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AN ANALYSIS OF VARIATIONS

IN

PUBLIC HEALTH NURSING REFERRAL MANAGEMENT

AND ITS APPLICATION

TO

WORKLOAD MEASUREMENT

BY

BY VERNA LILLIAN WILSON, B. Sc. (Nsg.)

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ABSTRACT

The impetus for this research arose from the need for accurate information on which to base decisions about how to equitably distribute the workload of public health nursing staff working in an official community health agency. The study was designed to answer questions about the amount of professional time required to manage the referrals made to the Ottawa-Carleton Health Department for public health nursing service to individuals and families. The basic assumption of the study was that variation in referral management time would be shown to be the product of both client-centred and provider-centred factors.

The study design was both descriptive and exploratory in nature. The study population consisted of 1143 clients referred for public health nursing service during the latter months of 1987. To collect the necessary information, a data collection system was devised in which public health nurses recorded the amount of time they spent providing service for each new case. From mid-September, 1987 to December 31, 1987 all incoming referrals not assigned to University of Ottawa nursing students were included in the study until the minimum number for each sub-group had been reached. These population sub-groups, Parent/Child Health, School Health, Adult Health, and Senior Adult Health, were defined in such a way as to ensure that the study results could be applied to the lifecycle programs which were to come into effect in the agency in 1988/1989.

For the total study population, the mean Total PHN Time was 208 minutes, the mean Number of Contacts was just under 2, and the mean Average Time per

Contact was 101 minutes. The most important client-centred predictor of both Total PHN Time and Numbe· of Contacts proved to be Health Need, while Referral Source was the most important provider-centred predictor. Service-provider variables, such as the PHN's Education and Experience caused little variation in Total PHN Time. Bec·use of the obvious importance of Number of Contacts in the determination of Total PHN Time, the analysis was first run with Number of Contacts as an independent variable relative to Total PHN Time, then as the dependent variable. When the dependent variable was "Number of Contacts" an interesting and useful grouping of Case Types occurred. Mental Illness, with a mean of 4.3 contacts was in 1 group; Maternal/Child Health and Paediatrics were grouped together with a mean of 1.6 contacts, while all the other case types formed the largest node with a mean of 2.5 contacts.

Based on the study results, modifications were proposed to the weighting system which had been used to predict the referral management component of the public health nursing workload.

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I would like to thank my family and friends who have been unfailingly supportive during this project. Their encouragement smoothed the way for the completion of the work.

My thesis supervisors, Professor Pran Manga and Professor Colin Lay, have been patient and helpful as the project evolved, and the paper is stronger as a result of their guidance.

A special thanks to Barry DeVille of First Mark who offered me the opportunity to participate in the beta testing of Knowledge Seeker. My analysis relied on his technical assistance as I learned to use this interesting decision-support program.

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I. INTRODUCTION

The empirical research reported here was undertaken for the purpose of answering questions about the time spent in the provision of public health nursing services to individuals and families in Ottawa-Carleton. As in most service organizations, the largest single expenditure in public health agencies is for professional staff, thus the effective and efficient allocation of human resources is an overriding concern. In the absence of information about how and why referral management time varies, nursing managers have lacked the necessary tools to optimize the use of human resources.

A. Context of the Study

In a generalized public health nursing program, service delivery consists of several types of activities carried out in a variety of settings. The time spent in such group activities as immunization clinics, screening programs, and education sessions can be accurately measured, but the time required to provide public health nursing services to individuals and families in their homes varies with each request. Responding to referrals (requests for service to individuals and/or families) consumes a large proportion of nursing time. Referrals requiring a public health nurse to make a home visit to an individual or family are received from many sources in the community. Referral sources include families and friends, social service agencies, physicians, and other health care providers. Referrals can also be generated through public health nursing liaison in hospitals and community agencies.

Many factors play a role in determining how much time will be spent by the public health nurse who is assigned the responsibility of managing a referral. Some of the variation in the amount of time required to provide public health nursing service to a case can be accounted for by such client-centred factors as the reason for the referral, the age of the client, the family's socioeconomic status, and the geographic location of the home. Other factors that may influence the amount of time spent include the education and experience of the nursing professional and her immediate supervisor. The challenge of ensuring that costly professional public health nursing time is appropriately and effectively used is complicated by the fact that much of the service is provided outside the central office in homes and other community locations. This means that managers must rely on the judgement of the service provider to decide how much time is appropriate for each individual case. Because the number and nature of the incoming requests are not totally within the control of the receiving agency, time spent in caseload management is difficult to forecast exactly. Prior to September 1988, the Ottawa-Carleton Health Department (OCHD) offered a generalized public health nursing program. The nursing staff was divided into teams which were responsible for delivery of all public health nursing service to defined geographic districts which consisted of aggregated census tracts. The demand for public health nursing service in each specific district was determined by the nature of the population, and varied with such factors as the population age profile, the population density, the socioeconomic status of families, and the number of

schools.

Given the variable nature of the requests for service, public health nursing managers require methods of quantifying the professional activities associated with the demand of incoming referrals. Staffing resources must be allocated in a manner which more-or-less equalizes the workload per team and per public health nurse and provides service proportional to the need.

A method of determining the workload for each district team was developed in 1984 as a means of deploying the public health nursing staff so that the incoming workload would be equitably distributed. Based on the premise that the total nursing time available could be matched with the incoming service demand, this process enabled nursing administration to use routinely-collected information to equalize the workload among teams. Information compiled and analysed on a yearly basis allowed the workload to be redistributed by making adjustments either to team district boundaries or to the number of nurses assigned to a team. When a major shift in staffing was necessary, as was the case in 1986 when sixteen public health nurse positions were withdrawn from the generalized program and reassigned to health promotion activities, the use of the staff deployment methodology ensured that there was an even redistribution of the workload among the district teams.

The Staff Deployment methodology used was based on a simple formula which allowed a comparison of the workload of district public health nursing teams:

$$\frac{\text{Discretionary Time (Available Time - Committed Time)}}{\text{PHN Referral Factor}} = \text{Workload Impact Index}$$

Each of the terms in my formula is explained as follows:

Available Time (AT): To match the available nursing time with the workload demand, the number of nursing hours available monthly for program delivery was calculated for each team. To arrive at the time available for program delivery, the number of total paid hours was reduced by an estimated average amount of time consumed in such activities as vacation, sick leave, inservice education, team activities and committee meetings. Over several years, the amount of time available for program delivery was found to average out at 110 hours per month per nursing position. The available nursing time (110 hours multiplied by the number of public health nurses) was calculated for each team.

Committed Time (CT): The next step in the process consisted of determining the amount of time required to provide mandated programs. The activities of the School Health Program, Day Care/Nursery Schools, Immunization Clinics, and High Risk Maternal/Child Health Program are mandated by the provincial government, and therefore they must take priority over other activity. The amount of time to be spent in schools is allocated on the basis of the school population. The base formula for the calculation of school time is one hour per week per 100 students. To arrive at a monthly amount, the time allocated for schools was calculated for the 40 weeks of the school year then averaged over 12

months. One hour per month per Day Care/Nursery School location was used as an estimate of time required for the mandated review of immunization records in these sites. Monthly average amounts of time spent in immunization clinics, and liaison activity for the Maternal and Child Health High Risk program were calculated per team.

Discretionary Time (DT): The time committed to mandatory programs was subtracted from the total time available to a team, leaving the amount of time left to the discretion of the public health nurses to allocate among the competing demands of their caseloads and other tasks, such as committee meetings, etc. This value was called Discretionary Time.

PHN Referral Factor: To estimate the impact of the incoming referrals, a derived value called the 'PHN Referral Factor' was calculated. Incoming referrals are assigned a Case Type code according to health need. The need for public health nursing time varies with the type of case, therefore a weighting system which was designed to predict the demand on nursing time was developed. Case Types were assigned weights between 1 and 4, depending on the estimated amount of nursing time they might be expected to consume during the course of 1 month. Lacking more accurate information, Nursing Division administration staff used a 'best guess' approach to developing the following weighting system which refers to time and/or visits which might reasonably be expected to occur within a 1-month period.

i) Level 1: 1 or 2 visits, time commitment of less than 3 hours
ii) Level 2: 3 to 5 visits, for a total of 3 to 10 hours
iii) Level 3: 4 or more visits and a total time of 10 to 15 hours
iv) Level 4: 4 or more visits and more than 15 hours

In 1986 a new automated system of keeping track of incoming referrals was introduced. This necessitated some "cosmetic" changes to Case Type coding which also facilitated the alignment of the coding system with the emerging Lifecycle Program groups. Because these modifications did not change the relative balance of the weighting between the case types, for this study I have chosen to return to the model as it was used in the first 3 years. With the exception of Home Care (which is a Referral Source), the codes describe the Health Need. In the original system, the Case Type Codes were assigned the following weightings:

(Original) Type Codes and Weighting Factors

Level 4	Mental Illness
Level 3	Home Care, Senior Adults, High Risk
Level 2	Medical/Surgical, Cancer, Paediatric
Level 1	Communicable Disease, Mental Health, Individual/Family Management Maternal/Child Health, Prenatal

To derive the PHN Referral Factor, the monthly average number of referrals in each category for each team was multiplied by the weighting assigned to that type of referral.

Workload Impact Index: The ratio of the PHN Referral Factor, i.e. the sum of the weighted categories, to the Discretionary Time available to that team, was calculated, yielding a value called the Workload Impact Index that was then

compared across teams. On the basis of this index the necessary adjustments were made to either team boundaries or staffing levels, thus equalizing the workload across all teams.

