THE PATTERNS OF PRESCRIPTION PATRONAGE

BY

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Chapter I

INTRODUCTION

This study is an attempt to gain some insight into the patronage patterns of customers who obtain prescribed medication from a community pharmacy. Applebaum distinguished the buying behavior patterns of customers from the buying habits of customers as follows, "Each customer has his or her own buying habits. Buying behavior patterns represent the design of behavior of a large number of customers."[1]

This study analyzes the implied buying behavior patterns of prescription purchasers.

Current Need of the Study

Although the provision of pharmaceutical services is a professional function as well as a retail function, the importance of a good location for a pharmacy is evident. The patient and pharmacist must have easy access to each other if the former is to utilize readily the services of the latter.

With reference to the importance of location in retailing, Ratcliff stated, "The importance of location in retailing is fundamental, for in a large degree merchants succeed or fail as their locations within the city structure

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1. William Applebaum, "Studying Customer Behavior in Retail Stores", Journal of Marketing, XVI, 2 (October, 1951) p. 172.

are favorable or unfavorable. Literally billions of dollars are staked on the selecting of proper locations for retail outlets. Skillful merchandising can modify but not extinguish the handicap of an inappropriate site."[2]

Commenting on the same subject, Nelson said, "Retail-store businesses are virtually all market oriented...the retailer must be accessible to people, and it is this fact that governs site selection."[3]

With reference to the ancillary services of pharmacy, Rolph commented, "Perhaps no kind of retail business is more sensitive to good or faulty location than the drug store."[4]

It is reasonable to assume that these comments on retail site selection are applicable to the selection of a location for the offering of pharmaceutical services.

The increasing importance of pharmaceutical services to the successful operation of a pharmacy is well known. In 1941, about 13% of the total revenue of Lilly Digest pharmacies was obtained from the dispensing of prescribed medication. By 1961 over 35% of the total revenue of

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2. Richard U. Ratcliff, The Problem of Retail Site Selection, Michigan Business Studies, IX, 1, University of Michigan, School of Business Administration, Bureau of Business Research, 1939, p. 1.

3. Richard L. Nelson, The Selection of Retail Locations, New York: F. W. Dodge Corp., 1958, p. 44.

4. I. K. Rolph, "Drug Store Location", Journal of the American Pharmaceutical Association, XXIII, 7 (July, 1934) p. 701.

Lilly Digest pharmacies was obtained from this source.[5]

A pharmacist who is planning to establish a new pharmacy or to change the location of an existing pharmacy makes a critical decision when he selects the location for the pharmacy. In order to evaluate the adequacy of a proposed location, one should have some knowledge of the patronage patterns of the anticipated customers. Speaking in general terms, Cohen and Applebaum said, "What is especially needed is information on shopping centers and individual store trading areas, on drawing power, on customer shopping habits, and on share of the market realized in relation to potential."[6]

A knowledge of prescription patronage patterns is also helpful in other areas of community pharmacy management. For example, a pharmacist who is planning an advertising campaign should have some knowledge of the location and concentration of his actual and potential customers if he is to select the most efficient method of communicating his advertising message.

Related Studies of Interest

Jones stated, "In general consumers will patronize the store most conveniently located for them."[7]

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5. F. C. Hecker, Ed., The Lilly Digest -- 30th Annual Edition, Indianapolis: Eli Lilly and Co., 1961, pp. 42-43.

6. Saul B. Cohen and William Applebaum, "Evaluating Store Sites and Determining Store Rents", Economic Geography, XXXVI, 1 (January, 1960) p. 35.

7. Fred M. Jones, Principles of Retailing, New York: Pitman, 1949, p. 172.

Consumer patronage studies have indicated that the convenience of a pharmacy's location is an important determinant of pharmacy patronage.

A series of annual customer interviews has been conducted under the sponsorship of the Burgoyne Index, Inc. In each of these studies, customers were requested to select the factor which they considered most important in selecting a favorite pharmacy. Convenient location was selected as the most important factor by more than two out of five respondents in the first three studies and by almost one out of four in the 1962 study.[8]

When asked, "Why do you shop here?", 58.4% of the 567 customers interviewed in six pharmacies in a southern city mentioned convenience, either in relation to location or parking facilities, as one of the reasons.[9]

In relation to prescription patronage motives, Ohvall concluded that "convenient location" was generally the most prominent single patronage motivating factor, although in most cases a combination of "personnel factors" and

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8. Ben L. Schapker, Annual Survey of Drug Store Shopping Habits, Cincinnati: Burgoyne Grocery and Drug Index, Inc., 1958.
Ben L. Schapker, Second Annual Continuing Report of Drug Store Shoppers, Cincinnati: Burgoyne Grocery and Drug Index, Inc., 1959.
Ben L. Schapker, Third Annual Continuing Report of Drug Store Shoppers, Cincinnati: Burgoyne Grocery and Drug Index, Inc., 1960.
Ben L. Schapker, Survey of Drug Store Shoppers, Fourth Annual Report, Cincinnati: Burgoyne Index, Inc., 1962.

9. ____, "Convenience, Parking Major Factors in Customer's Choice of Drug Store", Texas Pharmacy, LXXXI, 4 (April, 1962) p. 14. Results of a study by A. W. Jowdy and E. M. Smith, School of Pharmacy, University of North Carolina.

"service" appeared to motivate the majority of prescription patronage.[10]

Approximately four out of ten respondents in a study conducted by the Home Makers Guild of America indicated "convenient location" as one of the reasons for obtaining prescribed medication from a particular type of pharmacy. The proportion of respondents mentioning "convenient location" varied with the type of pharmacy patronized: about 45% of the respondents who patronized an independently operated general pharmacy, about 40% of the respondents who patronized a large corporate chain pharmacy, and about 35% of the respondents who patronized a prescription pharmacy mentioned "convenient location".[11]

Although convenient location appears to be one of the primary resons for patronizing a certain pharmacy, it should be noted that "convenient location" is not a static concept.

For example, consider a hypothetical patient leaving her physician's office after having received a prescription order from the physician. At this point, the pharmacy which is most convenient to the physician's office likely is also most convenient to the patient. As the patient travels from the physician's office to her home, she probably will pass

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10. Richard A. Ohvall, Prescription Patronage Motivation, unpub. M. B. A. paper, University of Wisconsin, 1959.

11. ____, Drug Store Survey, conducted by the Home Makers Guild of America for Owens-Illinois Glass Company, Toledo, undated, p. 5.

near several pharmacies any one of which may be most convenient to her at a given point. If the patient is not in a hurry to obtain the prescribed medication, she may retain the prescription order until she makes her next shopping trip and then obtain the prescribed medication while shopping.

One must, therefore, view the concept of "convenient location" in both a temporal and spatial dimension. A pharmacy may be considered conveniently located for a patient if the pharmacy is easily accessible (spatial) to the patient at the time (temporal) that the patient desires to utilize the services of the pharmacy.

Downs stated an analogous concept in his theory of consumer efficiency: "The central hypothesis of this theory is that consumers seek to minimize the costs of consumption. The basic costs of consumption are money, time, and energy..... These costs are not of the same relative importance to all consumers, or to any one consumer at every moment or concerning all types of shopping."[12]

A few available studies indicate the importance of a location which is convenient to the patient's residence. One study reported that approximately 50% of the respondents obtained prescribed medication from the pharmacy located nearest to their residence. About 45% of the respondents reported making all pharmacy purchases and an additional

12. Anthony Downs, "A Theory of Consumer Efficiency", Journal of Retailing, XXXVII, 1 (Spring, 1961) p. 7.

5% reported obtaining only prescribed medication from the pharmacy located nearest their residence.[13]

In a study reported by Olsen, 57.4% of the respondents stated that the prescribed medication most recently obtained for someone living in the household was obtained from the pharmacy located nearest to the patient's residence.[14]

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13. ____, Shopping Habits of Drug Store Customers, Drug Staff Presentation No. 4, New York: Batten, Barton, Durstine and Osborn, Inc., April, 1951, p. 4.

14. Paul C. Olsen, "Results of Interviews in 110 Households in the Los Angeles Metropolitan Area in January, 1962, on Use of Medicines Dispensed, Ordered, and Prescribed by Physicians Within the Preceding Three Months", mimeo., p. 2. From a speech at the Midwestern Meeting of the Pharmaceutical Manufacturers Association, Chicago, February 13, 1962.

Chapter II

DEFINITION OF TERMS USED IN THIS STUDY

For the purposes of this study, the following definitions are employed:

Community Pharmacy - Any establishment which is recognized as a pharmacy by the respective state board of pharmacy, provided that the pharmaceutical services of the establishment are available to all members of the community. The term "community pharmacy" excludes hospital pharmacies, pharmacies in nursing homes and similar institutions, "mail-order" pharmacies, and closed-door pharmacies the services of which are available only to persons who are members of a certain group.

General Pharmacy - Any community pharmacy which, in addition to offering pharmaceutical services, is engaged in the sale of goods unrelated to this service. The sale of greeting cards, stationery, candy, and similar products is considered as unrelated to the pharmaceutical services offered.

Prescription Pharmacy - Any community pharmacy in which at least 60% of the total revenue is obtained from the dispensing of prescribed medication, provided that the pharmacy is not a general pharmacy.

The following definitions apply to the location of a

pharmacy within the commercial developmental structure of a city. The commercial developmental structure of a city best can be thought of as a continuum of commercial activity, ranging from the downtown area with a high degree of commercial activity through the secondary and tertiary areas to the neighborhood shopping area with a relatively low degree of commercial activity. The points (shopping areas) on this continuum do not necessarily represent the geographic location of the different shopping areas. For example, secondary shopping areas do not necessarily surround the downtown area but usually are found as nucleations geographically dispersed throughout the city.

The definitions presented are for purposes of classification only. Since the commercial developmental structure best can be thought of as a continuum, no distinct point exists where one classification ends and the next classification begins.

The following definitions apply to the major groupings used to classify pharmacies for the purposes of this study:

Downtown Area - The major shopping area of a city. Its center usually contains a plot of land which is more valuable (in terms of dollars per square foot) than any other plot in the city. The downtown area extends in all directions from this center to either a transitional zone between commercial and residential areas or to some natural barrier such as a river.

