235; 67:108)
St. Boniface Hospital	231 (1967)
St. Boniface Hospital	365 (1968)
St. Boniface Hospital	365 (1969)
St. Vital Hospital	<u>58</u> (1970)
Total	1,436

Source: Canadian Paraplegic Association (Central Western Division), Winnipeg, 1971.

At the end of the hospital time listed, Individual III died. The initial 74 days spent in St. Boniface Hospital are not part of the calculation of costs attributable solely to paraplegia, for they were spent for other purposes. Therefore, the relevant days in hospital and costs are presented in Table A-13.

TABLE A-13

Year	Time	Rate in Dollars	Cost in Dollars
1966	235 days	@ 50	11,750.00
1967	339 days	@ 50	16,950.00
1968	365 days	@ 50	18,250.00
1969	365 days	@ 50	18,250.00
1970	58 days	@ 50	2,900.00

Source: Calculations based on Table A-12.

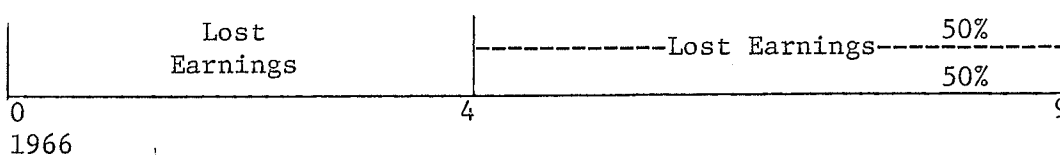
Discounted to 1966, these costs become:

	\$11,750.000
	16,142.850
	16,553.288
	15,765.036
	<u>2,385.840</u>
Total	\$62,597.014

2. Lost Production.

It is assumed that Individual III would have been capable of earning, on the average over the rest of a normal life span, \$7,000.00 in real 1966 dollars. At a 96% employment rate, this becomes \$6,720.00. His earnings pattern is presented schematically in Figure A-3.

FIGURE A-3



The Canadian Paraplegic Association has conjectured that the cause of death was 50% due to paraplegia and 50% due to separate health problems--hence the dotted line in Figure A-3: only half of lost potential earnings from age 60 to age 65 would be due to paraplegia. If that were actually the case, the formula for discounting

would appear as follows:

$$\left[\frac{i}{(1+i)^{P-1}} \cdot \frac{6720}{24} \cdot a_{\overline{9}|} \right] - \left[\frac{i}{(1+i)^{P-1}} \cdot \frac{3360}{24} \cdot a_{\overline{9}|} \right] +$$

$$\left[\frac{i}{(1+i)^{P-1}} \cdot \frac{3360}{24} \cdot a_{\overline{4}|} \right], \text{ stating that full earnings from age 56 to}$$

65 are discounted, then half earnings from age 56 to 65 are subtracted to allow for the fact that lost earnings due to death from paraplegia constitute only 50% of the full value, and finally, half earnings from age 56 to death at 60 are added to correct the understatement of loss. However, Individual III, in his 56th year, when injured, then had a revised life expectancy of 3.54 years, i.e.: he died when the probability said he would. Therefore, the opinion of the Canadian Paraplegic Association appears to be inaccurate; apparently death was due solely to paraplegia and full earnings from age 60 to 65 are to be discounted as follows:

$$\left[\frac{i}{(1+i)^{P-1}} \cdot R \cdot a_{\overline{9}|} \right] = \left[\frac{.05}{(1.00203499)-(1)} \cdot \frac{6720}{24} \cdot 7.10782168 \right] =$$

$$\left[(24.57) \cdot (280) \cdot (7.10782168) \right] = \left[(24.57) \cdot (1,990.1896) \right] =$$

$$\underline{\$48,898.958472} = \text{total lost earnings discounted to 1966.}$$

3. Medical Supplies.

The only data available with regard to medical supplies are those dealing with appliances required by Individual III; these are presented in Table A-14:

TABLE A-14

Item	Cost in Dollars
Cervical collar and hand splints	100.00
A. D. L. aids and E. and J. wheelchair	<u>405.00</u>
Total	505.00

Source: Canadian Paraplegic Association (Central Western Division) Winnipeg, 1971.

Assuming such equipment must be replaced every 10 years, the yearly cost is \$50.50 for an actual period of almost four years. The resulting costs discounted to 1966 are:

$$\left[\frac{i}{(1+i)^{P-1}} \cdot R \cdot a \right] = \left[\frac{.05}{(1.050)-(1)} \cdot \frac{50.50}{1} \cdot 3.5459505 \right] =$$

$$\left[(1) \cdot (50.50) \cdot (3.5459505) \right] = \left[(1) \cdot (179.07050025) \right] = \underline{\$179.071}.$$

For Individual III, there are no costs to be listed under categories 4 or 5.