Table 1 shows the calculations from the first 2 years. In the first year the baseline Workload Impact Index (WII) was calculated for each team. (Column titled "BASE") At that time the overall average Workload Impact Index was 4.6. The amount of variation is represented by the difference between the largest WII of 8.4 (showing the least heavy workload), and the smallest of 2.0 (showing the heaviest workload). The workload was equalized by changing boundaries and by reassigning PHNs between teams so that team workloads came closer to the overall average. A projected WII, based on the changes that were made, was calculated. (Third column 1984-85 "PROJECTED" in Table 1) At the end of the year, the actual WII was calculated, (Fourth column 1984-85 "ACTUAL") and compared with the projected. Columns five and six show the calculations for 1985-86. As shown by the standard deviations, and the maximum and minimum values, the methodology was successful in reducing the variation between teams. The system will be improved if the accuracy of the PHN Referral Factor component of the algorithm can be assured.

Table 1 Comparison of Workload Impact Index

		1984-85		1985-86	
TEAM	BASE	PROJECTED	ACTUAL	PROJECTED	ACTUAL
1.1	3.2	3.8	3.3	3.1	3.2
1.2	3.8	3.6	3.5	3.4	2.5
2.1	6.6	5.3	2.3	2.3	2.3
2.2	7.2	4.6	3.4	3.3	2.7
3.1	4.9	3.9	5.6	5.8	3.9
3.2	4.8	4.6	4.8	4.6	4.3
4.1	5.8	3.3	2.8	2.9	3.5
4.2	4.0	3.9	3.9	4.0	5.1
5.1	4.0	3.4	3.6	3.5	2.4
6.1	4.2	4.2	3.1	3.1	3.0
6.2	3.8	3.6	5.2	4.7	4.0
7.1	3.4	4.6	4.3	4.2	3.2
7.2	3.8	3.9	4.3	4.3	3.1
8.1	4.3	4.0	3.3	3.3	4.1
8.2	3.9	4.3	2.7	2.8	4.1
9.1	2.0	2.4	2.0	2.7	1.6
9.2	8.4	4.2	3.3	3.3	3.1
AVGE	4.6	4.0	3.6	3.6	3.3
STDEV	1.5	0.6	0.9	0.9	0.9
MAX	8.4	5.3	5.6	5.8	5.1
MIN	2.0	2.4	2.0	2.3	1.6

B. Justification of Present Study

Information concerning the amount of time required to manage each different type of referral, and the factors which cause the time to vary from case to case, will provide the necessary information for either validating or modifying

the weighting system used to calculate the PHN Referral Factor which is such a critical component of the Staff Deployment methodology. More accurate determination of the PHN Referral Factor will further refine the Staff Deployment process so that a comparison of the workload between teams becomes more reliable. Although the impetus for the study came from an interest in validating the weighting system used for staff deployment, because of the type of data generated the study will provide information which will also be useful wherever a requirement exists for information about average amounts of time used in public health nursing case management.

While the information obtained in this study can also be used in developing productivity measures, and in the costing of programs, the objective which gave rise to this study was the optimal allocation of staff resources in a generalized public health nursing program. Accurate data generated in actual field situations can be used to either validate the current weighting system, or make the necessary modifications to it. There are several possible options in the allocation of staffing resources within a public health nursing program. For example, instead of offering a generalized program in which all public health nurses are expected to do all tasks, staff might be assigned to do only one type of activity. Other options include the deployment of staff according to specific programs, or the traditional method of a simple nurse/population ratio. The primary question to be answered by the study, i.e. "How much time is spent by public health nurses in managing different types of referrals?" is of particular interest in generalized public health

nursing programs in which nurses are assigned to a variety of tasks. Other related questions which have importance for population-based health programs include:

i) How much variation can be explained by client-centred factors? and,

ii) How much variation is explained by provider-centred factors?

II. CURRENT LITERATURE AND RELATED WORK

The optimal allocation of human resources is not a new problem in public health nursing. Ruth Freeman discussed the implications of inadequate quantitative information in public health nursing in an address given at Yale in 1970; "It is clear that there are too few public health nurses to meet the demand as calculated on the basis of currently accepted staffing patterns, and that the deficit so calculated is substantial. The exact nature of the need is clouded by inadequate data, however."[1] More recently, in discussing the rather different and more complex issue of the survival of community health nursing services, Archer and Fleshman stated that this survival may "...well depend on proving ... quantitatively the legitimate role nursing has in influencing health status."[2]

A. Existing Studies

In community health settings the task of quantifying nursing activities is complicated by the nature of the activities and by the variety of service settings. Nursing literature contains many articles describing the problem of measuring nursing care in the community, but to date there have been relatively few actual studies carried out. Perusal of the health administration literature did not yield any useful studies, as the primary focus of these journals tends to be the institu-

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[1] *Ruth B. Freeman. "Newer Aspects of Community Nursing Participation in the Public Health Program". Lecture given March 2, 1970, reported in Public Health Nursing Vol. 1, No. 1 (1989): 55.*

[2] *Sarah E. Archer and Ruth P. Fleshman. Community Health Nursing, Third Edition. (Wadsworth Health Sciences. Monterey, Cal. 1985): 226.*

tional sector of health care. Most of the efforts to develop methods of quantification reported in the literature have taken place in agencies such as American Visiting Nurse Associations and British district nursing programs. Direct comparison of British and American community health nursing with the Canadian public health nursing field must be made with caution. Primary prevention activities which include immunization, screening, health education, and counselling account for the majority of the functions of Canadian public health nurses working in official public health agencies, whereas American and British visiting nurses (district nurses in Britain) provide direct nursing care. The work of British health visitors most closely resembles that of Canadian public health nurses, but there are some important differences, such as the source of referrals. Health visitors work as part of a multidisciplinary team, usually attached to a medical practice group, while Canadian public health nurses work out of official government agencies whose mandate is the protection and promotion of the health of the community. The Visiting Nurse agencies more closely parallel the Canadian Victorian Order of Nurses. Despite the differences, valuable information was obtained from the studies done in these agencies.

Kissinger describes an applied research study she did in a community nursing agency in a large American city.[3] She used a task analysis to identify the activities of the agency's community health nurses. By observing nurses in

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[3]*Charmaine L. Kissinger. "Community Nursing Administration: Quantifying Nursing Utilization." Journal of Nursing Administration. (September/October 1973): 42-48.*

their daily activities, the author collected information on the types of activities performed and divided them into eight categories. This work was the basis for the task analysis instrument. The study showed that approximately one-third of a nurse's time was spent directly with the patient, and two-thirds of her time was spent in planning and paperwork.[4] The proportion of home visit time in that study is consistent with a 1984 analysis of nursing activity in Chautauqua County Department of Health which found that nurses' visits to patients' homes used 37.37% of the time available.[5] The latter analysis, however, included travel time in the home visit category, while the Kissinger study did not. Client contact also accounted for approximately one-third of the nursing time in a collaborative research study done by Cross et al.[6] The study was done in a large eastern U.S. county health department for the purpose of establishing the relationship between nursing activities and patient outcomes. It found that several factors influenced the amount of time that was spent in various activities. These factors included the method of intake, population density, number of single-parent families, number and experience of personnel, and the philosophy, leadership style and experience of the supervisor. From the study, supervisors were able to determine

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[4]*Ibid 47.*

[5]*Dorothea F. Janczak. "Changes in a Rural Public Health Nursing Program: A Community Profile." Home Healthcare Nurse. Vol. 3, No. 5. 28-33.*

[6]*Jean Cross, Cynthia Northrop and Judith Strasser. "How Community Health Nurses Spend Their Time." Nursing and Health Care. June 1983. p. 314-7.*

that in some areas of program activity nurses were spending more time in recording their activities and interventions than in client encounters.[7]

According to Corriveau and Rowney, who studied the development and introduction of a statewide reporting system for public health nurses in Michigan, service volume is the most significant cost factor.[8] They also found that demand increased as a result of environmental factors such as the "new federalism" and a declining economy. Under the new federalism the federal government in the USA passed on the responsibility of caring for the poor to state and local governments. This lead to fiscal problems for such programs, thus emphasizing the need for raising the productivity of public health nursing programs. Cost containment is a function of improved productivity, and the introduction of a productivity measure was designed to ensure that direct service would account for at least 50% of time spent in Michigan Public Health agencies. Use of the tool was based on an average agency time for various activities. Introduction of the measure helped to identify where time was being wasted, thus allowing for improvements to be made to the system. The tool can also be used in performance appraisal to identify poor performance.[9]

In a quasi-experimental study conducted by Sienkiewicz the quality of care given to an experimental group of patients was compared to the care given to a

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[7]*Ibid 315.*

[8]*Claire L. Corriveau and Rosemarie H. Rowney. "What is in a Day's Work?"* Nursing Outlook. *(November/December 1983): 335-339.*

[9]*Ibid 339.*

control group.[10] Using a patient classification system, the experimental group was classified by required level of care; the control group was not. Because the admission visit requires more time, a weighting of 2 instead of 1 was assigned to the initial visit. This weighting assumes that an admission visit was the equivalent of two regular nursing visits. While the admission, or assessment visit required more time, the study findings did not support the hypothesis that this meant better service in that visit. The quality of care was assumed to be related to the number of services or procedures recorded in the chart. Using an instrument that was developed for the study, supervisors assessed the record as incomplete or complete. Sienkiewicz observed that quality of care in this study was actually quality of record.[11]

The variation in the workload of health visitors and visiting nurses has been the subject of several English studies. Representative of the work being done in this area is a 1980 study done in Wigan under the guidance of Leonard Goldstone, a lecturer in management sciences.[12] By comparing records referred to as diary sheets, he noted that there were significant differences, both between and within centres. Explanation of the variation included factors such as age

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[10]*Josephine I. Sienkiewicz. "Patient Classification in Community Health Nursing." Nursing Outlook Vol. 32, No 6. (November/December 1984) 319-21.*

[11]*Ibid 320.*

[12]*Leonard A. Goldstone and Jessie Worrall. "The Problems of Variations in Work Patterns of District Nurses." Occasional Papers Vol. 76, No. 11 in the Nursing Times (April 24, 1980) 45-51.*

differences of patients, mobility of patient (an indicator of the acuity of the patient's condition), and differences in the need for travel. Another factor appeared to be the differing pre-conceived ideas about the work of district nurses held by general practitioners referring patients for service. At the conclusion of the study, Mr. Goldstone proposed that "...in the longer term the best solution is to incorporate into the patient register a patient dependency/classification scheme which would provide month by month a reliable guide to workloads".[13]

The Korner report, which looked at the National Health Service in Britain, identified many of the problems besetting nursing service in the community. Speakman, in his review of the information gathered for the report in Lewisham and North Southwark, says the unquantifiable and open-ended nature of community care is its major problem.[14] The analysis of the report showed that the average time in 97.7% of district nurse visits was under 1 hour, while 61% of the health visitors' visits were under 1 hour. District nurses provide "hands-on" care to patients, while the activities of health visitors are primarily counselling and teaching. The need for comparative information was noted, so that differences and their causes can be measured.[15] The Korner recommendations of a minimum data set as a means of obtaining valid information for managing community services is discussed in 2 other articles, part of a series about this

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[13]*Ibid 51.*

[14]*Jim Speakman. "Measuring the Immeasurable: the Korner Report, Part Six". Nursing Times (May 30, 1984) 56-58.*

[15]*Ibid. 58.*

major review of the National Health Service.[16]

B. Related Work

Workload measurement has not yet become standard practice in community settings, but some of the work being done has relevance for this study.