Secondary Shopping Area - A group of stores selling

both convenience goods and shopping goods. In this respect, the stores are similar to those found in the downtown area. However, in a secondary shopping area the stores are generally smaller, the selection of goods is more limited, and the sale of convenience goods is relatively more important than in the downtown area.

Tertiary Shopping Area - A group of stores primarily engaged in the sale of convenience goods, but containing a few establishments which sell shopping goods. The stores are generally smaller than those in the secondary shopping areas, the number of stores selling shopping goods is smaller than the number of stores selling convenience goods, and the selection of goods is more limited than in the secondary shopping areas.

Neighborhood Shopping Area - A group of stores or an isolated store which is not a part of a larger retail grouping. Stores located in neighborhood shopping areas are primarily engaged in the sale of convenience goods.

The following definitions apply to the subgroupings used to classify pharmacies for the purposes of this study:

Central Business District of the Downtown Area - The area of highest land valuation, characterized by a high concentration of retail businesses and offices and having a relatively high pedestrian traffic flow.

Fringe Area of the Downtown Area - An area surrounding the central business district. It usually consists of

warehouses, wholesalers, light manufacturing establishments, and multi-family dwellings. Its outer perimeter consists of a transitional zone between the major business area and the residential areas of the city.

Traditional Shopping Development - A "ribbon" or "string" development of stores located on either side of a main thoroughfare. These developments usually are not under single ownership or control and usually little provision is made for parking.

Planned Shopping Center Development - A building or group of buildings, usually under single ownership or control. The buildings house retail and service establishments. A large amount of free parking is available adjacent to the buildings.

Prescription Order - An order from a licensed medical practitioner directing a pharmacist to dispense some specified medication. A medical practitioner who is authorized by law to prescribe medication may originate a prescription order in writing or by verbal communication with a pharmacist. In this study, prescription orders are limited to those written orders or written records of oral orders which appear in the prescription records of the community pharmacies in the study. As used in this study, the term "prescription order" includes only original prescription orders and excludes orders which merely authorize a pharmacist to renew a previous prescription order.

Prescribed Medication - The therapeutic agent which a pharmacist dispenses as a result of an original prescription order.

Patient - The person for whom a prescribed medication is intended. It is assumed that each prescription order represents an individual patient. Thus, if more than one prescribed medication was dispensed for an individual person, this person is considered as more than one patient.

Patient Distance - The distance in miles between the patient's residence and the community pharmacy in which the patient's prescribed medication was dispensed.

Prescriber Distance - The distance in miles between the office of a prescriber who originated a prescription order and the community pharmacy in which prescribed medication was dispensed as a result of this order.

Patient-Prescriber Distance - The distance in miles between a patient's residence and the office of the prescriber who originated a prescription order for this patient.

Local Prescription - A prescription order which is associated with both a patient distance and a prescriber distance which are each less than 0.75 miles.

Prescription for a Local Patient - A prescription order which is associated with a patient distance less than 0.75 miles.

Prescription from a Local Prescriber - A prescription order which is associated with a prescriber distance less

than 0.75 miles.

Emergency Medication - Prescribed medication which is either an anti-infective intended for internal use or an analgesic (unless the analgesic is a salicylate or other mild analgesic).

Maintenance Medication - Prescribed medication which is a tranquilizer (but not a sedative); a vitamin or vitamin combination; a therapeutic agent (other than aspirin) used in the treatment of chronic arthritis; or a therapeutic agent used in the treatment of chronic diabetes mellitus or a chronic cardiovascular disease.

Unclassified Medication - Prescribed medication which is not included in the definition of "emergency medication" or "maintenance medication".

Prescriptions for the Least Distant Patients - Prescription orders for the approximate 25% of the patients whose residences are least distant from the individual pharmacy in which the patients' prescribed medications were dispensed. See pages 44-45 for a further description and the method of selecting these prescription orders.

Prescriptions for the Most Distant Patients - Prescription orders for the approximate 25% of the patients whose residences are most distant from the individual pharmacy in which the patients' prescribed medications were dispensed. See pages 44-45 for a further description and the method of selecting these prescription orders.

Chapter III

METHODOLOGY

The primary data in this study are based on an analysis of information obtained from 2,965 prescription orders. The prescribed medication associated with each of these orders was dispensed during the period August 12th through August 25th of 1962, in thirty-three community pharmacies which were located in two mid-western cities.

Research Design

The following information was recorded from each prescription order in the study:

Address of Patient's Residence
Name of Prescriber
Address of Prescriber's Office
Name of the Prescribed Medication
Charge to the Purchaser for the Pharmaceutical Service

In addition, if the information was available, the date on which the prescription order was authorized by the prescriber and the date on which the prescribed medication was dispensed by the pharmacist were recorded.

Each prescription was analyzed individually and the following information determined:

Distance* from the patient's residence to the community pharmacy in which the prescribed medication was dispensed

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*Using maps of the two test cities, all distances were measured as straight lines.

Distance from the prescriber's office to the community pharmacy in which the prescribed medication was dispensed
Distance from the patient's residence to the prescriber's office
Therapeutic classification of the medication prescribed
Number of days between the time the prescription order was authorized by the prescriber and the time the prescribed medication was dispensed by the pharmacist (if this information was available)
Apparent patronage pattern

A coded numerical value was assigned to each of these observations and the coded values were transferred to punched cards ("IBM cards"). Each of the 2,965 cards also received an identification number. The punched cards were analyzed utilizing an IBM 083 sorter to obtain various cross-classifications from the available information.

Sample Selection

The selection of the two test cities was based on convenience to the author and on the comparability of the cities with regard to the variables of population, number of households, income of households, number of drug outlets, and volume of sales by drug outlets. The range of the values of these variables for the two test cities are indicated in Table I.

General pharmacies and prescription pharmacies in each of the test cities were classified in one of the following categories:

1. General Pharmacies Located in the Downtown Area
2. General Pharmacies Located in Secondary Shopping Areas
3. General Pharmacies Located in Neighborhood Shopping Areas

Table I

SOME CHARACTERISTICS OF THE TEST CITIES

(Each of the values given is a range which included the value of the variable for each city)

Population (Estimated as of December 31, 1961).....130,000-136,000

Number of Households (Estimated as of December 31, 1961).....40,400-40,700

Annual Cash Income of Households (1961).....

Cash Income of Households	Percentage of Households
$0-$2,499	14.4%-15.1%
$2,500-$3,999	11.9%-14.2%
$4,000-$6,999	33.6%-37.0%
$7,000-$9,999	16.2%-17.4%
$10,000 and over	19.2%-21.0%

Number of Drug Outlets (As of December 31, 1961).....46-53

Total Annual Sales of Drug Outlets (1961)...$9.9-$10.2 (million)

Source of Data: "Survey of Buying Power", Sales Management, Vol. 88, No. 12 (June 10, 1962).

4. General Pharmacies Located in Tertiary Shopping Areas

5. Prescription Pharmacies

Four pharmacies in each city were selected to be included in the sample for each of the five major groupings for a total of 40 pharmacies. Permission to utilize the prescription records for an academic study was obtained from the owner or other authoritative representative of each of the forty pharmacies. Later, it was determined that data from seven of these pharmacies was incomplete in that the patient's address was recorded on only a small proportion of the prescription orders. For this reason, these seven pharmacies were not retained in the sample.

Four of the five major groups of pharmacies were divided into the following subgroups:

1. General Pharmacies Located in the Downtown Area
   A. General Pharmacies in the Central Business District
   B. General Pharmacies in the Fringe Area of the Downtown Area

2. General Pharmacies Located in Secondary Shopping Areas
   A. General Pharmacies in Traditional Shopping Developments
   B. General Pharmacies in Planned Shopping Center Developments

3. General Pharmacies Located in Tertiary Shopping Areas
   A. General Pharmacies in Traditional Shopping Developments
   B. General Pharmacies in Planned Shopping Center Developments

4. General Pharmacies Located in Neighborhood Shopping Areas-----No subgroups were formed

5. Prescription Pharmacies
   A. Prescription Pharmacies in the Downtown Area
   B. Prescription Pharmacies Outside of the Downtown Area

An attempt was made to obtain data from a probability sample of 100 prescription orders in each pharmacy. A further restriction on the sampling procedure was that the prescription orders represent prescribed medication dispensed during the two-week survey period.*

If the population of prescriptions for a pharmacy was greater than 100, a systematic probability sampling procedure was used to select the prescription orders for inclusion in the sample. The following will serve to illustrate this procedure:

The number of prescription orders in the population of prescriptions for each pharmacy was determined by subtracting the serial number ("prescription number") of the prescription order which represented the first prescribed medication dispensed during the survey period from the serial number of the prescription order which represented the last prescribed medication dispensed during the survey period. This number was rounded to the next lowest hundred and the result divided by 100. For example, if 430 prescription orders were included in the population of prescriptions for a pharmacy, the number 430 was rounded to 400 and divided by 100 to obtain 4.

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* Prescription orders representing prescribed medication dispensed by a pharmacy during the two-week survey period hereafter are referred to as the "population of prescriptions" for that pharmacy.

The resulting number determined that every n'th (in this example, every 4th) prescription order was to be included in the sample.

Some number between one and n was selected randomly. This number determined the first prescription order to be included in the sample. For example, if the number 2 was selected, then the second prescription order from the population of prescriptions was the first order to be included in the sample. Every n'th prescription order following the first order selected was included in the sample.

A similar procedure was used to eliminate some prescription orders from the sample so that the final sample contained exactly 100 prescription orders. For example, selecting every 4th prescription order beginning with the second order would have resulted in a sample of n=108 if the population of prescriptions contained 430 prescription orders. The eight excess prescription orders were eliminated by removing every 13th order from the sample. The first order to be eliminated was determined by randomly selecting a number between one and thirteen.

If the patient's address was not recorded on the selected prescription order, the following order was included in the sample in place of the originally selected prescription order.

If the population of prescriptions for a pharmacy included less than 100 prescription orders, all prescription

orders which were in the population of prescriptions and which contained all of the required information were included in the sample.

The breakdown of the final sample used in the study is illustrated in Table II.