6. Summary.

The total stream of costs resulting from avoidable paraplegia in the case of Individual III discounted to the year of the injury is presented in Table A-15.

TABLE A-15

Item	Cost in Dollars
Initial Hospitalization	62,597.014000
Lost production	48,898.958472
Medical supplies	<u>179.071000</u>
Total	111,675.043472

Source: Previous calculations.

Total lost human life years equal 15.64; total lost productive life years equal 5.00.

Summary: The Total Social Burden
Attributable to Paraplegia

The total stream of costs resulting from avoidable paraplegia imposed upon society and discounted to 1966 is presented in Table A-16.

TABLE A-16

Individual	Cost in Dollars
Individual I	41,801.561
Individual II	217,460.041
Individual III	<u>111,675.043</u>
Total	370,936.645

Source: Previous calculations.

However, only 6.51% of this amount fairly can be attributed to the ambulance industry.⁵⁰ Therefore, the total stream of costs resulting from paraplegia and directly attributable to the ambulance industry discounted to 1966 is \$24,149.97. Total lost human life years attributable to paraplegia equal 59.78; total lost human life years attributable to the ambulance industry equal 3.89. Total lost productive life years attributable to paraplegia equal 30.50; total lost productive life years attributable to the ambulance industry equal 1.99.

3. The Total Social Burden

Both avoidable death and avoidable injury and their accompanying costs have been analyzed. The avoidable death cost attributable

50. See Chapter I, p. 16.

to the ambulance industry in 1966 is \$100,959.91. The avoidable injury cost attributable to the ambulance industry is \$24,149.98. The total social burden imposed upon society in 1966 as the result of inadequate ambulance facilities is \$125,109.89. Moreover, lost human life years total 95.61 and lost productive life years total 37.99.

BIBLIOGRAPHY

LITERARY SOURCES

1. Advisory Committee on Hospital Insurance & Diagnostic Services. Report of the Working Party on Ambulance Services to the Sub-Committee on Quality of Care and Research. Ottawa, April 13, 1972.
2. Ambulance Service Committee, G. L. Pickering (Chairman). Report on Ambulance Services, Province of Manitoba. Queen's Printer, Manitoba, 1965.
3. American College of Surgeons, The Committee on Trauma. Emergency Care. Robert H. Kennedy, M.D. (Editor). W. B. Saunders Company, 1969.
4. Bain, Joe S. Industrial Organization (Second Edition). John Wiley and Sons Inc., New York, 1968.
5. Bator, Francis M. "The Anatomy of Market Failure". Quarterly Journal of Economics, Vol. 72, No. 3 (August, 1958) p. 351-379.
6. Blaug, Mark. A Selected Annotated Bibliography in the Economics of Education. University of London, Institute of Education, London, 1964.
7. Breithaupt, D. J., M.D., A. T. Jousse, M.D., and Megan Wynne-Jones, M.D. "Late Causes of Death and Life Expectancy in Paraplegia". The Canadian Medical Association Journal, Vol. 85 (July 8, 1961) p. 73-77.
8. Bruser, David M., M.D., F.R.C.S. (C). "Some Thoughts on the Emergency Care of Accident Victims". Unpublished working papers, Manitoba, 1966.
9. Chamberlin, E. H. The Theory of Monopolistic Competition (Eighth Edition). Harvard University Press, Cambridge, Massachusetts, 1965.
10. City of Winnipeg. By-law 19613, Section 40 A.
11. Dernburg, T. F., and Duncan M. McDougall. Macro-Economics, The Measurement, Analysis, and Control of Aggregate Economic Activity (Second Edition). McGraw-Hill Book Co., New York, 1963.