1. Daily Activity Report

Nurses working in many public health agencies in Ontario keep weekly records of the time spent in all paid activities.[17] This provincial recording system, known as Community Health Activity Recording Information System (CHARIS) has been in use for many years, and while it does provide general information about nursing activities, it is of limited utility for specific program costing and staff deployment decisions in a large urban setting. In the autumn of 1985 a new activity recording system, the Daily Activity Record (DAR), was piloted in the OCHD Nursing Division.[18] The purpose of this project was to develop a means of costing activities by program. The DAR trial period showed that direct client activity accounted for 56% of the total paid time.[19] Work on the DAR system was discontinued when the provincial Ministry of Health began

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[16] *Xenia Webster. "Korner and the Community". Nursing Times. (May 30, 1984 51-52; and Nora Saddington. "Putting Korner into Practice." Nursing Times (May 30, 1984) 53-55.*

[17] *Community Health Activity Recording Information System. (Ministry of Health) 1980.*

[18] *Daily Activity Report Recording Guidelines. Internal Document (O-C Health Department; November, 1985)*

[19] *Daily Activity Report. Unpublished Data (O-C Health Department, 1986)*

work on modifications to the CHARIS system which were designed to more accurately reflect current information requirements.

2. North York Nursing Information System

Public health departments in urban centres are beginning to develop computerized referral intake systems. North York has in place a system which generates not only an intake form when a referral is received, but also an encounter form which is completed by the nurse who takes the case.[20] The classification system, based on the Orem's self-care nursing theory, allows for more complete analysis of both the time required and the complexity of the case.

3. Caseload/Workload Analysis

The Easley-Storfejell Caseload/Workload Analysis Instrument is being used in the Middlesex-London Health Unit.[21] The purpose of this instrument is to provide a summary description of a nurse's caseload, on a case-by-case basis. Of interest to this research is the fact that a weighting system is used in the determination. Each case is assessed, on a scale of 1 to 4, for its time requirement.[22] The instrument is designed to be of use to both the public health nurse

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[20] *Referral Intake and Disposition System. Internal Document (North York Department of Public Health, Nursing Division; February, 1986)*

[21] *Easley-Storfjell Caseload/Workload Analysis as Adopted by the Middlesex-London Health Unit. Internal Document (Middlesex-London Health Unit)*

[22] *Ibid 3*

and her supervisor, and has been adopted for use in Michigan.[23] An interesting adaptation of this instrument was described by Shultz et al.[24] The original paper-based instrument was modified and a computer program was written in BASIC. The system links information from the parts of the original instrument and provides a prediction of the amount of time required, and the complexity of the service requirements by case.[25]

4. Patient Classification

Nursing departments in all health care settings have been attempting to quantify nursing service. Mona Callin and Kathleen Scherer discuss the use of quantitative data derived from patient classification systems in predicting staffing ratios, matching client needs with qualified nursing resources and as cost containment tools.[26] In their review of systems currently used in Canadian community settings, they found only one patient classification system, i.e. the one in use by the VON. Patient classification systems which quantify nursing activities for staffing purposes in hospital settings have been evolving for over twenty

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[23] *The Easley-Storfjell Instruments for Caseload/Workload Analysis. Unpublished Document: description of the copyrighted tool (1980)*

[24] *Samuel Schultz II and Mary L. McHugh. "A Microcomputer Based Community Health Nursing Database Management System." In H.G. Heffernan (Ed.) Proceedings: The Seventh Annual Symposium on computer Applications in Medical Care. (IEEE Computer Society Press New York 1988) 531-532*

[25] *Ibid 532*

[26] *Mona Callin and Kathleen Scherer. "Evaluation Research--Quality of Care". Chapter 37: Community Health Nursing in Canada. Edited by Miriam Stewart, Jean Innes, Sarah Searl and Carol Smillie. (Gage Educational Publication Co. Toronto, Ont. 1985) 692-3*

years.[27] The value of such systems is recognized by accrediting bodies, which now require that such systems be in place in acute and long-term care settings,[28] and by the Canadian Hospital Association which adopted patient classification as nursing workload measurement systems in its landmark MIS project.[29]

The Victorian Order of Nurses developed a patient classification system in 1979.[30] In an unpublished report, Ruth McKenzie describes the system and discusses its testing in one VON branch. The VON system classifies patients according to levels of function in three dimensions; Functional, Therapeutic and Adaptive. The study was designed to test reliability and validity of the classification, and to identify variables which discriminate between score levels of the three dimensions of the system. While the nurses who used the system felt it accurately reflected workload, the study demonstrated that the method used relied on subjective data. In her conclusion McKenzie stated that a more objective method of classification needed to be developed.[31]

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[27] *Phyllis Giovannetti. Patient Classification Systems in Nursing: A Description and Analysis. U.S. Department of Health, Education, and Welfare. (DHEW Publication) 78-22.*

[28] *Elizabeth N. Lewis and Patricia V. Carini. Nurse Staffing and Patient Classification. (Aspen Systems Corporation. Rockville, Md. 1984) 5-6.*

[29] *Guidelines for Management Information Systems in Canadian Health Care Facilities - Ambulatory Care Services. MIS Project Steering Committee (Canadian Hospital Association. 1985) 3-1*

[30] *Ibid. Callin et al. 693*

[31] *Ruth McKenzie. VON Patient Classification: Development and Testing of the System Unpublished Report. (March, 1983)*

III. METHODOLOGY AND ESTABLISHING THE DATA

A. Basic Assumptions

The rationale for undertaking this research is that more efficient and equitable use of human resources in public health nursing agencies can be achieved if accurate means of quantifying professional activities can be developed. Accurate quantification of these services requires baseline data about the use of time for the provision of service to individuals and families in their own homes. The input for the public health nursing "service product" consists primarily of two elements: i) professional expertise; and ii) time. Because time is a common factor in all activities, the product cost can be predicted if an accurate means of establishing the amount of time for each type of activity is determined. While it is theoretically possible to establish average times for each type of activity, in practice these will vary with factors inherent in both sides of the service-provision transaction. The estimation of average times can be enhanced by accounting for factors which will cause the variations.

B. Model Design

The working hypothesis of the research was that variations in the amount of time spent in the referral management component of public health nursing workload are associated with both client-centred variables and provider-centred variables. While an average time can be shown for each class of case, each individual case will take more or less than the average time. The reasons may be

either provider-centred or client-centred. Client factors that affect the amount of time PHNs use to manage cases include age, geographic location, socioeconomic status and the health need which was the reason for the initial request for PHN service. Provider-centred factors responsible for differences in the amount of time spent in referral management include the source of the referral, and variables such as education and experience of the professional and her supervisor.

C. Conceptual Framework

A diagram of the conceptual framework developed for this study is presented in Figure 1. The dependent variable, called "Referral Management Time" is influenced primarily by client-centred and provider-centred groups of independent variables. While these two groups of variables represent the most important predictors of variation of referral management time, other less predictable factors such as inclement weather and competing work demands likely play some part in determining the amount of time that is spent by PHNs on case management. No attempt was made to include these items, as there is no satisfactory means of measurement or easy inclusion in the model.