Table II

NUMBER OF PHARMACIES AND PRESCRIPTION ORDERS IN THE SAMPLE

Type of Pharmacy (By Location)	Number of Pharmacies	Number of Prescription Orders
1.a. General Pharmacies in the Central Business District	2	168
1.b. General Pharmacies in the Fringe of the Downtown Area	4	247
2.a. General Pharmacies in Secondary Traditional Shopping Developments	4	355
2.b. General Pharmacies in Secondary Planned Shopping Center Developments	3	300
3.a. General Pharmacies in Tertiary Traditional Shopping Developments	4	370
3.b. General Pharmacies in Tertiary Planned Shopping Center Developments	4	400
4. General Pharmacies in Neighborhood Shopping Areas	7	625
5.a. Prescription Pharmacies in the Downtown Area	2	200
5.b. Prescription Pharmacies Outside of the Downtown Area	3	300
Total	33	2,965

Chapter IV

ANALYSIS OF FINDINGS

The analysis of the data obtained from approximately three thousand prescription orders indicated that certain types of community pharmacies were characterized by one of two general patronage patterns. The first of these has been termed the "prescriber oriented" pattern and characterized prescription pharmacies and general pharmacies located in the downtown area. The second of these patterns has been termed the "patient oriented" pattern and characterized most general pharmacies located outside of the downtown area.

A third pattern which was suggested by the data has been termed the "shopper oriented" pattern. This pattern was found in general pharmacies located in planned shopping centers.

A more complete analysis is presented in the following pages.

Patient Distance

The median* patient distance associated with the 2,965 prescription orders in the study was 0.90 miles. This is interpreted as meaning that for approximately one-half of the prescription orders in the study the

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* For the calculation of this median value, see Appendix A.

distance between the patient's residence and the pharmacy in which the patient's prescribed medication was dispensed was 0.90 miles or less.

An indication of the dispersion of the observed values was obtained from the values of the first and third quartiles*. The first quartile is a value such that approximately 25% of the observations have a value equal to or less than the value of the first quartile. The value of the first quartile associated with the prescription orders in the study was 0.38 miles.

The third quartile is a value such that approximately 75% of the observations have a value equal to or less than the value of the third quartile. The value of the third quartile associated with the prescription orders in the study was 2.04 miles.

Thus, approximately 25% of the prescription orders in the study were associated with a patient distance of 0.38 miles or less; approximately 50% were associated with a patient distance of 0.90 miles or less; and approximately 75% were associated with a patient distance of 2.04 miles or less. This means that for the "central" 50% of the observations (those observations in which the patient distance was equal to or greater than the value of the first quartile but equal to or less than the value of the third quartile) the patient distance was equal to or between

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* For the calculation of these quartile values, see Appendix A.

0.38 miles and 2.04 miles.

To determine if the distribution of patient distances was independent of the type of pharmacy in which the prescribed medication was dispensed, the following hypothesis was tested: The distribution of patient distances is independent of the group in which the pharmacies were classified. The chi square test for independence* was applied to the data from the five major groups of pharmacies at the following patient distance levels: less than 0.25 miles, 0.25 to 0.99 miles, 1.00 to 1.99 miles, and 2 miles or greater. These levels were selected because they divided the sample into four approximately equal proportions and because each of the four classes contained an integral number of classes as the data were coded for IBM tabulation. It is believed that this provides more accurate analysis than would be obtained if values were interpolated within the coded classes.

At the 95% confidence level, $X^2_{0.95}$ (df=12) = 21.03. The chi square value for the sample being tested was 338.11. Since 338.11 exceeded 21.03, the hypothesis of independence was rejected and it was concluded that the distribution of patient distances was dependent on the group in which the pharmacies were classified.

Table III shows the median patient distances which were associated with each of the groups, subgroups, and

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* For a sample calculation and explanation of the chi square test for independence, see Appendix B.

Table III

PATIENT DISTANCES ASSOCIATED WITH PRESCRIPTION ORDERS
(All Values Expressed in Miles)

All Prescription Orders.....1st Quartile------0.38
Median----------0.90
3rd Quartile------2.04

Prescription Orders from Groups of Pharmacies	Prescription Orders from Subgroups of Pharmacies (all values are medians)	Prescription Orders from Individual Pharmacies (all values are medians)	
Prescription Pharmacies	Downtown----------2.06	2.22	1.97
1st Quartile----0.99	Outside of	2.92	1.12
Median----------1.83	Downtown----------1.70	1.33	
3rd Quartile----3.46			
General Pharmacies			
Downtown Area	Central Business		
1st Quartile----0.61	District----------1.70	2.46	1.42
Median----------1.36			
3rd Quartile----2.61	Fringe Area----------1.20	1.62	1.04
		1.08	0.52
Secondary Shopping Area	Planned Shopping	1.46	0.79
1st Quartile----0.31	Center----------1.17	1.26	
Median----------0.74	Traditional Shopping	0.62	0.46
3rd Quartile----1.74	Development----------0.52	0.60	0.43
Tertiary Shopping Area	Planned Shopping	1.41	0.66
1st Quartile----0.32	Center----------0.72	0.80	0.53
Median----------0.64	Traditional Shopping	0.99	0.37
3rd Quartile----1.45	Development----------0.51	0.62	0.22
Neighborhood Shopping		0.97	0.37
Area		0.95	0.22
1st Quartile----0.23	(No Subgroups)------0.64	0.95	0.18
Median----------0.64		0.53	
3rd Quartile----1.44			

individual pharmacies in the study.

The median patient distances were quite variable. They ranged from 0.18 miles for one pharmacy to 2.92 miles for another pharmacy. However, several important relationships were found to exist.

Among the median patient distances for groups of pharmacies, the highest median patient distance (1.83 miles) was associated with prescription pharmacies.

The median patient distances of general pharmacies declined throughout the commercial developmental structure of the city from the downtown area, through secondary and tertiary shopping areas, to the neighborhood shopping areas. The highest median for a group of general pharmacies (1.36 miles) was associated with pharmacies in the downtown area. The next highest group median (0.74 miles) was associated with general pharmacies located in secondary shopping areas, and the lowest group medians (0.64 miles) were associated with general pharmacies located in tertiary and neighborhood shopping areas.

Of the median patient distances for subgroups of pharmacies, the highest subgroup median (2.06 miles) was associated with prescription pharmacies located in the downtown area. The next highest subgroup median (1.70 miles) characterized both prescription pharmacies outside of the downtown area and general pharmacies located in the central business district. General pharmacies located in the fringe of the downtown area had the third highest

subgroup median (1.20 miles).

The median patient distances for subgroups of general pharmacies located in planned shopping centers were 1.17 miles for secondary centers and 0.72 miles for tertiary centers. Both of these medians were greater than the medians associated with the corresponding subgroups of general pharmacies located in traditional shopping developments.

The median patient distance for general pharmacies located in neighborhood shopping developments was slightly higher than the medians for general pharmacies located in secondary traditional groupings and tertiary traditional groupings.

The median patient distances for individual pharmacies in the study were quite variable. There are many factors which might be expected to affect the median patient distance for an individual pharmacy. These include factors such as the location and competitive strength of nearby pharmacies, the personality of the pharmacist, the non-professional services (such as delivery and credit) offered by the pharmacy, and the type and amount of promotion conducted by the pharmacy.

In spite of the large degree of variability, there was a tendency for the median patient distances for individual pharmacies to decline throughout the continuum of the commercial developmental structure from the downtown to neighborhood shopping areas. This tendency is demonstrated

by Chart A in which the median patient distances associated with individual pharmacies have been plotted.

Since the data in the survey were obtained from pharmacies located in two different cities, it is possible that the median patient distances for pharmacies surveyed in one test city differ significantly from the median patient distances for pharmacies surveyed in the other test city. The following hypothesis was tested using the Wald-Wolfowitz Runs Test*: The median patient distances associated with individual pharmacies are independent of the city in which the pharmacy is located. Since there was insufficient evidence to reject this hypothesis at the 95% confidence level, it was assumed that the median patient distances were not influenced significantly by the city in which the pharmacy was located.