12. Dominion Bureau of Statistics. Life Tables, Canada and Provinces 1965-1967 (Catalogue No. 84-527). Queen's Printer, Ottawa, 1971.
13. Due, John F. Government Finance: Economics of the Public Sector (Fourth Edition). Richard D. Irwin, Homewood, Illinois, 1968.
14. Economic Council of Canada. Sixth Annual Review, Perspective 1975. Queen's Printer, Ottawa, September, 1969.
15. Elson, Reginald, M.B., B.CH., F.R.C.S. Practical Management of Spinal Injuries for Nurses. E. and S. Livingstone Ltd., Edinburgh and London, 1965.
16. Geisler, W. O., M.D., M. Wynne-Jones, M.D., and A. T. Jousse, M.D. "Early Management of the Patient with Trauma to the Spinal Cord". Medical Services Journal Canada, Vol. 22 (July-August, 1966) p. 512-522.
17. Hay, Rankin (Chairman), W. M. Loughheed, and Gilles Bertrand. Paraplegic Care in Canada, Report of a Sub-Committee of the Canadian Neurological Society. June, 1969.
18. Hotelling, Harold. "The General Welfare in Relation to Problems of Taxation of Railway and Utility Rates". Econometrica, Vol. 6, No. 3 (July, 1938) p. 242-269.
19. Jousse, A. T., M.D., F.R.C.P. (C), Megan Wynne-Jones, M.D., and D. J. Breithaupt, M.D. "A Follow-up Study of Life Expectancy and Mortality in Traumatic Transverse Myelitis". The Canadian Medical Association Journal, Vol. 98 (April 20, 1968) p. 770-772.
20. Klarman, H. E. The Economics of Health. Columbia University Press, New York and London, 1967.
21. Long, Millard F. "Collective-Consumption Services of Individual-Consumption Goods: Comment". Quarterly Journal of Economics, Vol. 71, (May, 1967) p. 351-352.
22. Manitoba Federation of Labour. Legislative Submission to Premier and Cabinet. Winnipeg, January 30, 1973.
23. Manitoba Hospital Commission. Suggested Standards of Vehicles, Medical and Rescue Equipment, First-Aid Material, and Report Forms for Ambulance Organizations. September, 1969.
24. Manitoba Medical Association. "Brief on Ambulance Services in Metropolitan Winnipeg and the Province of Manitoba with a Suggested Scheme for their Re-organization". Manitoba, 1965.

25. Manitoba. Revised Statutes. "The Highway Traffic Act",
Ch. H60.
26. Manitoba. Revised Statutes. "The Public Health Act", Regulation
8/71. February 4, 1971.
27. Mansfield, E. Micro-Economics, Theory and Applications. W. W.
Norton and Company Inc., New York, 1970.
28. National Institute for Neurological Diseases and Blindness, Dr.
P. Bucy (Chairman). "Paraplegic Workshop", Report of Proceedings
in Paraplegia News (December, 1968) p. 8.
29. Prest, A. R. and P. Turvey. "Cost Benefit Analysis: A Survey".
Economic Journal, Vol. 75 (December, 1965) p. 683-735.
30. Rolf, Earl R., and George F. Break. "The Welfare Aspects of Excise
Taxes". Journal of Political Economy, Vol. 57, No. 1 (February,
1949) p. 46-54.
31. Royal Australasian College of Surgeons, E. S. R. Hughes, D. G.
Macleish, A. R. Waterhouse, J. K. Clarebough (Organizing and
Editorial Committee). The Management of Road Traffic
Casualties, Proceedings of the First Seminar, October, 1969.
McCarron Bird Pty. Limited, May, 1970.
32. Ryan, W. J. L. Price Theory. Macmillan, London, St. Martins Press,
New York, 1967.
33. Sheppard, N. E. and D. C. Baillie. Compound Interest. University
of Toronto Press, Toronto, 1965.
34. Symington, D. C., M.B., Ch.B., and Wilbert E. Fordyce, Ph.D.
"Changing Concepts in the Management of Traumatic Paraplegia".
G.P., Vol. 72, No. 3 (The American Academy of General
Practice, September, 1965) p. 140-155.
35. Turvey, R. (Editor). Public Enterprise. Penguin Books. Richard
Clay (The Chaucer Press) Ltd., Bungay, Suffolk, 1968.
36. Weisbrod, Burton A. "Collective-Consumption Services of Individual-
Consumption Goods". Quarterly Journal of Economics, Vol. 78
(August, 1964) p. 471-477.
37. Weisbrod, Burton A. "Investing in Human Capital". A paper
prepared for the National Conference on Canadian Goals,
Fredericton, September 9-12, 1964.

COMMUNICATIONS

1. Chapman, C. G., Provincial Ambulance Officer, Manitoba Health Services Commission, Government of Manitoba. December 23, 1970; July 29, 1971. File: A8-00-00.
2. Dunmall, G., A/Superintendent. City of St. James-Assiniboia Police Department, Winnipeg. July 13, 1971.
3. Lowry, J. A., Education Specialist, Department of Health and Social Development (Education Services), Government of Manitoba. February 17, 1971.
4. Mann, T., Executive Director and M. Thomson, M.S.W., Canadian Paraplegic Association (Central Western Division) Winnipeg. July 7, 23, August 9, 12, 1971.
5. Shewan, C., Chief, City of Winnipeg Fire Department. January 20, 1971.
6. Sutton, E. G., A/Superintendent, City of Winnipeg Police Department. July 21, 1971.
7. Williamson, H. G., Chief, City of East Kildonan Fire Department. July, 1971.