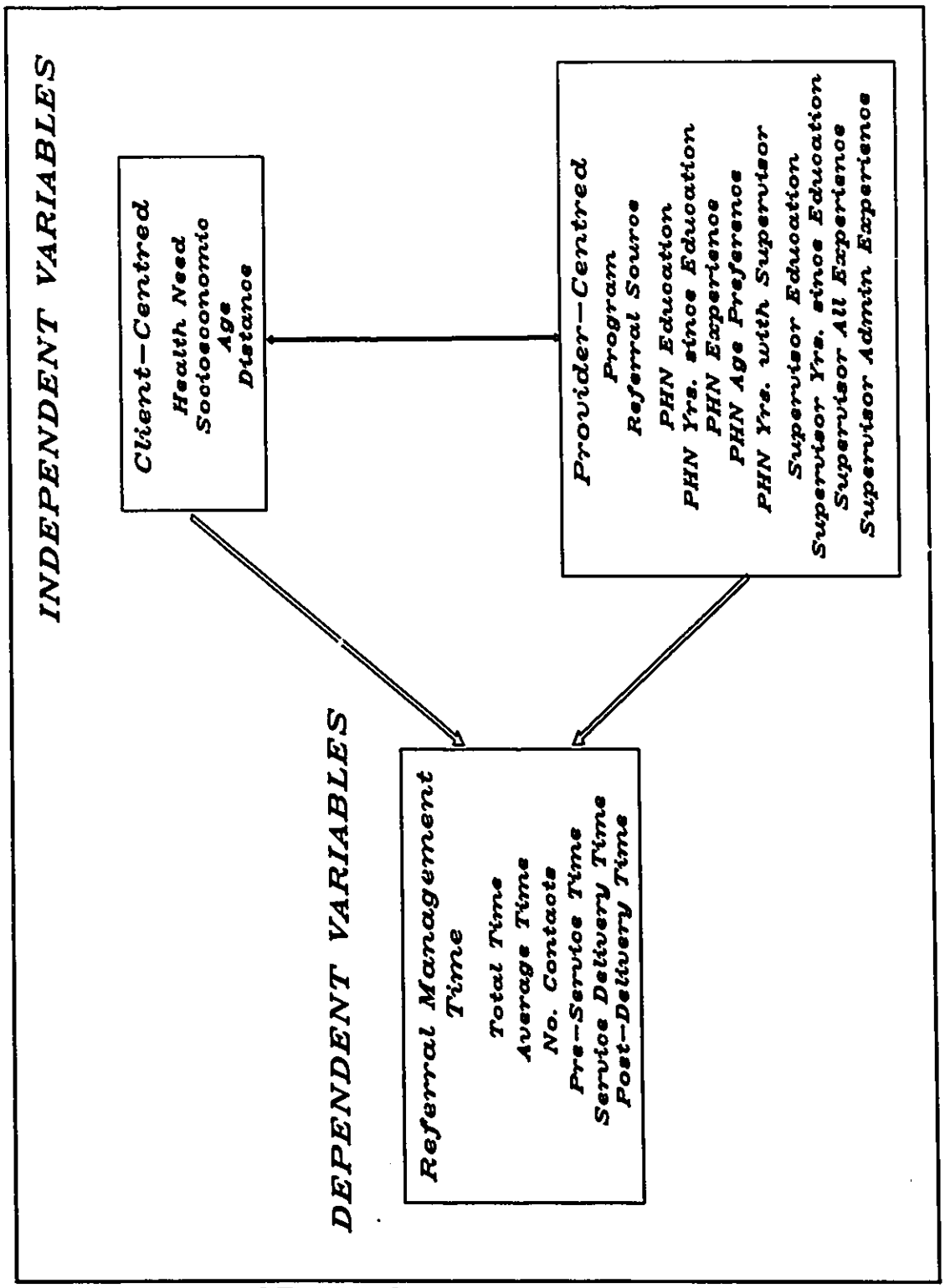

Figure 1 Conceptual Framework

1. Dependent Variables

The dependent variable, "Referral Management Time" was measured in several dimensions: i) the total amount of time spent in referral management - (sum of: time before service delivery, time spent in actual service delivery, and time spent after service delivery), ii) number of contacts, and iii) average time per visit. The time variables were measured in minutes, with the smallest interval being 5 minutes.

1. "Total Time": defined as time spent with, or on behalf of, the client for whom the service was requested. This variable represented the total amount of professional time utilized in providing public health nursing service to the client.
   - i) "Pre-Service Delivery Time": a measurement of time spent in activities done prior to client contact, including travel to the client's home.
   - ii) "Service Delivery Time": time spent in activities done during the course of the client contact. In some cases the significant service delivery contact may not be with the actual client per se, but with a caregiver or significant other in the home. Contact with another person on behalf of the client was considered as client contact.
   - iii) "Post-Service Delivery Time": time spent on activities (e.g. recording) completed after the actual delivery of service but which are directly related to providing service to the client.
2. "Number of Contacts": the total number of contacts with or on behalf of the client for which service delivery time was spent, including time with 3rd-party contacts.
3. "Average Time per Contact": derived by dividing "Total Time" by "Number of Contacts".

2. Independent Variables

Two distinct groups of independent variables which could be expected to be associated with variations in the amount of time spent were identified as having significance for the study; i) Client-centred variables, and ii) Provider-

centred variables.

a. Client-Centred Variables

1. "Health Need": The classification of case types, (client problems) used in OCHD Nursing Division was used to identify the reason for the referral. This classification, in use for over 5 years, is consistently applied through the use of standard definitions for client problem categories.
2. "Age": Measured in years. In the Maternal/Child category, the mother's age was used rather than the infant's age.
3. "Income": The Canada Census (1986) Average Income by Census Tract was used as a proxy for the socioeconomic status of the clients in the study.
4. "Distance": For those clients visited in their homes, the distance from the central office to the client's home was used as a standard measure to estimate the impact of travel on the amount of time required to deliver the service. If no home visit was made (e.g. telephone counselling contact only), this variable was measured as 0.

b. Provider-Centred Variables

1. "Referral Source": Information about the source of the referral provides an indication of whether such nursing-initiated activities as liaison are responsible for variations in the amount of time spent in referral management.
2. "Public Health Nurse Education": a) The type of educational preparation of the nurse providing the service and b) the number of years since completion of her last professional education.
3. "Public Health Nurse Experience": The years of experience in public health nursing.
4. "Public Health Nurse Preference": Nurses responses to the question of whether they preferred to work with a specific age group. If the answer was 'yes', the preferred age group was recorded.
5. "Supervisor Education": a) The educational preparation of the public health nurse's supervisor and b) the amount of time elapsed since the supervisor's last formal education.
6. "Supervisor Experience" a) The number of years experience in public health nursing administration and b) the total number of years of public health nursing experience.

7. "Supervisor/Nurse Influence" The amount of time the nurse had worked with her present supervisor was used as an indirect measure of the supervisor's influence on the amount of time spent by the nurse on each client.

In the conceptual framework diagram (Figure 1) interdependent relationships are shown by the arrow between the sets of independent variables. Programs are designed for specific target groups, thus it is understandable for example that "Health Need" and "Age" are related to "Program". A prime example of this is the obvious relationship between "Age" and "Health Need" which exists for Senior Adult cases. The Case Type coding for anyone over 65 years of age is Senior Adult (SA), and the Program is obviously Senior Adult Health (SAH). Another interdependent relationship is to be expected in cases which are generated by PHN hospital liaison activity. Examples of this interdependence include cases in the Maternal/Child Health, Mental Illness, and Medical/Surgical categories. Because the majority of these referrals are generated by hospital liaison activity, "Referral Source" would in most cases be "PHN Liaison".

The issue of travel time in Public Health Nursing is a contentious one. When designing the study, careful consideration was given as to how to measure the possible influence of geographic distance on Referral Management Time. The distance between the client's home and the central office was chosen as it provided a standard measurement. While PHN's who provide service in outlying suburban and rural areas may have to travel more kilometres than those who

serve urban clients, they will minimize the effects of actual distance travelled by visiting several clients in the same general area during the same day. Urban-based PHN's, while not driving as far, are frequently faced with traffic delays and the need to find suitable parking space in downtown areas. In 1985 a study was done in the Nursing Division on the issue of Travel Time[32]. For this study, all travel time including driving time, finding parking, time in traffic, and time between leaving the car and reaching the client's home via walking and/or elevator was recorded. The study showed that if all these factors were included, generally speaking the overall difference between the amount of time spent by PHN's in suburban/rural versus urban settings was 10 to 15 minutes per contact.

D. Description of the Research

For this research a descriptive study design was chosen. According to Mayer and Greenwood, research has a role to play during several policy phases; needs assessment, design of alternate courses of action, estimation of consequences, implementation, and evaluation. The question being asked in this study fits in primarily with the monitoring of policy implementation, which lends itself to a descriptive design. This approach, which relies on quantitative precision, requires structured data collection and analysis procedures made possible because the variables are well-defined.[33]

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[32] *Travel Time Study. Internal document (unpublished) Ottawa-Carleton Health Department, Nursing Division. 1985.*

[33] *Robert R. Mayer and Ernest Greenwood. The Design of Social Policy Research. (Prentice-Hall, Inc.; Englewood Cliffs, N. J. 1980) 54-60.*

E. Data Sources and Limitations

With the exception of the data for "Income", for which the Average Income per Census Tract from the 1986 Canada Census was used as an approximate measure of socioeconomic status, it was necessary to generate new data for the study. Data was collected using a set of survey tools developed specifically for the study. Copies of the Data Collection tools are included in Appendix A. Data about the education and experience of both public health nurses and their supervisors was readily collected using brief questionnaires. Because the type of information about the service-providers was straightforward, and recorded by the individuals concerned, the level of accuracy can be assumed to be relatively high. Data about client-centred variables and the dependent variables was recorded on 2-part tool, "Service Delivery Form" (Appendix A). The data about the independent variables such as client age, referral type (Health Need), source of referral, etc. are concrete facts which were transposed from incoming referrals onto the survey tool by clerical staff. This data could be easily verified from the client record if a discrepancy was noted. Recording of the indicators of the dependent variable "Referral Management Time" was not expected to be more than a reasonably accurate estimate, as it is rather difficult in the field situation to keep an accurate record of time. In any case, an insistence on "stop-watch accuracy" would only have served to alienate the busy public health nursing staff. Also, despite the detailed instructions for using the survey tool, it must be recognized that because the data was collected by 88 different professionals, variation

in interpretation of the instructions could be a factor in this study, as in any other study of this nature.

F. Study Population

The target population for the study was all recipients of the home visiting component of public health nursing service, while the sampling frame consisted of the referrals received in the latter 4 months of 1987. The actual study population consisted of 1143 clients who were referred for public health nursing services between September 1987 and December 31, 1987. According to Mayer and Greenwood, for a descriptive study the study population should closely approximate the target population.[34] Only incoming referrals assigned to nursing students from the University of Ottawa were excluded from the study, therefore the difference between the sampling frame, which also represented the target population in a specific time period, and the study population was small.

Two different approaches to selecting the unit of observation were possible in this study: i) client or ii) service provider. The unit of observation chosen for the study was clients referred for public health nursing service. In a study in which the major focus is the use of time by professionals, one might well ask why the client rather than the service provider was selected as the unit of observation. If the primary reason for the study had been the examination of the productivity of service providers, the appropriate unit of observation would have been the public health nurse, not the client. Because the impetus for the study was

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[34]*Ibid. Mayer and Greenwood. 182.*

generated from an interest in refining the Staff Deployment methodology, the unit of observation was defined as the client rather than the service-provider. The Staff Deployment methodology assumes that the use of time can be predicted by analysing the incoming demand(s) prior to service provision, therefore variations in referral management time which are attributable to differences in the professional providing the service are not factored into the equation.