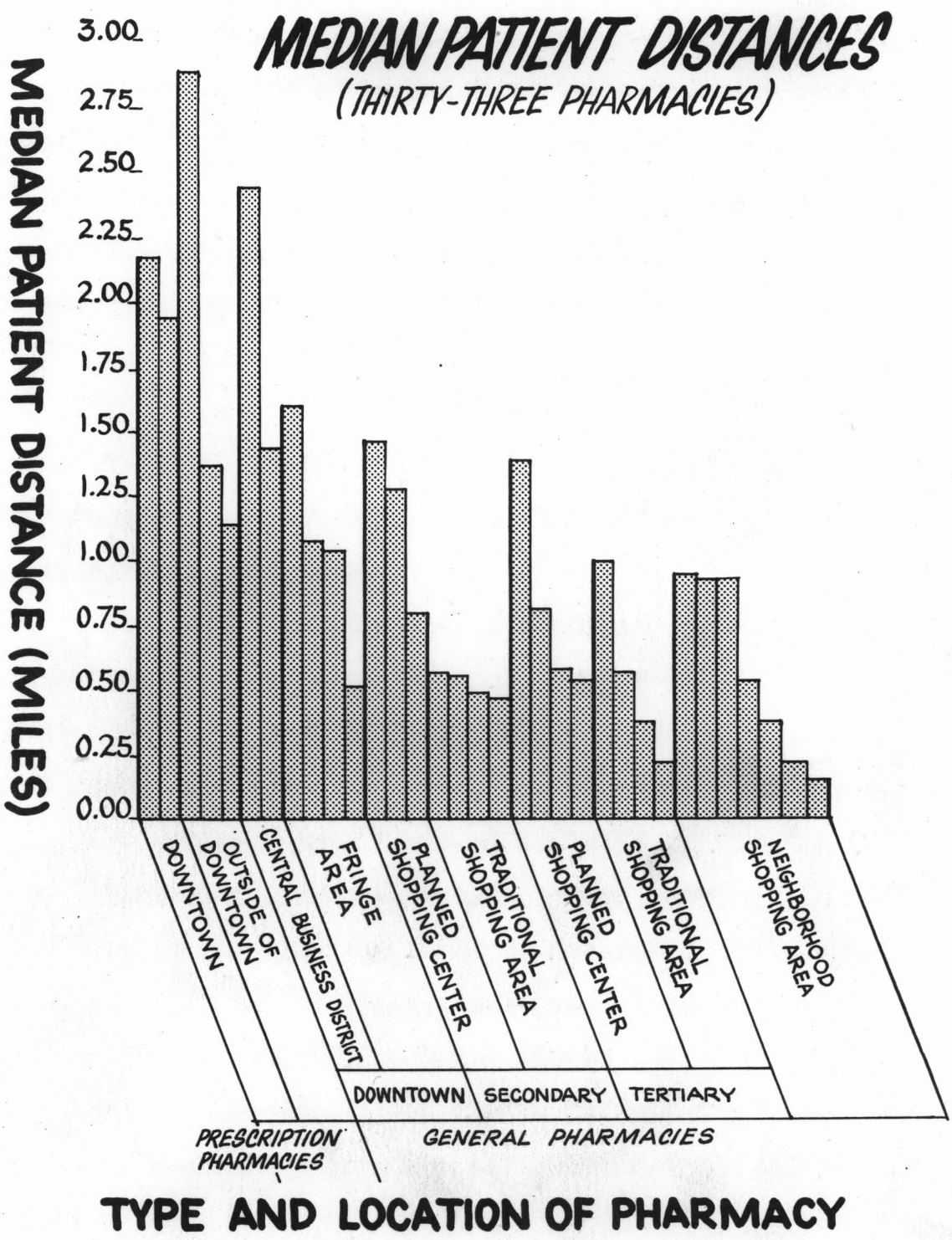
Prescriber Distance

The median prescriber distance associated with the 2,965 prescription orders in the study was 1.27 miles. The first quartile had a value of 0.22 miles and the third quartile had a value of 2.54 miles.

The lowest median prescriber distances for groups of pharmacies were associated with prescription pharmacies, which had a median prescriber distance of 0.14 miles, and with general pharmacies in the downtown area, which had a median prescriber distance of 0.29 miles. The relatively

* For an explanation of the Wald-Wolfowitz Runs Test and the test of this hypothesis, see Appendix C.

Chart A


MEDIAN PATIENT DISTANCES
(THIRTY-THREE PHARMACIES)
MEDIAN PATIENT DISTANCE (MILES)
3.00
2.75
2.50
2.25
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
DOWNTOWN
OUTSIDE OF DOWNTOWN
CENTRAL BUSINESS DISTRICT
FRINGE AREA
PLANNED SHOPPING CENTER
TRADITIONAL SHOPPING AREA
PLANNED SHOPPING CENTER
TRADITIONAL SHOPPING AREA
NEIGHBORHOOD SHOPPING AREA
DOWNTOWN
SECONDARY
TERTIARY
PRESCRIPTION PHARMACIES
GENERAL PHARMACIES
TYPE AND LOCATION OF PHARMACY

low values may be related to the fact that pharmacies in these groups usually are located near prescribers' offices.

For the major groupings of general pharmacies, the median patient distances increase throughout the commercial developmental structure of the city from the downtown area to neighborhood areas. General pharmacies in secondary shopping areas had a group median of 1.73 miles, those in tertiary shopping areas had a group median of 1.80 miles, and those in neighborhood shopping areas had a group median of 1.82 miles.

Table IV shows the median prescriber distances which were associated with the groups, subgroups, and individual pharmacies in the study.

The median prescriber distances for groups of pharmacies were related inversely to the median patient distances for groups of pharmacies. High median prescriber distances were associated with low median patient distances and vice versa at this level of analysis.

Several exceptions to this general statement were observed at the subgroup level of analysis. For general pharmacies in the downtown area, those located in the central business district had a higher median patient distance than those located in the fringe of the downtown area. The median prescriber distances for these subgroups retained this relationship, the higher median prescriber distance (0.45 miles) was associated with general pharmacies in the central business district and the lower median

Table IV

PRESCRIBER DISTANCES ASSOCIATED WITH PRESCRIPTION ORDERS
(All Values Expressed in Miles)

All Prescription Orders.....1st Quartile-----0.22
Median----------1.27
3rd Quartile-----2.54

Prescription Orders from Groups of Pharmacies	Prescription Orders from Subgroups of Pharmacies (all values are medians)	Prescription Orders from Individual Pharmacies (all values are medians)	
Prescription Pharmacies	Downtown----------0.14	0.16	0.13
1st Quartile----0.07	Outside of	0.20	0.13
Median----------0.14	Downtown----------0.14	0.13	
3rd Quartile----0.22			
General Pharmacies			
Downtown Area	Central Business		
1st Quartile----0.13	District----------0.45	0.46	0.24
Median----------0.29			
3rd Quartile----1.27	Fringe Area----------0.23	1.04	0.23
		0.42	0.14
Secondary Shopping Area	Planned Shopping	3.50	1.55
1st Quartile----0.77	Center----------2.83	2.75	
Median----------1.73	Traditional Shopping	1.81	0.98
3rd Quartile----3.00	Development----------0.98	1.00	0.41
Tertiary Shopping Area	Planned Shopping	2.92	1.89
1st Quartile----1.11	Center----------2.52	2.64	1.87
Median----------1.80	Traditional Shopping	2.30	1.16
3rd Quartile----2.94	Development----------1.24	1.41	1.11
Neighborhood Shopping Area		2.20	1.86
1st Quartile----0.91	(No Subgroups)----------1.82	2.16	1.07
Median----------1.82		1.94	0.74
3rd Quartile----2.69		1.91	

prescriber distance (0.23 miles) was associated with general pharmacies in the fringe of the downtown area.

The other exception which occurred at this level of analysis was between general pharmacies located in planned shopping centers and those located in traditional shopping developments. The higher median patient distances and the higher median prescriber distances were associated with general pharmacies located in planned shopping centers in both the secondary and tertiary categories.

The median patient distances and the median prescriber distances for groups and subgroups of pharmacies are compared in Table V.

To determine if a relationship existed between the median prescriber distances and the median patient distances for the individual pharmacies in the study, the following hypothesis was tested using the coefficient of rank correlation*: There is no relationship between the median prescriber distances and the median patient distances for the individual pharmacies in the study.

If the hypothesis was correct, a coefficient of rank correlation equal to zero would be expected. For the data in the study, a coefficient of rank correlation equal to -0.41 was obtained. Therefore, the hypothesis of no relationship was rejected and it was concluded that an inverse relationship existed between the median prescriber distances and the median patient distances for the individual pharmacies in the study.

* For an explanation of the coefficient of rank correlation and the testing of this hypothesis, see Appendix D.

Table V

COMPARISON OF MEDIAN PRESCRIBER DISTANCES AND MEDIAN PATIENT DISTANCES

Groups of Pharmacies	Median Prescriber Distance (in miles)	Median Patient Distance (in miles)
Prescription Pharmacies	0.14	1.83
General Pharmacies:		
Downtown Area	0.29	1.36
Secondary Area	1.73	0.74
Tertiary Area	1.80	0.64
Neighborhood Area	1.82	0.64
Subgroups of Pharmacies		
Prescription Pharmacies		
Downtown	0.14	2.06
Outside of Downtown	0.14	1.70
General Pharmacies:		
Downtown Area		
Central Business District	0.45	1.70
Fringe Area	0.23	1.20
Secondary Area		
Shopping Center	2.83	1.17
Traditional	0.98	0.68
Tertiary Area		
Shopping Center	2.52	0.72
Traditional	1.24	0.51
Neighborhood Area	1.82	0.64

Patient-Prescriber Distance

The median patient-prescriber distance associated with the 2,965 prescription orders in the study was 2.16 miles. The first quartile had a value of 1.18 miles and the third quartile had a value of 3.44 miles.

Table VI shows the median patient-prescriber distances which were associated with the groups, subgroups, and individual pharmacies in the study.

For each of the five major groups of pharmacies, the median patient-prescriber distance exceeded the median patient distance. The two values were closest for prescription pharmacies, which had a median patient-prescriber distance of 1.98 miles and a median patient distance of 1.83 miles. General pharmacies in the downtown area had a median patient-prescriber distance of 1.68 miles and a median patient distance of 1.36 miles.

This finding, along with the relatively low median prescriber distances associated with pharmacies of these types, indicated that prescription pharmacies and general pharmacies located in the downtown area were "prescriber oriented" rather than "patient oriented". That is, for these types of pharmacies a location convenient to prescribers' offices appeared to be more important than a location convenient to patients' residences.

For general pharmacies located in secondary, tertiary, and neighborhood shopping areas, the median patient-prescriber distances were approximately three times the

Table VI

PATIENT-PRESCRIBER DISTANCES ASSOCIATED WITH PRESCRIPTION ORDERS
(All Values Expressed in Miles)

All Prescription Orders.....1st Quartile-----1.18
Median----------2.16
3rd Quartile-----3.44

Prescription Orders from Groups of Pharmacies	Prescription Orders From Subgroups of Pharmacies (all values are medians)	Prescription Orders from Individual Pharmacies (all values are medians)	
Prescription Pharmacies	Downtown----------2.04	2.16	1.95
1st Quartile----1.12	Outside of	2.93	1.33
Median----------1.98	Downtown----------2.13	1.77	
3rd Quartile----3.85			
General Pharmacies			
Downtown Area	Central Business		
1st Quartile----0.85	District----------2.10	2.36	1.79
Median----------1.68			
3rd Quartile----2.91	Fringe Area---------1.55	1.74	1.41
		1.44	1.12
Secondary Shopping Area	Planned Shopping	3.38	2.44
1st Quartile----1.07	Center----------3.04	2.90	
Median----------2.04	Traditional Shopping	2.19	1.54
	Development---------1.24	1.58	1.25
Tertiary Shopping Area	Planned Shopping	5.22	2.43
1st Quartile----1.32	Center----------2.91	2.96	2.20
Median----------2.34	Traditional Shopping	2.84	1.60
3rd Quartile----3.52	Development---------1.75	2.00	1.36
Neighborhood Shopping Area		3.17	2.21
1st Quartile----1.30	(No Subgroup)-------2.40	2.64	1.97
Median----------2.40		2.34	1.11
3rd Quartile----3.38		2.28	

corresponding median patient distances. This finding, along with the relatively high median prescriber distances associated with pharmacies in these locations, indicated that general pharmacies in secondary, tertiary, and neighborhood shopping areas were patient oriented rather than prescriber oriented.