G. Sample Design

A descriptive study design needs to include the largest possible number of units of observation that is economically feasible. The chosen units should also include a sufficient number of any subgroups within the overall population. During the year following the Data Collection phase, the Nursing Division was reorganized into 4 age-specific lifecycle programs. To provide useful data, subgroups which are aligned with program populations were defined. Program-specific referral types were aggregated into the four subgroups, Parent/Child Health, School Health, Adult Health, and Senior Adult Health.

For this study a sample consisting of all incoming cases assigned to public health nurses appeared to be the best approach. By using all incoming cases during a specific time period both validity and ease of administration were achieved. If a seasonal variation in the type of case being referred for service had been a potential factor in the study, a random sample over a longer period of time would have been appropriate. Although the actual number of cases of a specific type may vary slightly from one time period to another, with the exception

of a somewhat higher number of Maternal/Child Health referrals during the spring and summer months, there is no appreciable difference in referral types from one season to another. Since the actual process of ensuring that units were included in the study was being incorporated into the daily work of the clerical staff, the selection of the simplest administrative approach was a major factor for consideration in designing the Data Collection process.

A minimum number of cases for each sub-group was calculated. Because population means are of primary importance in measuring the dependent variables, the Confidence Interval method of calculating sample size seemed appropriate. Using a 95% Confidence Interval, and selecting acceptable Errors for each major subgroup (Parent/Child Health, Adult Health and Senior Adult Health), a minimum number of cases was determined for each of the 3 groups. A subgroup sample size for School Health was not calculated, because very few referrals are received for this age group. The following minimum subgroup sample sizes were determined:

i) Parent/Child Health: 484 cases
ii) Adult Health: 179 cases
iii) Senior Adult Health: 179 cases

H. Ethics and Confidentiality

Prior to embarking on this study, enquiries were made to ascertain what guidelines existed for ethics in research at the Health Department. The research complied with requirements as stipulated in the appropriate confidentiality

guidelines.[35] Dr. G. Dunkley, Associate Medical Officer of Health and chairperson of the Ethics Committee, reviewed the research proposal, plans for data collection and the survey instruments. The plans for the confidentiality of the data collection process were discussed with Dr. Dunkley. Based on the fact that there was no intent to modify the service provided, nor to collect client information that would not ordinarily be collected, in his opinion there was no need to submit the research proposal to the Health Department's Ethics Committee. The data collection methodology used ensured that the confidentiality of both clients and service providers was respected. The data were securely stored and handled only by Nursing Division staff and myself.

To ensure that the research complied with current expectations, two texts on research design were consulted.[36] According to Long, when embarking on research, the researcher(s) must consider 4 questions:

> i) Whose interests are involved?
> ii) Are any of the interested parties threatened in any way by the research?
> iii) Is the study design, including sample size, adequately developed to analyze the research questions, and allow for any alternative explanations? and
> iv) Do the expected research results justify the cost of the research?

Interested parties in the study included the recipients of the service being provided, the direct providers of the service, the nursing supervisors, and the

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[35] *Confidentiality of Health Department Information, A Policy Guideline. DRAFT. (April 1987)*

[36] *Long, A.F. Research into Health and Illness, Issues in Design, Analysis and Practice. (Gower Publishing Co. Brookfield, Vt. 1984) 109-118; Ibid. Mayer and Greenwood. 60-64*

Nursing Division of the Health Department. For the recipients of service the study did not in any way alter the service they received, therefore their interests were not jeopardized. There was no threat to the public health nurses who were providing the service, their immediate supervisors, or the Nursing Division because of the stringent means adopted to ensure the confidentiality of the data being collected and because the focus of the study was the client, not the nurse. The use of an alphanumeric code to link the data collected on the 3 survey tools ensured that the privacy of participating professionals and their clients was respected (see Appendix A). The study design, with several types of independent variables, was sufficiently exhaustive to allow for alternative explanations about the amount of time spent in managing referrals. Finally, with the exception of the recording of the time, which was estimated to require 258 professional and 70 clerical hours, the cost of the study to the Health Department was minimal. Copies of the proposal, data collection plans, ethical considerations and an estimate of the Health Department costs were given to the Acting Director of Nursing, Aline Thompson and Assistant Director of Nursing, Heather Caloren. Approval was granted in the spring of 1987 to proceed with the research.

I. The Survey

1. Preparation for the Survey

To ensure the complete documentation of referral management time a major step in preparing for the survey was ensuring that all possible activities which make up the referral management component of public health nursing

service were incorporated into the main data collection tool, the Service Delivery Form. The listing of all possible activities on the form helped to improve the reliability of the tool. Using the cited in the literature review and my own clinical knowledge and that of my colleagues, a form was drafted and circulated during the week of May 4, 1987 to all the district nursing teams with a request to review the listed activities and, in the appropriate category, add any that had been missed. The resulting information was incorporated into the first draft of the "Service Delivery Form", which was then tested in a small pilot study.

2. Pilot Test of Instrument

On the advice of the supervisors of the district nursing teams, one volunteer PHN from each of the 8 district teams was asked to use the survey form for at least one client until discharge or for a period of a month, whichever was sooner. The public health nurses who volunteered to use the form received written and verbal instructions on the use of the form. The nurses were asked to include any suggestions which would improve the accuracy and utility of the form when they returned the completed forms at the end of the pilot period. The final Service Delivery Form, produced in a smaller format with written definitions for all sections of the form, incorporated the recommendations from the pilot study group.

3. Data Collection Methodology

As previously mentioned, empirical data were collected using an interlocking set of survey tools. The provider-centred data concerning the nurses

and their supervisors were collected only once. The recording of the codes of the nurse and her supervisor on the Service Delivery Form completed the link between client and service provider.

a. Provider Survey Instruments

To collect data on the service providers 2 tools were created. Form I, "Public Health Nurse Profile" (see Appendix A) was designed to record data about the district public health nurses who would be providing the service to the clients. Form II, "Supervisor Profile" (see Appendix A) collected information about the supervisors to whom the public health nurses reported. Both instruments included questions about type of educational preparation, years since completion of formal education, and amount of experience. The "PHN Profile" also asked about the length of time the nurse had worked with the Supervisor and whether she preferred working with a specific age group.

b. Client Survey Instrument

The primary survey instrument, Form III, "Service Delivery Form" (see Appendix A), consisted of 2 pages, both of which had been stamped with the same identifying client code number. An important consideration in the design of the form was the ease of its use. For the duration of the study all district PHNs were expected to incorporate the use of the tool into their recording of client contacts. For the purpose of recording all time spent for that specific case, Page 1 of the Service Delivery Form was retained by the PHN for the duration of her contact with the client, or until 3 months had elapsed. The form was divided into

Pre-Service Delivery, Service Delivery, and Post Service Delivery sections and had space for recording of 8 client contacts. More forms could be used as required if the number of contacts exceeded 8. The reverse side of Page 1 contained detailed definitions for each section, thus providing a ready reference when using the form. Page 2 of this form was used to collect data about the client, the case type, and the source of referral. The second page of the form was completed at the time of assignment of the case to the PHN, and submitted to the researcher to serve as a Master Control file for the duration of the study.

c. Data Collection Process

In August, prior to the start of the main data collection period, all public health nurses working in district teams completed a "Public Health Nurse Profile". Supervisors responsible for district teams completed a Supervisor Profile Form, and provided their nurses with their code number. The PHN Profile contained a space for the appropriate Supervisor Profile code, thus creating the necessary link between PHN and Supervisor. The connection between the 3 survey instruments was completed when the Nurse's code and the Supervisor's code were recorded on the Service Delivery Form. To increase the accuracy of the code links, an adhesive label was provided with each Public Health Nurse Profile. The label with the PHN code, on which the nurse recorded her supervisor's code, was to be attached to the nurse's casebook for the duration of the study so that she had a ready reference which ensured that the correct codes were recorded on the "Service Delivery Form". The week before the survey was to begin written

instructions were distributed to the supervisors and team leaders, who then provided the information to the district teams. During the first week of the study, several specific questions were raised, so clarification was given and additional written guidelines were provided.

From September 14, 1987, until December 31, 1987, the reception clerical staff attached a Service Delivery Form to all incoming referrals prior to forwarding them to the appropriate teams. At the time of receipt, all incoming referrals are also routinely marked with the appropriate census tract which allowed the addition of the Average Family Income to be added to each record in the study database. When the referrals were received by the teams, the team clerk copied relevant client data from the referral onto Page 2 of the Service Delivery Form. Once the referral had been assigned to a public health nurse, she completed the Master Control File (Page 2) by adding any missing demographic information, the Referral Information, Centralized Caseload Book Classification, her Nurse's Code, and her Supervisor's Code. This page was then detached from Page 1 and forwarded to me. Because cases managed by students were not part of the study, if the referral was assigned to a University of Ottawa nursing student, the form was returned unused, thus that client was not included in the study. Page 1 was retained with the client record in the PHN's casebook and used to record the amount of time spent in all client-related activities. Additional uncoded forms were available if the number of client contacts exceeded the space on the numbered form. If an additional form was needed, the nurse added the

client code to the additional form. When the case was discharged, or 3 months from the receipt of referral, whichever was sooner, the nurse forwarded the completed Page 1 of the Service Delivery form to me, and the data set for the case was complete. While the Service Delivery form did not include the information about whether the case was discharged within the 3-month period, by making certain assumptions a relatively solid estimate can be made of the number of cases that would continue beyond 3 months. Home Care cases can be eliminated, as they are short-term, and based on the assumption of the minimum frequency of visiting being 1 visit a month, plus an assessment visit, any cases which have less than 4 visits would likely not continue. By eliminating both these groups, and reviewing the remaining cases I was able to estimate that only 88 cases of the 1143 retained in the study might have continued on the PHN caseload beyond 3 months. Of these, 27 (15%) were Adult Health cases, 40 (6%) were Parent/Child Health, 20 (8%) were Senior Adult Health, and 1 (8%) was School Health. The percentages shown are the proportion within the program group.