An analysis of the data by subgroups of pharmacies showed that the highest median patient-prescriber distances were associated with general pharmacies located in planned shopping centers. A median value of 3.08 miles was associated with the general pharmacies in secondary planned shopping centers and a median value of 2.91 miles was associated with general pharmacies in tertiary planned shopping centers.

For one subgroup, prescription pharmacies in the downtown area, the median patient-prescriber distance (2.04 miles) was less than the median patient distance (2.06 miles). The difference between these medians is, however, very small.

An analysis of the data from individual pharmacies showed that the median patient-prescriber distance exceeded the median patient distance for thirty of the thirty-three pharmacies studied. The three exceptions were pharmacies in the downtown area, two of these were prescription pharmacies and one was a general pharmacy. In all three cases, the difference between the two medians for each pharmacy was 0.1 miles or less.

Local Patient and Prescriber Prescriptions

An alternative method of analyzing prescription patronage patterns is to construct a circle around each pharmacy at some arbitrary limit and determine what proportion of the prescription orders originated within this circle (either because the patient's residence was located within this circle or because the prescriber's office was located within this circle).

This procedure was followed using each pharmacy as the center of a circle with a radius of 0.75 miles. The results of this analysis for the various subgroups of pharmacies are shown in Table VII.

The results of this analysis support the previous suggestion that general pharmacies located in the downtown area and prescription pharmacies are prescriber oriented rather than patient oriented. In all four subgroups of these two groups, "convenience" to the prescriber's office rather than "convenience" to the patient's residence appeared to be the more important determinant of prescription patronage. More than 50% of the prescribed medications dispensed in pharmacies in each of these subgroups were the result of a prescription order from a local prescriber.

For general pharmacies located in traditional shopping developments in secondary, tertiary, and neighborhood shopping areas, "convenience" to the patient's residence appeared to be the more important determinant of prescription patronage. More than 50% of the prescribed medications

Table VII

LOCAL PATIENT AND PRESCRIBER PRESCRIPTIONS BY SUBGROUPS OF PHARMACIES

Subgroups of Pharmacies	Local Prescriptions*	Prescriptions for a Local Patient*	Prescriptions from a Local Prescriber*	All Other Prescriptions*	Sample Size
Prescription Pharmacies					
Downtown Area	7.5%	10.5%	86.5%	10.5%	200
Outside of Downtown	12.3%	16.3%	86.3%	9.7%	300
General Pharmacies					
Downtown					
Central Business District	10.1%	17.8%	56.5%	35.7%	168
Fringe Area	22.7%	36.5%	68.4%	17.8%	247
Secondary Area					
Shopping Center	1.7%	36.0%	3.0%	62.7%	300
Traditional	28.2%	63.4%	45.4%	19.4%	355
Tertiary Area					
Shopping Center	3.8%	52.8%	7.0%	44.0%	400
Traditional	13.0%	62.2%	21.4%	29.5%	370
Neighborhood Area	11.7%	56.0%	22.7%	33.0%	625
					2,965

*Horizontal percentage totals exceed 100.0% because local prescriptions have been included in three categories. A local prescription is also a prescription for a local patient and a prescription from a local prescriber.

dispensed in pharmacies in each of these subgroups were the result of a prescription order for a local patient.

For general pharmacies located in planned shopping centers, "convenience" to the patient's residence appeared to be more important than "convenience" to the prescriber's office. More than one-third of the prescribed medications dispensed in pharmacies in each of these subgroups were the result of a prescription order for a local patient, while less than 10% were the result of a prescription order from a local prescriber. However, more than 40% were neither the result of prescription orders from a local prescriber nor the result of prescription orders for a local patient.

This finding indicated that the prescription patronage pattern associated with general pharmacies in planned shopping centers was strongly influenced by some factor other than "convenience" to the patient's residence. It is suggested that pharmacies located in planned shopping centers are "shopper oriented". That is, for these types of pharmacies, a location which is "convenient" to stores in which the patient shops is important.

Charges for Pharmaceutical Service

The median charge for pharmaceutical service associated with the prescription orders in the study was $2.94. The first quartile had a value of $1.93 and the third quartile had a value of $4.16.

The following hypothesis was tested: The distribution of charges for pharmaceutical service is independent of the

type or location of the pharmacy in which the prescribed medication was dispensed. The chi square test for independence was applied to the data from the five groups of pharmacies at the following levels: below $2.75, $2.75 to $3.24, and $3.25 or greater. The median value of $2.94 was approximately in the middle of a class ($2.75 to $3.24) as the data were coded for IBM tabulation; therefore it was decided to test the hypothesis of independence at the above levels.

The chi square value for the sample was 15.15. At the 95% confidence level, $X^2_{0.95}$ (df=8) = 15.51. Since the chi square value for the sample was less than 15.51, there was not sufficient evidence to reject the hypothesis of independence at the 95% confidence level. Therefore, it was concluded that the distribution of charges for pharmaceutical service was not dependent on the type or location of the pharmacy in which the prescribed medication was dispensed.

Emergency and Maintenance Medication

The classification of a prescribed medication as "emergency" or "maintenance" is, of course, dependent on the condition being treated. For example, a salicylate might be prescribed for the treatment of chronic arthritis and as such should be classified as maintenance medication. A salicylate might also be prescribed for the treatment of hyperpyrexia and as such should be classified as emergency rather than maintenance medication.

Since the condition being treated could not be determined for each prescription order, the classification of prescribed medication was, in many cases, arbitrary. Prescribed medication which logically could not be classified as either emergency medication or maintenance medication was considered to be "unclassified" medication.

Of the prescription orders studied, 28.1% were classified as orders for emergency medication, 24.5% were classified as orders for maintenance medication, and 47.4% were unclassified.

Table VIII shows the results of this analysis for the subgroups of pharmacies studied.

The proportion of prescription orders for emergency medication in each of the subgroups of the sample was tested against the proportion of orders for emergency medication in the entire sample of 2,965 prescription orders. The following hypothesis was tested at the 95% confidence level using the distribution of sample proportions*: The proportion of prescription orders for emergency medication in each of the subgroups of the sample is not significantly different from 0.281.

The proportion of prescription orders for emergency medication in prescription pharmacies outside of the downtown area (0.347) and in general pharmacies in tertiary

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* For an explanation of this test and its application to this hypothesis, see Appendix E.

Table VIII

EMERGENCY AND MAINTENANCE MEDICATION BY SUBGROUPS OF PHARMACIES

Subgroups of Pharmacies	Emergency Medication	Maintenance Medication	Unclassified	Sample Size
Prescription Pharmacies				
Downtown Area	26.0%	29.5%	44.5%	200
Outside of Downtown	34.7%	17.0%	48.3%	300
General Pharmacies				
Downtown				
Central Business District	22.6%	26.8%	50.6%	168
Fringe Area	22.7%	25.5%	51.8%	247
Secondary Area				
Shopping Center	25.0%	21.0%	54.0%	300
Traditional	28.2%	27.3%	44.5%	355
Tertiary Area				
Shopping Center	33.2%	23.5%	43.2%	400
Traditional	25.4%	24.0%	50.5%	370
Neighborhood Area	29.1%	26.4%	44.5%	625
				2,965

planned shopping centers (0.332) were the only subgroup proportions which differed significantly from 0.281.

It might be assumed that a patient who received a prescription order for emergency medication would obtain the prescribed medication as quickly as possible. If this was true, pharmacies which are prescriber oriented would tend to receive a larger proportion of prescription orders for emergency medication than would pharmacies which are patient oriented. This was true for prescription pharmacies outside of the downtown area, however the other prescriber oriented subgroups contradicted this tendency.

It also might be assumed that a patient who received a prescription order for maintenance medication would not necessarily attempt to obtain the prescribed medication as quickly as possible. If this was true, pharmacies which are patient oriented would tend to receive a larger proportion of prescription orders for maintenance medication than would pharmacies which are prescriber oriented.

The following hypothesis was tested at the 95% confidence level using the distribution of sample proportions: The proportion of prescription orders for maintenance medication in each of the subgroups of the sample is not significantly different from 0.245.

The proportion of prescription orders for maintenance medication in prescription pharmacies outside of the downtown area (0.170) was the only subgroup proportion which differed significantly from 0.245. Therefore, the

data in this study did not support the suggestion that patient oriented pharmacies receive a larger proportion of prescription orders for maintenance medication than did prescriber oriented pharmacies.

Prescriptions for the Least Distant and Most Distant Patients

An analysis was performed to determine if prescription orders associated with relatively low patient distances differed in any measurable aspect from prescription orders associated with relatively high patient distances.

The punched cards representing these two groups of prescription orders were isolated by the following procedure:

For prescription orders with a patient distance classified as "six miles or greater, or indeterminate"*, the exact distance could not be determined. Therefore the punched cards representing these prescription orders were excluded from the sample used to select the prescriptions for the least distant and most distant patients.

The remaining punched cards were arranged in a random manner. Since the data, as they appeared on the punched cards, were coded into numerical classifications, this randomization procedure was necessary to minimize any possible bias in later steps of the sample selection. The randomized punched cards were arrayed according to the coded patient distances and the arrayed cards were then separated

* See footnote, Appendix A

into groups, each group representing prescription orders from an individual pharmacy.

The number of punched cards in each of the thirty-three groups was divided by four, and two samples each of size $n \div 4$ (where n was the number of cards in each group) were selected from each group. One sample consisted of the punched cards with the lowest patient distances; the other sample consisted of the punched cards with the highest patient distances. This procedure was repeated for each of the thirty-three groups of punched cards.

The thirty-three samples consisting of the punched cards with the lowest patient distances for each pharmacy were combined and are referred to as "Prescriptions for the Least Distant Patients". The thirty-three samples consisting of the punched cards with the highest patient distances for each pharmacy were combined and are referred to as "Prescriptions for the Most Distant Patients". Each of these combined groups contained data from 678 prescription orders.*

The median prescriber distance associated with prescriptions for the least distant patients was 1.24 miles. That associated with prescriptions for the most distant patients was 1.22 miles.

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* Of the 2,965 prescription orders included in the study, 271 were classified as having patient distances "six miles or greater, or indeterminate". After these orders were eliminated from the sample for an individual pharmacy, the resulting number of orders often was not an integral multiple of four. Therefore, each of the combined samples of 678 do not represent exactly one-fourth of the prescription orders in the study.

The following hypothesis was tested: The distribution of prescriber distances is independent of the classification of prescription orders as "prescriptions for the least distant patients" and "prescriptions for the most distant patients". The chi square test for independence* was applied to these two samples at the level of prescriber distances less than 1.25 miles and prescriber distances of 1.25 miles or greater. The test produced a chi square value of 0.82 which was less than $X^2_{0.95}$ (df=2) = 5.99. Therefore, there was not sufficient evidence to reject the hypothesis of independence and it was concluded that the distribution of prescriber distances was independent of the classification of prescription orders as "prescriptions for the least distant patients" and "prescriptions for the most distant patients".

The median patient-prescriber distance associated with prescriptions for the least distant patients was 1.41 miles; that associated with prescriptions for the most distant patients was 2.82 miles. The chi square test of independence was applied to the data to test the following hypothesis: The distribution of patient-prescriber distances is independent of the classification of prescription orders as "prescriptions for the least distant patients" and "prescriptions for the most distant patients". This hypothesis was tested at the levels of patient-

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* For an example of the use of the chi square test to test the hypotheses for these samples, see Appendix F.

prescriber distances less than two miles and patient-prescriber distances of two miles or greater. The test produced a chi square value of 183.36 which exceeded $X^2_{0.95}$ (df=2) = 5.99. Therefore the hypothesis of independence was rejected and it was concluded that the distribution of patient-prescriber distances was dependent on this classification. The lower patient-prescriber distances were associated with prescriptions for the least distant patients.

The median charge for pharmaceutical service was $2.84 for prescriptions for the least distant patients and $2.87 for prescriptions for the most distant patients. The following hypothesis was tested: The distribution of charges for pharmaceutical service is independent of the classification of prescription orders as "prescriptions for the least distant patients" and "prescriptions for the most distant patients". The chi square test for independence was applied to these two samples at the level of charges for pharmaceutical service less than $2.75 and charges for pharmaceutical service of $2.75 or more. The test produced a chi square value of 5.70 which was less than $X^2_{0.95}$ (df=2) = 5.99. Therefore, there was not sufficient evidence to reject the hypothesis of independence and it was concluded that the distribution of charges for pharmaceutical services was independent of this type of classification of prescription orders.

Of the prescriptions for the least distant patients,

25.1% were classified as prescription orders for emergency medication and 26.0% were classified as prescription orders for maintenance medication. The following hypothesis was tested*: The proportions of emergency and maintenance medication for the least distant patients is not significantly different from the corresponding proportions obtained for all prescription orders in the study. At the 95% confidence level, these proportions were not significantly different from the corresponding proportions obtained for all prescription orders in the study, and therefore the hypothesis was accepted.

Of the prescriptions for the most distant patients, 29.1% were classified as prescription orders for emergency medication and 23.6% were classified as prescription orders for maintenance medication. The following hypothesis was tested*: The proportion of emergency and maintenance medication for the most distant patients is not significantly different from the corresponding proportions obtained for all prescription orders in the study. At the 95% confidence level, these proportions were not significantly different from the corresponding proportions obtained for all prescription orders in the study, and therefore the hypothesis was accepted.

Prescribed Medication Not Dispensed on the Day the Prescription Order Was Issued

It was determined that 247 of the 2,965 prescription

*The distribution of sample proportions was used to test these hypotheses. This distribution is described in Appendix E.

orders studied represented prescribed medication which was not dispensed on the day the prescription order was issued by the prescriber. The actual number may differ significantly from 247, since many of the prescription orders studied did not have the pertinent dates recorded. It is also possible that in some cases a prescription order was misdated accidentally. Bearing this limitation in mind, these 247 prescription orders were studied to determine if they differed in any measurable characteristic from the 2,965 prescription orders in the entire study.

The median patient distance associated with these 247 prescription orders was 0.85 miles. The chi square test for independence was used to test the following hypothesis: The distribution of patient distances is independent of the fact that the prescribed medication was not dispensed on the day the prescription order for this medication was issued. This hypothesis was tested at the levels of patient distances less than one mile and patient distances of one mile or greater. The test produced a chi square value of 1.26, which was less than $X^2_{0.95}$ (df=1) = 3.84. Therefore there was not sufficient evidence to reject the hypothesis and it was concluded that the distribution of patient distances was independent of the fact that the prescribed medication was not dispensed on the day the prescription order for this medication was issued.

The median prescriber distance associated with these 247 prescription orders was 1.93 miles. The chi square

test for independence was used to test the following hypothesis: The distribution of prescriber distances is independent of the fact that the prescribed medication was not dispensed on the day the prescription order for this medication was issued. This hypothesis was tested at the levels of prescriber distances less than two miles and prescriber distances of two miles or greater. The test produced a chi square value of 96.13 which exceeded $X^2_{0.95}$ (df=1) = 3.84. Therefore the hypothesis of independence was rejected and it was concluded that the distribution of prescriber distances was dependent on the fact that the prescribed medication was not dispensed on the day the prescription order for this medication was issued.

The median patient-prescriber distance associated with these 247 prescription orders was 2.32 miles. The chi square test for independence was used to test the following hypothesis: The distribution of patient-prescriber distances is independent of the fact that the prescribed medication was not dispensed on the day the prescription order for this medication was issued. This hypothesis was tested at the levels of patient-prescriber distances less than two miles and patient-prescriber distances of two miles or greater. The test produced a chi square value of 1.67, which was less than $X^2_{0.95}$ (df=1) = 3.84. Therefore there was not sufficient evidence to reject the hypothesis and it was concluded that the distribution of

patient-prescriber distances was independent of the fact that the prescribed medication was not dispensed on the day the prescription order for this medication was issued.

Only 19.4% of these 247 prescription orders were orders for emergency medication. Using the distribution of sample proportions, 19.4% was found to be significantly different at the 95% confidence level from 28.1% (the percentage of prescription orders for emergency medication for the 2,965 prescription orders in the study).

About one-third (32.4%) of these 247 prescription orders were orders for maintenance medication. Using the distribution of sample proportions, 32.4% was found to be significantly different at the 95% confidence level from 24.5% (the percentage of prescription orders for maintenance medication for the 2,965 prescription orders in the study).

The lower proportion of prescription orders for emergency medication and the higher proportion of orders for maintenance medication which were found in this sample of 247 orders would be expected on the basis of the classification of prescribed medication as "maintenance" or "emergency".

The median charge for pharmaceutical service associated with these 247 prescription orders was $3.35. This value was $0.41 higher than the median charge for all prescription orders in the study. The chi square test for independence was used to test the following hypothesis: The distribution charges for pharmaceutical service is independent of the

fact that the prescribed medication was not dispensed on the day the prescription order for this medication was issued. This hypothesis was tested at the levels of charges for pharmaceutical service of less than $2.75 and charges of $2.75 or greater. The test produced a chi square value of 9.40, which exceeded $X^2_{0.95}$ (df=1) = 3.84. Therefore the hypothesis of independence was rejected and it was concluded that the distribution of charges for pharmaceutical services was dependent on the fact that the prescribed medication was not dispensed on the day the prescription order for this medication was issued.

This finding might imply that because of the relatively high value associated with these prescription orders, the patient could not afford to obtain the prescribed medication immediately. Two factors may be noted which do not substantiate this implication. First, since most pharmacies offer credit services, it is unlikely that a patient would be obligated to forego prescribed medication because of a temporary lack of funds. Second, the results of a study of non-dispensed prescription orders by Campbell and Williams indicated that price is not an important factor in determining whether a patient does or does not obtain prescribed medication.[15]

This sample of 247 prescription orders contained a significantly larger proportion of orders for maintenance medication than did the entire sample of 2,965 prescription

15. Norman A. Campbell and Paul O. Williams, An Analysis of a Community's Unfilled Prescriptions, unpub. M. B. A. paper, University of Wisconsin, 1961.

orders. It is possible that, since the patient might be expected to receive maintenance medication over a long period of time, the quantities prescribed were relatively larger than for the other prescription orders. However, this possible explanation for the higher median charge associated with these 247 prescription orders cannot be tested with the available data.

Although prescription orders representing prescribed medication dispensed in pharmacies located in planned shopping centers comprised only 700 of the 2,965 orders studied (about 23%), these orders comprised 86 out of the 247 orders (about 35%) for medication which was not dispensed on the day the order was issued. Using the distribution of sample proportions this difference in percentages was found to be significant at the 95% confidence level. This higher proportion among the sample of 247 prescription orders lends additional support to the suggestion that pharmacies located in planned shopping centers are "shopper oriented".

Percent of Prescription Orders from the Top Ten Prescribers

In 1932, the Department of Commerce published the results of an analysis of the prescription departments in eight pharmacies.[16] For each of the eight pharmacies, ten

16. Frank A. Delegado and Arthur A. Kimball, Prescription Department Sales Analysis in Selected Drug Stores. Part of the National Drug Store Survey, U. S. Department of Commerce, Bureau of Foreign and Domestic Commerce, Domestic Commerce Series, No. 61, 1932.

prescribers originated between 21.02% and 89.25% of the prescription orders received by the pharmacy. The arithmetic mean for the eight pharmacies was 51.82%. That is, for the "average pharmacy" in the 1932 study, approximately one-half of the prescription orders were issued by only ten prescribers.

The 1932 study and this study are not exactly comparable. The 1932 study was conducted in a city which was larger than either of the test cities used for the present study and the 1932 study analyzed data for a period of one year while the present study was limited to an analysis of data for a two week period.

For the twenty-eight general pharmacies* in the present study, the "top ten prescribers" for each pharmacy accounted for between 37.00% and 80.00% of the prescription orders received by each pharmacy. The arithmetic mean for the twenty-eight pharmacies was 48.44%. Thus, for the "average general pharmacy" in the present study, approximately one-half of the prescription orders were issued by only ten prescribers.

Limitations of the Study

In addition to the limitations already discussed, the following factors should be noted:

The thirty-three community pharmacies included in this study were not selected by probability sampling procedures.

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* Prescription pharmacies have been omitted from this section of the analysis since the 1932 study referred to did not include any prescription pharmacies.

Therefore, the data, analyses, and conclusions in this study are limited to the pharmacies which were included in the sample.