During the data collection period I reviewed the incoming Page 2's of the Service Delivery Forms to monitor the number of cases in each program category. Once the desired number of cases in a program category was reached, the clerical staff were instructed to discontinue the attachment of Service Delivery Forms to the incoming referrals of the case types in that program. For the Parent/Child Health category, which receives the largest number of incoming referrals, the

minimum number of cases was reached sooner than with either Senior Adult Health or Adult Health. A satisfactory number of cases for each category was reached before the end of December 1987 for all program categories.

As the Page 1's of the Service Delivery Form were received, they were reattached to the Page 2 Master Control File. The completed tool was reviewed to verify that the data was complete. If demographic data was missing the data on the Master Control File was matched against the Nursing Division's Family Index System (FIS). Where the missing data required PHN input, forms were returned to PHNs by looking up the names on the Family Index System and finding out the name of the PHN who had followed the case. By verifying information in this manner, only a few cases needed to be eliminated from the study. Only those cases for which complete records, i.e. both pages of the Service Delivery Form were returned, were included. While some missing data was acceptable, e.g. age or census tract, if the PHN code was missing, the record was eliminated. Without the link between PHN and client no provider-centred variables could be matched with the client. Once the verification process had been completed, of the 1207 cases for which forms were returned, 1143 cases (95%) were considered to be acceptable for inclusion in the study. The study population was 56% of the referrals received (2026, estimated) during this time period.

A lexicon of the variables and their respective sources is provided in Appendix B. For purposes of this study a complete record consisted of data from

the Service Delivery Form, Public Health Nurse Profile, Supervisor Profile, and Average Income from the Canada Census (1986). In preparation for analysis the data were entered into a microcomputer using Lotus Symphony. To verify the accuracy of the data entry, printouts of the data were run and compared to the original data. Corrections were made as necessary.

During the data collection phase, all the research materials containing information about the nurses, supervisors and clients were retained in the secure central storage area of Nursing Division at the Health Department. Research materials have subsequently been securely stored in my home office, and will be returned to the Health Department for shredding once this thesis has been successfully defended.

IV. DATA ANALYSIS

A. Analysis of Data

The reporting of the analysis is divided into 2 sections, i) a general description of the findings and ii) an exploration of the relationships between the dependent and independent variable(s). For the general descriptive analysis I used SPSSPC+, and included graphs generated from the original database by Lotus Symphony. On the advice of my second thesis supervisor, Professor Colin Lay, I used an exciting new analytic tool, First Mark's Knowledge Seeker (KS), for the analysis of relationships between variables. KS is particularly well suited for the analysis of data sets which do not conform to the balanced design requirements of a classical Analysis of Variance approach.

Before presenting the findings, a little explanation is in order. Some of the categories in the Tables (generated in SPSSPC+) contain very few cases, thus the means may not be representative. In the discussion that follows, only groups with more than 20 cases were considered to contain results that are representative. Results have been rounded to the nearest whole number in the body of the text. The categories used to describe the independent variable "Health Need" are Case Type codes which have been in use in the Nursing Division for several years. While most of these codes are self-explanatory, some are not. Individual/Family Management referrals are for non-specific health-related needs which often indicate a coping or informational deficit. The Mental Health category includes

referrals for clients whose mental health problems have no psychiatric diagnosis. Referrals coded as High Risk (MCH) are those in which professionals have identified the presence of specific risks which are assessed according to a standard tool. Because PHN's are familiar with the standard definitions for these codes, they provided a convenient and consistent means of identifying the Health Need, or reason for the referral.

Since the completion of the study, the Nursing Division has undergone a major re-organization which realigned service delivery by the age groups specified in the Health Department's long-range plan. For the analysis Case Type Codes have been allocated to program groups in order to make the data useful in the new lifecycle configuration. In the case of Pediatrics, an age group which spans both the Parent/Child Health and School Health Programs, the category has been split by age (0-4 and > 4) where the data were analyzed by Program.

Concurrent with the time period of the study, an automated system to replace the outdated Cardex for keeping track of Health Records was being introduced. In preparation both for the move to the lifecycle program groups, and for the full implementation of this computerized system, called "Family Index System" (FIS), some modifications were being made to the Case Type Coding system. For purposes of this study, however, I opted to use the Case Type Codes that matched the original staff deployment weighting system mentioned earlier (page 6). These codes are listed in Table 2 with their associated abbreviation and a brief definition. They are presented according to current program group.

Table 2 Case Type Codes

ABBREVIATION	CASE TYPE CODE	DEFINITION
Program: ADULT HEALTH		
CA	Cancer	Cases referred from Cancer Clinic(s)
CD	Communicable Disease	Primarily Tuberculosis cases, but includes all cases referred for follow-up of a communicable disease.
IFM	Individual/Family Management	Follow-up requested for teaching and/or counselling for health-related concerns and coping.
MH	Mental Health	Assessment and follow-up of mental health problems that do not have a psychiatric diagnosis.
MI	Mental Illness	Cases with psychiatric diagnosis.
MS	Medical/Surgical	Post-hospitalization follow-up of clients with medical or surgical diagnoses. Primarily cardiac cases.
Program: PARENT/CHILD HEALTH		
HR	High Risk (MCH)	Assessed as being potentially at risk due to presence of factors known to be associated with negative outcomes.
MCH	Maternal/Child Health	Postpartum follow-up.
PED	Pediatrics	0 to 4 years of age, not in school.
PRN	Prenatal	Clients referred for follow-up of pregnancy-related health concerns.
Program: SENIOR ADULT		
SA	Senior Adult	Clients over 65 years of age.
Program: SCHOOL HEALTH		
PED	Pediatrics	Children over 4 years and up to 19, unless Health Need is prenatal or postnatal.

B. Results of the Survey

1. General Description of Findings

For the general description of the data set, the analysis was done using the SPSSPC+ "Tables" command, with Health Need represented by the Case Type Codes, which are nested in the Program groups. To show the statistics for the dependent variables, tables were generated for 3 populations: i) the full data set of 1143 cases; ii) the "trimmed data set", with outliers removed; and iii) the outliers. For the dependent variables Total PHN Time, Number of Contacts, and Average Time per Contact the tables for the different populations were juxtaposed in panels which clearly show the differences between the groups. In each of the combined tables, Panel A shows findings for the total study population, Panel B shows the trimmed study population, and Panel C (and D) shows the statistics for the excluded cases. The trimmed population consists of all cases whose Total PHN Time was >= 10 minutes but <= 660 minutes. Because the trimmed population findings will have more importance for managers who are interested in average or unit costs, this set will form the basis for a more detailed discussion including the breakdown of Total PHN Time into its constituent components, Pre-Service Delivery Time, Service Delivery Time, and Post-Service Delivery. Since the School Health program group of cases is so small (n=13), it is presented in the tables, but not discussed.

Trimming the population was done by removing outliers. When the whole sample population (n=1143) was first analysed, it was evident that outliers were

skewing the data. To achieve a more compact sample for the general description, I decided that once they had been examined, the outliers should be excluded. Correcting for outliers left a population of 1094 cases (96% of n=1143).

To remove the outliers and achieve a roughly mound shaped distribution, the Empirical Rule[37] was applied to the dependent variable "Total Time". Two standard deviations (2 X 226) were added to the mean (208) for the upper limit, and 10 minutes was chosen for the lower limit, as subtracting 2s from the mean would have resulted in a negative value. Only 3 cases were found to fit into the lower outlier group.

a. Description of the Total Study Population

In Panel A of each of the 3 following sets of tables the statistics for the full study population of 1143 cases are presented.

Total PHN Time as Dependent Variable

Total Time was measured in increments of 5 minutes and included time spent by the public health nurse on all activities attributable to having received a referral for a particular client. In the full data set (n=1143), the overall mean for Total PHN Time was found to be 208 minutes. Panel A of Table 3 shows the large amount of variation in Total PHN Time. Of the groups with more than 20 cases, means varied from a low of 135 minutes for the Pediatric < 4 (PCH) to a high of 442 minutes for Mental Illness (AH). There is a noticeable difference

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[37] *Ott, L. and Hildebrand, D.K.; Statistical Thinking for Managers; Duxbury Press, Boston, Mass.; 1983; p.23.*

Table 3 Total PHN Time by Health Need/Program

A Total Study Population (n=1143)

	TOTAL PHN TIME			
	# Cases	Mean	Maximum	St Dev
AH Program				
CA	7	512.9	2210.0	753.2
CD	3	455.0	945.0	429.3
IFM	26	290.2	870.0	240.1
MH	6	330.8	880.0	318.4
MI	27	441.5	1725.0	357.9
MS	106	250.5	2090.0	292.6
Program	175	302.6	2210.0	332.5
PCH Program				
HR	87	293.3	1785.0	323.9
MCH	573	151.5	1355.0	161.4
PED	27	134.6	315.0	72.6
PRN	24	256.5	890.0	184.5
Program	711	171.7	1785.0	193.5
SAH Program				
SA	244	248.5	1380.0	197.4
Program	244	248.5	1380.0	197.4
SH Program				
PED	13	168.5	405.0	107.9
Program	13	168.5	405.0	107.9

B Trimmed Study Population (n=1094)