These pharmacies were located in two mid-Western cities each of which had a population in the range of 130,000 to 136,000. Care should be taken in attempting to generalize the results of this study to community pharmacies located in different-sized cities or in cities of comparable size in different geographic areas.

The data utilized in this study were obtained from prescription orders which represented medication dispensed during a two-week period in the summer. It is possible that there is some seasonal variation in prescription patronage patterns. No attempt has been made to quantify this possible variation.

Because of the nature of the prescription records which are maintained by most pharmacies, the prescription orders studied were limited to original prescription orders. It is possible that different results would have been obtained if orders authorizing the renewal of a previous prescription order also were included in the study.

The prescription patronage patterns suggested by the results of this study are based primarily on three geographic locations: the patient's residence, the prescriber's office, and the community pharmacy in which the prescribed medication was dispensed.

It should be noted that the patient probably did not

obtain prescribed medication directly from a pharmacist in all cases. Prescribed medication may have been obtained from a pharmacist by an agent of the patient, especially if the patient was an infant or an invalid. In most of these cases it can be assumed that the patient's agent resides at the same location as the patient. However, it is also possible that prescribed medication was delivered to the patient by an agent of the pharmacy. No attempt has been made to quantify the effects of this possibility.

Also, a prescription order may be originated in some place other than the prescriber's office. Although the effects of this factor on the results of this study are not known, they are not believed to be great.*

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* Approximately three-fourths (73.2%) of the patient visits of U. S. physicians were visits by the patient to the physician's office, 4.8% were visits by the physician to the patient's home, and 22.0% were visits by the physician to a hospital (Source: _____, "Estimated 1962 Patient Visits of U. S. Physicians", Modern Medicine Topics, XXIV, 3 (March, 1963) p. 1).

All patient visits, particularly visits of a physician to a hospitalized patient, do not result in a prescription order which would be received by a pharmacist in a community pharmacy.

Chapter V

SUMMARY

The median patient distances for groups of general pharmacies included in the study declined throughout the commercial developmental structure of the city from the downtown area to neighborhood shopping areas. The highest median patient distances for general pharmacies were associated with general pharmacies located in the downtown area and progressively lower median patient distances were associated with general pharmacies located in secondary shopping areas and in tertiary and neighborhood shopping areas. The general pharmacies located in planned shopping centers were characterized by higher median patient distances than were general pharmacies located in traditional shopping developments.

The median prescriber distances for groups of pharmacies exhibited a relationship inverse to that of the median patient distances. Throughout the commercial developmental structure of the city from the downtown area to neighborhood shopping areas, the median prescriber distances tended to increase while the median patient distances tended to decrease. At the subgroup level of analysis, general pharmacies in the downtown area and general pharmacies in planned shopping centers were exceptions to this inverse relationship.

For most of the pharmacies studied, the median patient-prescriber distance exceeded the median patient distance.

Prescription pharmacies in the study were characterized by relatively high median patient distances and relatively low median prescriber distances.

Over 50% of the prescribed medications dispensed in general pharmacies located in the downtown area and in prescription pharmacies were the result of a prescription order issued by a prescriber whose office was located within 0.75 miles of the pharmacy.

Over 50% of the prescribed medications dispensed in general pharmacies located in traditional shopping developments outside of the downtown area were the result of a prescription order issued for a patient whose residence was within 0.75 miles of the pharmacy.

Previous studies have shown that "convenient location" is an important determinant of prescription patronage. The results of this study indicated that for general pharmacies in the downtown area and for prescription pharmacies, "convenient location" implied a location which is convenient to the prescriber's office. For general pharmacies located outside of the downtown area, "convenient location" implied a location which is convenient to the patient's residence.

Convenience to the patient's residence appeared to be more important for general pharmacies located in traditional shopping developments. For general pharmacies located in planned shopping centers, convenience to the patient's

residence was somewhat less important and it has been suggested that "convenient location" as applied to these pharmacies was a combination of convenience to the patient's residence and convenience to a group of stores in which the patient shops.

The distribution of charges for pharmaceutical service was not found to be dependent on the type or location of the pharmacy in which the prescribed medication was dispensed.

It was proposed that prescriber oriented pharmacies would receive a larger proportion of prescription orders for emergency medication than would patient oriented pharmacies. The data in this study did not support this proposal.

It was proposed that patient oriented pharmacies would receive a larger proportion of prescription orders for maintenance medication than would prescriber oriented pharmacies. The data in this study did not support this proposal.

The distribution of charges for pharmaceutical service and the distribution of prescriber distances were found to be independent of the classification of prescription orders as "prescriptions for the least distant patients" and as "prescriptions for the most distant patients". However, the distribution of patient-prescriber distances was dependent on this classification. The lower patient-prescriber distances were associated with prescriptions for

the least distant patients and the higher patient-prescriber distances were associated with prescriptions for the most distant patients. The proportion of maintenance and emergency medication in the orders classified as prescriptions for the least or most distant patients was not significantly different from the corresponding proportions obtained for all prescription orders in the study.

Of the 2,965 prescription orders in the study, 247 orders represented prescribed medication which was not dispensed on the day the order was issued. These 247 orders were associated with a median charge for pharmaceutical service which was higher than the median charge associated with all prescription orders in the study. In comparison to all prescription orders in the study, these 247 orders contained a higher proportion of orders for maintenance medication and a lower proportion of orders for emergency medication.

Appendix A

COMPUTATION OF MEDIAN AND QUARTILE VALUES

Distribution of Patient Distances for 2,965 Prescription Orders

Patient Distance	Number of Orders in Each Class	Cumulative Frequency
Less than 0.25 miles	482	482
0.25 - 0.49 miles	477	959
0.50 - 0.74 miles	359	1,318
0.75 - 0.99 miles	279	1,597
1.00 - 1.24 miles	180	1,777
1.25 - 1.49 miles	182	1,959
1.50 - 1.74 miles	142	2,101
1.75 - 1.99 miles	108	2,209
2.00 - 2.49 miles	188	2,397
2.50 - 2.99 miles	118	2,515
3.00 - 3.49 miles	69	2,584
3.50 - 3.99 miles	42	2,626
4.00 - 4.49 miles	29	2,655
4.50 - 4.99 miles	20	2,675
5.00 - 5.49 miles	13	2,688
5.50 - 5.99 miles	6	2,694
6.00 miles or greater, or indeterminate*	271	2,965

The above sixteen classes represent the classifications which were used in coding the data for IBM tabulation.

The median is a value such that, in an array of observations, approximately 50% of the observations are

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* Several prescription orders in the study were for patients who lived hundreds of miles from the pharmacy in which the prescribed medication was dispensed. Because of the inflating effect these extreme values would have on an arithmetic mean, it was decided that the median would be a more representative value.

Also a number of prescription orders in the study listed the patient's residence as a rural route. Since the exact location of these residence could not be determined, they were classified as "indeterminate".

equal to or less than this value. Since there were 2,965 observations in the study, the median value was the value of the 1,482.5th observation (2,965 ÷ 2) in the array. From the cumulative frequency column, it was found that the first three classes contained 1,318 observations. The fourth class contained an additional 279 observations, thus the first four classes contained 1,597 observations.

Therefore, the 1,482.5th observation occurred within the fourth class, between 0.75 miles and 0.99 miles. Since the first three classes contained 1,318 observations, the median value was the value of the 164.5th observation (1,482.5 - 1,318) in the fourth class. It was assumed that the observations were distributed equally throughout each class, therefore the median value was located 164.5 ÷ 279 (since there were 279 observations in the fourth class) or 59% of the way through the fourth class.

The fourth class covered an interval of approximately 0.25 miles, thus the median value occurred approximately 0.15 miles (59% of 0.25) above the lower limit of the fourth class. Since the fourth class began at 0.75 miles, the median value was 0.75 + 0.15, or 0.90 miles.

The first and third quartiles were computed in a similar way. The first quartile is a value such that 25% of the observations are equal to or less than this value. For the preceding data, the first quartile was the value of the 741.25th observation (2,965 ÷ 4), or 0.38 miles.

The third quartile is a value such that 75% of the

observations are equal to or less than this value. For the preceding data, the first quartile was the value of the 2,223.75th observation, or 2.04 miles.

Appendix B

CHI SQUARE TEST FOR INDEPENDENCE

The chi square (X^2) test for independence is based on the assumption that if the observations are independent of the group in which they are observed, each group will have approximately the same proportion of observations at each level of the variable.

Assume that a random sample of 1,000 prescription orders (500 from a pharmacy in a shopping center and 500 from a pharmacy in a traditional location) was analyzed and it was found that 40% of the 1,000 prescription orders were associated with a patient distance less than one mile. If patient distances were independent of the type of pharmacy from which the observations were taken, it would be assumed that approximately 40% of the 500 prescription orders from each of the two pharmacies would be associated with a patient distance less than one mile.

However, suppose it was observed that 300 of the 500 prescriptions orders from the pharmacy in the traditional location and 100 of the 500 prescription orders from the pharmacy in the shopping center location were associated with a patient distance less than one mile. Is this difference large enough to assume that patient distances are not independent of the type of pharmacy from which the observations were taken?

The hypothesis that patient distances are independent of the type of pharmacy from which the observations were taken can be tested by the following procedure:

Compute the theoretical frequencies that would be expected in each class if the hypothesis of independence was correct. Since 40% of the 1,000 prescription orders in the sample were associated with a patient distance less than one mile, it would be expected that 40% of the 500 prescription orders from each type of pharmacy would be associated with a patient distance less than one mile. Since 60% of the 1,000 prescription orders in the sample were associated with a patient distance of one mile or greater, it would be expected that 60% of the 500 prescription orders from each type of pharmacy would be associated with a patient distance of one mile or greater.

Each of these theoretical values is subtracted from the corresponding value which was observed in the sample and each of the differences is squared. Each squared difference is divided by the corresponding theoretical value and the sum of the resulting quotients is determined.

The resulting number is the chi square value for the sample. This value is compared with the appropriate chi square value obtained from a statistical table. If the chi square value for the sample exceeds the chi square value obtained from a statistical table, the hypothesis of independence is rejected.