	TOTAL PHN TIME			
	# Cases	Mean	Maximum	St Dev
AH Program				
CA	6	230.0	370.0	93.0
CD	2	210.0	275.0	91.9
IFM	23	223.9	625.0	157.8
MH	5	221.0	500.0	190.3
MI	22	317.0	630.0	196.7
MS	99	189.8	610.0	145.0
Program	157	215.4	630.0	158.3
PCH Program				
HR	80	213.8	620.0	148.3
MCH	559	137.6	660.0	120.5
PED	27	134.6	315.0	72.6
PRN	23	229.0	510.0	128.6
Program	689	149.4	660.0	115.9
SAH Program				
SA	235	222.2	640.0	141.6
Program	235	222.2	640.0	141.60
SH Program				
PED	13	168.5	405.0	107.9
Program	13	168.5	405.0	107.9

C Eliminated Cases Total Time > 660 min. (n=48)

	TOTAL PHN TIME			
	# Cases	Mean	Maximum	St Dev
AH Program				
CA	1	2210.0	2210.0	
CD	1	945.0	945.0	
IFM	3	798.3	870.0	95.4
MH	1	880.0	880.0	
MI	5	989.0	1725.0	412.1
MS	7	1108.6	2090.0	484.6
Program	18	1063.1	2210.0	467.9
PCH Program				
HR	7	1202.1	1785.0	407.8
MCH	11	896.4	1355.0	228.9
PRN	1	890.0	890.0	
Program	19	1008.7	1785.0	328.0
SAH Program				
SA	9	933.9	1380.0	221.0
Program	9	933.9	1380.0	221.0

D Eliminated Cases Total Time < 10 minutes (n=3)

	TOTAL PHN TIME			
	# Cases	Mean	Maximum	St Dev
PCH Program				
MCH	3	6.3	9.0	2.3
Program	3	6.3	9.0	2.3

Table 4 Number of Contacts by Health Need/Program

A Total Study Population (n=1143)

	NUMBER OF CONTACTS			
	# Cases	Mean	Maximum	St Dev
AH Program				
CA	7	3.9	16.0	5.4
CD	3	1.7	3.0	1.2
IFM	26	2.8	9.0	2.1
MH	6	2.8	6.0	2.4
MI	27	4.3	16.0	3.3
MS	106	2.4	28.0	3.3
Program	175	2.8	28.0	3.2
PCH Program				
HR	87	2.6	14.0	2.4
MCH	573	1.6	13.0	1.4
PED	27	1.5	4.0	1.1
PRN	24	2.5	7.0	2.0
Program	711	1.7	14.0	1.6
SAH Program				
SA	244	2.5	13.0	2.1
Program	244	2.5	13.0	2.1
SH Program				
PED	13	1.7	4.0	1.0
Program	13	1.7	4.0	1.0

B Trimmed Study Population (n=1094)

	NUMBER OF CONTACTS			
	# Cases	Mean	Maximum	St Dev
AH Program				
CA	6	1.8	3.0	.8
CD	2	2.0	3.0	1.4
IFM	23	2.3	7.0	1.5
MH	5	2.2	4.0	2.0
MI	22	3.5	9.0	2.4
MS	98	1.8	9.0	1.4
Program	157	2.2	9.0	1.7
PCH Program				
HR	80	2.1	8.0	1.6
MCH	559	1.5	8.0	1.2
PED	27	1.5	4.0	1.1
PRN	23	2.4	7.0	1.9
Program	689	1.6	8.0	1.3
SAH Program				
SA	235	2.3	11.0	1.7
Program	235	2.3	11.0	1.7
SH Program				
PED	13	1.7	4.0	1.0
Program	13	1.7	4.0	1.0

C Eliminated Cases Total Time > 660 min (n=46)

	NUMBER OF CONTACTS			
	# Cases	Mean	Maximum	St Dev
AH Program				
CA	1	16.0	16.0	
CD	1	1.0	1.0	
IFM	3	6.7	9.0	2.5
MH	1	6.0	6.0	
MI	5	7.6	16.0	4.9
MS	7	9.8	28.0	7.60
Program	18	8.3	28.0	6.4
PCH Program				
HR	7	8.3	14.0	2.8
MCH	11	6.1	13.0	2.9
PRN	1	6.0	6.0	
Program	19	6.9	14.0	2.9
SAH Program				
SA	9	7.9	13.0	3.7
Program	9	7.9	13.0	3.7

Table 5 Average Time per Contact by Health Need/Program*

A Total Study Population (n=1073)

	AVERAGE TIME PER CONTACT			
	# Cases	Mean	Maximum	St Dev
AH Program				
CA	7	134	195	40
CD	3	394	945	478
IFH	26	118	450	106
MH	4	104	147	39
MI	27	115	300	69
MS	101	112	325	54
Program	168	119	945	92
PCH Program				
HR	82	118	610	75
MCH	535	96	350	55
PED	24	94	195	43
PRN	21	114	208	53
Program	662	99	610	58
SAH Program				
SA	230	107	282	45
Program	230	107	282	45
SH Program				
PED	13	110	285	66
Program	13	110	285	66

B Trimmed Study Population (n=1026)

	AVERAGE TIME PER CONTACT			
	# Cases	Mean	Maximum	St Dev
AH Program				
CA	6	133	195	44
CD	2	118	145	38
IFH	23	115	450	111
MH	3	89	125	32
MI	22	107	300	70
MS	94	111	325	54
Program	150	112	450	67
PCH Program				
HR	75	115	610	76
MCH	523	94	290	53
PED	24	94	195	43
PRN	20	112	208	54
Program	642	97	610	56
SAH Program				
SA	221	105	250	44
Program	221	105	250	44
SH Program				
PED	13	110	285	66
Program	13	110	285	66

C Eliminated Cases Total Time > 660 (n=46)

	AVERAGE TIME PER CONTACT			
	# Cases	Mean	Maximum	St Dev
AH Program				
CA	1	138	138	
CD	1	945	945	
IFH	3	138	218	72
MH	1	147	147	
MI	5	151	257	61
MS	7	124	190	41
Program	18	181	945	196
PCH Program				
HR	7	152	223	53
MCH	11	173	350	79
PRN	1	148	148	
Program	19	164	350	67
SAH Program				
SA	9	141	282	69
Program	9	141	282	69

* Average Time Per Contact = Total PHN Time divided by Number of Contacts; not all cases had "Service Delivery" Contact

between program groups, with Adult Health showing the largest mean Total Time of 303 minutes. The means of all the Adult Health groups are higher than the overall mean. Senior Adult shows the next highest Program mean (249 minutes). Parent/Child Health (mean=172 minutes), and School Health (mean=169 minutes) are below the overall mean. In the PCH program group, means for both the High Risk (293) and Prenatal (257) groups are above the overall mean (208 minutes). While the mean for the PCH group is appreciably lower than the overall mean, the sheer volume of cases in this group is noteworthy. In fact, the PCH Program group accounts for 62% (711 out of 1143) of the cases in the study.

Number of Contacts as Dependent Variable

To count as a "Contact", time had to be documented in the "Service Delivery" section of the data collection tool, Form III (Service Delivery Form). Panel A in Table 3 shows the findings for Number of Contacts as dependent variable for the full study population. The overall mean number of contacts was 2.04.[38] There is not a large difference between program groups. For Adult Health the mean is 2.8, for Senior Adult Health the mean is 2.5, and for Parent/Child Health the mean is 1.7. The range of variation is from 1.5 contacts in Pediatric < 4 (PCH) to 4.3 contacts in Mental Illness (AH). From the

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[38] *Despite the earlier assertion that I would be reporting rounded values in the body of the text, when discussing "Number of Contacts" as a dependent variable, for this variable I am reporting fractions because the values are small and the size of the difference between groups would tend to disappear if the results were rounded to whole numbers.*

Maximum and Standard Deviation columns in the Adult Health group it is obvious that there is little consistency within these groups. The largest number of contacts was 28, in the Medical/Surgical (AH) group.

Average Time per Contact as Dependent Variable

This variable was calculated by dividing the Total PHN Time by the Number of Contacts. The importance of the Average Time per Contact is that it can be used as a unit cost measure. The study population of 1073 shows that for 70 cases, while PHN time was spent on the case, the contact could not be counted as "significant" according to the study definition.[39] The overall Average Time per Contact was 104 minutes. Results in Panel A of Table 4 show that there was little difference between program groups. PCH showed the smallest mean Average Time per Contact of 99 minutes. Adult Health had the largest mean of 119 minutes, while Senior Adult, at 107 minutes, was close to the overall mean.

Before moving on to an examination of the excluded cases, and a detailed discussion of the trimmed population, a brief look at the components of Total PHN Time will round out the description of the full study population. Direct client contact represents only 1 component of the time spent for each client. The findings concerning the proportion of time spent in direct Service Delivery

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[39] *In this context, "significant" does not have a statistical meaning, rather it is used in its more prosaic, non-statistical definition. For PHN's "significant contact" means a home visit, or telephone contact replacing a home visit.*

activities relative to non-Service Delivery activities are not consistent with those of the DAR reporting system mentioned earlier. (page 17) In the Daily Activity Record (DAR), 56% of time was in direct activities.[40]