The procedure is summarized below:

	Observed Value	Theoretical Value	Theoretical Value minus Observed Value (Difference)	Difference Squared	Squared Difference Divided by Theoretic Value
Shopping Center Pharmacy					
Patient Distance less than one mile	100	200	100	10,000	50
Patient Distance one mile or greater	400	300	-100	10,000	33
Pharmacy in a Traditional Location					
Patient Distance less than one mile	300	200	-100	10,000	50
Patient Distance one mile or greater	200	300	100	10,000	33
Total	1,000	1,000	0	-	166

The chi square value for the sample is 166. Since the classification is a two-by-two table, the statistic has one degree of freedom. At the 95% confidence level with 1 degree of freedom, $X^2_{0.95}$ (df=1) = 3.84. Since the chi square value for the sample exceeds 3.84, the hypothesis of independence is rejected at the 95% confidence level. Therefore it is concluded that patient distances are dependent on the type of pharmacy from which the observations were taken.

For further information about this test, see Wilfrid J. Dixon and Frank J. Massey, Jr., Introduction to Statistical Analysis, Second Edition, New York: McGraw-Hill, 1957, pp. 221-226.

Appendix C

WALD-WOLFOWITZ RUNS TEST FOR THE DIFFERENCES BETWEEN MEDIAN PATIENT DISTANCES OBTAINED FROM COMMUNITY PHARMACIES IN TWO CITIES

Hypothesis: The median patient distances for individual pharmacies in the study are independent of the city in which the pharmacy is located.

Test: All median values were arrayed in order of increasing magnitude. If the median was dependent on the city in which the pharmacy was located, the median values from City A should have been concentrated at one end of the array and the median values from City B should have been concentrated at the other end.

The number of "runs" in the array was determined. A "run" is any sequence of values from the same group. For example, if values from City A were denoted by "A" and values from City B by "B", there would be four runs in an array of the type A A B A B B B (the four runs are AA, B, A, and BBB).

The array of median patient distances for the thirty-three pharmacies in the study is shown below. Median values from one city have been underscored to differentiate them from median values from the other city.

0.18	0.46	0.62	0.97	1.33	2.22
0.22	0.50	0.66	0.99	1.41	2.46
0.22	0.53	0.79	1.04	1.42	2.97
0.37	0.53	0.80	1.08	1.46	
0.37	0.60	0.95	1.12	1.62	
0.43	0.62	0.95	1.26	1.97	

At the 95% confidence level the hypothesis of independence would be rejected if 11 or fewer runs occurred when the two samples were jointly arrayed.

In the preceding array, 19 runs occurred. Since this exceeded 11 runs, there was not sufficient evidence to reject the hypothesis of independence.

Therefore, it was concluded that the distribution of median patient distances for the pharmacies included in the study was independent of the city in which the pharmacy was located.

For further information about the Wald-Wolfowitz Runs Test see Sidney Siegel, Nonparametric Statistics for the Behavioral Sciences, New York: McGraw-Hill, 1956, pp. 136-145.

Appendix D

COEFFICIENT OF RANK CORRELATION

The coefficient of correlation is a number which indicates the relationship between two variables. A coefficient of correlation equal to +1 indicates a perfect direct relationship between the two variables being studied, a coefficient of -1 indicates a perfect inverse relationship between the variables, and a coefficient of 0 indicates no relationship between the variables.

Several methods of determining the coefficient of correlation are available. Spearman's method was selected for this test because this method does not require that the variables be distributed normally. The coefficient of correlation determined by Spearman's method is known as the "coefficient of rank correlation".

The median patient distances for individual pharmacies were arrayed and a numerical rank was assigned to each value. The largest value was assigned a rank of "1", the second largest value was assigned a rank of "2", and so forth. A similar procedure was followed for the median prescriber distances. Each rank assigned to a median patient distance was subtracted from the rank assigned to the median prescriber distance for that pharmacy. The difference between each pair of ranks was squared and the following formula used to determine the coefficient of rank

correlation:

$$r = 1 - \frac{6 \leq (D^2)}{N (N^2-1)}$$

where, r = the coefficient of rank correlation

D = the difference between the median patient distance and the median prescriber distance

N = the number of pharmacies in the study

Median Patient Distance		Median Prescriber Distance			
Actual Value (miles)	Rank	Actual Value (miles)	Rank	D	D^2
2.92	1	0.13	32	31	961
2.46	2	0.46	24	22	484
2.22	3	0.13	32	29	841
1.97	4	0.16	29	25	625
1.62	5	0.14	30	25	625
1.46	6	1.55	14	8	64
1.42	7	1.06	19	12	144
1.41	8	2.92	2	6	36
1.33	9	0.13	32	23	529
1.26	10	3.50	1	9	81
1.12	11	0.20	28	17	289
1.08	12	0.23	27	15	225
1.04	13	0.42	25	12	144
0.99	14	1.16	16	2	4
0.97	15	1.86	12	3	9
0.95	16.5	0.74	23	6.5	42.25
0.95	16.5	2.16	7	9.5	90.25
0.80	18	1.87	11	7	49
0.79	19	2.75	3	16	256
0.66	20	2.64	4	16	256
0.62	21.5	0.98	22	0.5	0.25
0.62	21.5	2.30	5	16.5	272.25
0.60	23	1.00	21	2	4
0.53	24.5	1.89	10	14.5	210.25
0.53	24.5	2.20	6	18.5	342.25
0.50	26	1.04	20	6	36
0.46	27	1.81	13	14	196
0.43	28	0.41	26	2	4
0.37	29.5	1.11	17	12.5	156.25
0.37	29.5	1.91	9	20.5	420.25
0.22	31.5	1.94	8	23.5	552.25
0.22	31.5	1.41	15	16.5	272.25
0.18	33	1.07	18	15	225
				Total	8,445.50

$$r = 1 - \frac{6 (8,445.5)}{33 (1,088)}$$

$$r = -0.41$$

The following hypothesis was tested: There is no relationship between the median prescriber distances and the median patient distances for the individual pharmacies in the study.

If this hypothesis was correct, a coefficient of rank correlation equal to zero would be obtained. Since the coefficient of rank correlation computed from the data in the study was -0.41, the hypothesis was rejected.

Therefore, it was concluded that an inverse relationship existed between the median patient distances and the median prescriber distances for the individual pharmacies in the study.

For further information about the coefficient of rank correlation see Wilfrid J. Dixon and Frank J. Massey, Introduction to Statistical Analysis, Second Edition, New York: McGraw-Hill, 1957, pp. 294-295.

Appendix E

TEST OF SIGNIFICANCE INVOLVING THE DISTRIBUTION OF SAMPLE PROPORTIONS

The following example illustrates the use of this test to determine if the proportion of prescription orders for emergency medication received by prescription pharmacies in the downtown area was significantly different from the proportion of orders for emergency medication in the sample of 2,965 prescription orders.

Hypothesis: The two proportions referred to above do not differ significantly from each other.

Test: The 2,965 prescription orders in the study constitute the universe of prescription orders for this test. Of the universe of orders, 28.1% were orders for emergency medication.

If an infinite number of probability samples of 200 prescription orders was selected from this universe, the distribution of sample proportions would approximate the normal distribution with a mean of 0.281 and a standard deviation equal to the following:

$$\sqrt{\frac{p\,q}{n}} = \sqrt{\frac{(0.281)\,(0.719)}{200}} = 0.032$$

where, p = the universe proportion having the characteristic being studied (prescription orders for emergency medication)

q = the universe proportion which does not have the characteristic being studied (prescription orders for maintenance medication and unclassified medication)

n = the size of the sample being studied.

At the 95% confidence level, a sample proportion is significantly different from a universe proportion if the sample proportion differs from the universe proportion by 1.96 or more standard deviations. This is based on the knowledge that in a normal distribution 95% of the observations, or for this example 95% of the sample proportions, have a value between the universe mean plus 1.96 standard deviations and the universe mean minus 1.96 standard deviations. If a sample proportion is outside of these limits, it is considered to be significantly different from the universe proportion.

The sample tested in this example consisted of the 200 prescription orders in the study which represented prescribed medication dispensed in prescription pharmacies in the downtown area. Of the 200 prescription orders, 26.0% were classified as orders for emergency medication.

From a distribution with a universe mean of 0.281 and a standard deviation of 0.032, a sample value is significantly different from the universe value if the sample value is not within the interval $0.281 \pm (1.96)(0.032)$, or 0.218 to 0.344.

Since the sample proportion being tested (0.260) was within these limits, there was not sufficient evidence to

reject the hypothesis. Therefore, it was concluded that the difference between the sample proportion and the universe proportion was not statistically significant.

Since the sample size differed for each of the subgroups of pharmacies in the study, each of the tests performed involved a different standard deviation.

Appendix F

CHI SQUARE TEST FOR INDEPENDENCE APPLIED TO THE DISTRIBUTION OF PRESCRIBER DISTANCES FOR PRESCRIPTIONS FOR THE LEAST DISTANT AND MOST DISTANT PATIENTS

The following hypothesis was tested: The distribution of prescriber distances is independent of the classification of prescription orders as "prescriptions for the least distant patients" and "prescriptions for the most distant patients".

Prescriber Distance	Prescriptions for the Least Distant Patients	Prescriptions for the Most Distant Patients	All Other Prescriptions	Total
Less than 1.25 miles	340 (337.0)	346 (337.0)	789 (799.7)	1,475 or 49.7%
1.25 miles or greater	338 (341.0)	332 (341.0)	820 (809.3)	1,490 or 50.3%
	678	678	1,609	2,965 or 100.0%

Note: Values given in parentheses are the theoretical values. For example, 49.7% of all prescription orders were associated with a patient distance less than 1.25 miles. Therefore, if there was complete independence, 49.7% of 678 (or 337.0) prescriptions for the least distant patients would be associated with a prescriber distance less than 1.25 miles.

Subtracting each of the observed values from the corresponding theoretical values, squaring these differences, dividing the squared differences by the corresponding theoretical values, and summing the results a chi square value of 0.82 was produced by the test.

$X^2_{0.95}$ (df=2) = 5.99. Since the test produced a chi square value less than 5.99, there was not sufficient evidence to reject the hypothesis of independence. Therefore, it was concluded that the distribution of prescriber distances was independent of the classification of prescription orders as "prescriptions for the least distant patients" and "prescriptions for the most distant patients".

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