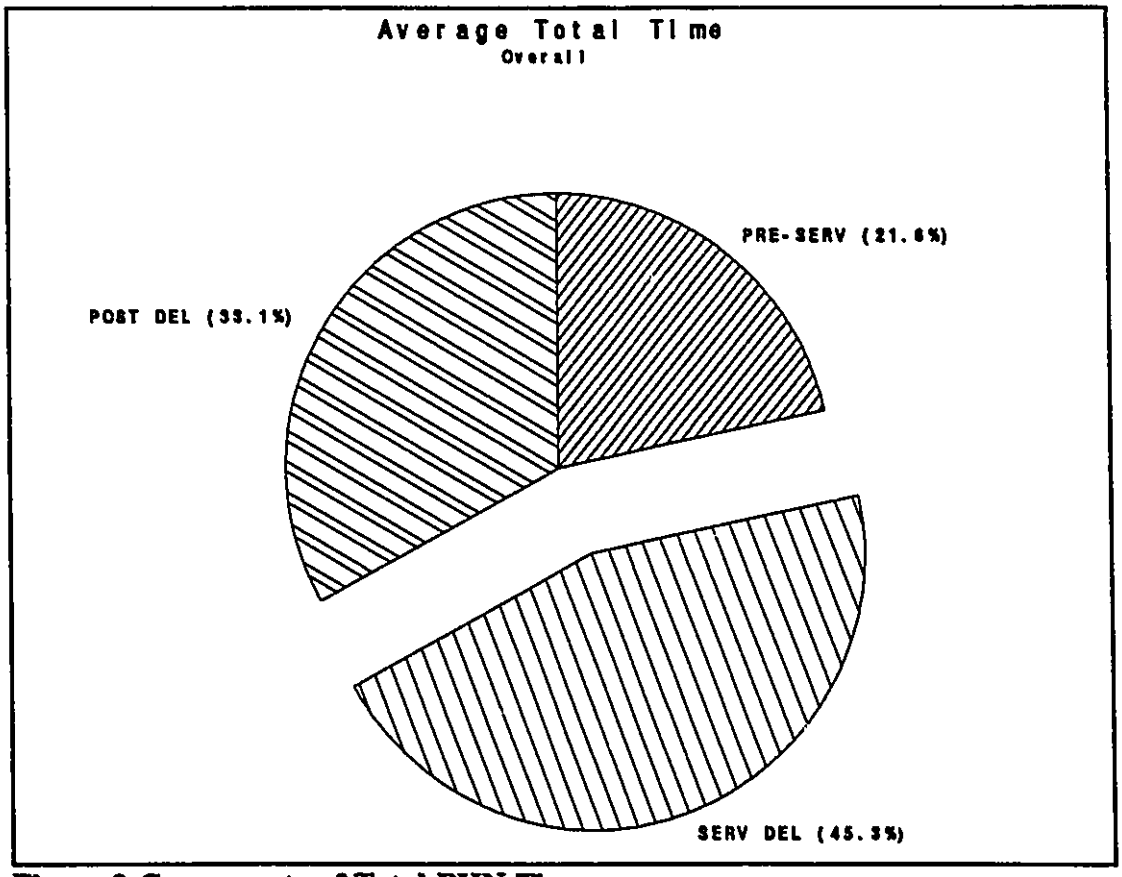

Figure 2 Components of Total PHN Time

[40] *See page 15.*

The pie chart in Figure 2 shows that during the study, only 45.3% of the overall time was spent in direct service delivery. Pre-Service time, which included travel to the home visit, used 21.6% of the total time. One-third (33.1%) of the time was spent in post-service delivery activities, which included recording. In 1987 PHN's were beginning to use a new theory-based recording system which needed additional time to learn. The traditional recording method, which required a narrative note for each intervention, was an adequate record from a legal standpoint, however it was not designed to help nurses to formulate their record according to problem statements (or nursing diagnoses).

The stacked bar graph in Figure 3 shows the overall Average Total Time by Program, with the breakdown by time component; i.e. Pre-Service, Service Delivery, Post-Delivery Time for the 3 program groups in which most of the referral management activity occurs, and the overall population. As in the pie chart, the large amount of post-delivery time is clearly evident. The proportions for components of time for the different program groups do not differ markedly from the overall proportions shown in the pie chart.

From the earlier discussion we know that there is wide variation between groups for the important dependent variable Total PHN Time. To make the results of this study useful for program planning and costing purposes, the study population was reduced to a less unpredictable profile by the elimination of outliers. Before continuing with a full description of the trimmed population, we

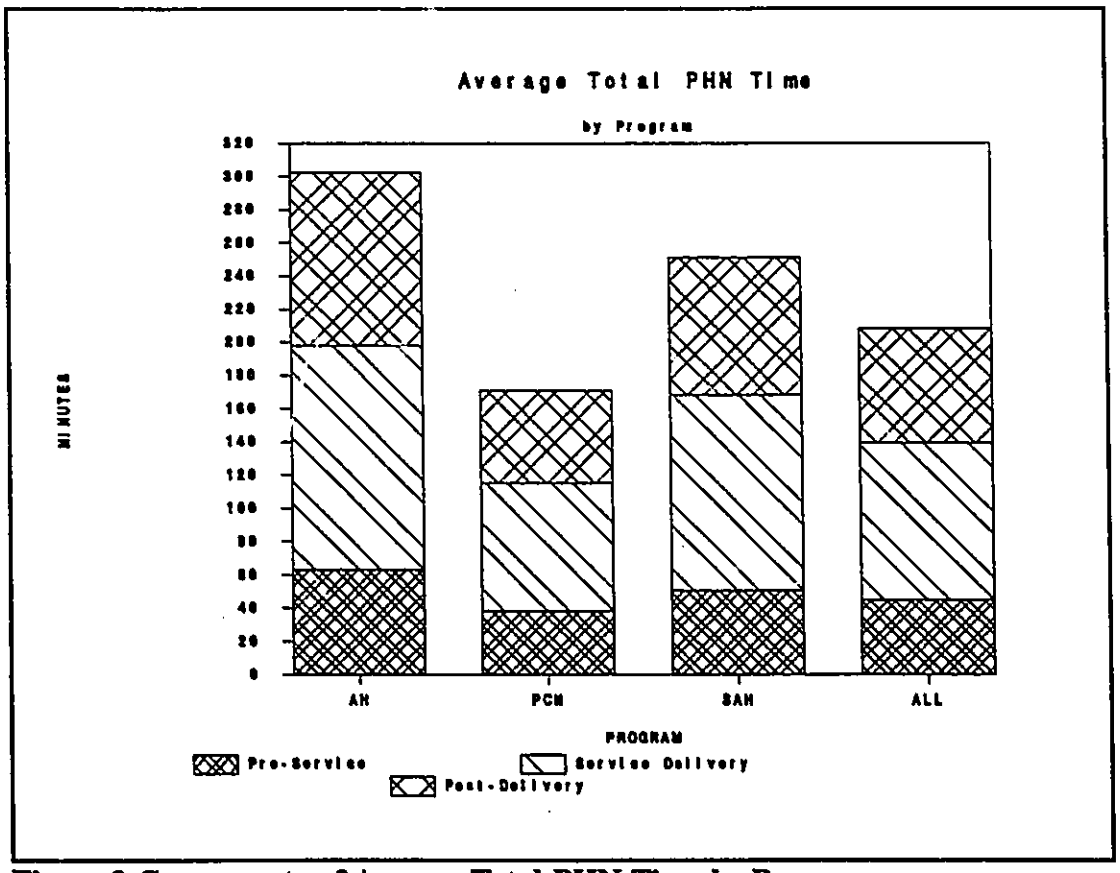

Figure 3 Components of Average Total PHN Time by Program

will look briefly at the excluded population. In the set of tables, Panel C, and in Table 2, Panel D, shows the findings for the outliers.

b. Description of The Excluded Cases

As Panel D of table 2 shows, at the low end of the spectrum only 3 cases have a Total Time < 10 minutes. These cases were all in the Maternal/Child Health group. Because they are so few, with so little overall impact, they can safely be discounted in further analysis.

Panel(s) C of tables 2, 3, and 4 give some interesting information about

excluded cases (n=46) where Total Time was > 660 minutes. The distribution of cases with Total Time greater than normal is significant. As indicated in Table 2, the Adult Health Program had a greater proportion of cases which required more than 660 minutes. Of the 175 Adult Health cases in the study, 10% (i.e. 18) used more than 660 minutes. For the Parent/Child Health Program (n=711), the 19 cases represent 3% of the PCH cases, while the 9 Senior Adult Health cases are 4% of the total SAH number (n=244). If these findings are representative over time it means that the time required to manage the overall caseload of the Adult Health Program is less predictable than that of other programs, therefore more "flex" will have to be built in to predictions in that program.

The overall mean Number of Contacts was just over 2. Panel C of Table 3 clearly shows that "Number of Contacts" is an important determining factor for a higher-than-normal Total Time. This is not unexpected since overall Total Time is obviously strongly influenced by the number of contacts. One example of an exception to this rule is the CD case in the Adult Health Program which, for 1 identified client contact, used 935 minutes. Much of this time was no doubt due to the contact tracing activities which are inherent in the follow-up of TB cases.

The Average Contact Time is not significantly different than the retained cases. Panel C of Table 4 summarizes the Average Time per Contact for the excluded cases.

c. Description of Trimmed Study Population

Total PHN Time as Dependent Variable

In the 'trimmed' population, the overall mean Total Time for all types of cases (n=1094) is 175 minutes. The MCH category, with 559 cases represents 51% of the study population. Panel B of Table 2 provides data about Total PHN Time by Health Need for the trimmed population. The mean Total Time within specific categories varied from 135 minutes for Pediatrics < 4 (n=27) to 317 minutes for Mental Illness (n=22). Large differences are noticeable between Program group means. Means for Senior Adult and Adult are much higher than Parent/ Child, however as far as overall workload is concerned, the low mean time in PCH is offset by the large number of cases. Senior Adult Health program (n=235) shows a mean of 222 minutes. The next highest program group mean of 215 minutes was found in Adult Health. Parent/Child Health (n=689) program had an overall mean of 149 minutes. All the subgroups in Adult Health (n=157) Program registered means higher than the overall average time reported for Nursing Division. Program means in both Parent/Child Health and School Health were below the overall mean, but High Risk and Prenatal cases in PCH required higher-than-average amounts of time.

While the actual numbers of cases in both the Cancer (n=6) and Communicable Diseases (n=2) groups are small, the unpredictable nature of these cases deserves some discussion. Recall that in the earlier discussion about

the excluded outliers, mention was made of the higher proportion of unpredictable cases in the Adult Health program. The Cancer and CD cases are illustrative of this. PHN time for both Cancer and TB cases can be very unpredictable.[41] Most Cancer referrals consist of a request to complete the paperwork necessary to obtaining volunteer services such as transportation, friendly visiting, etc. Occasionally, the PHN will identify family or client needs which will necessitate extensive work with the family. One Cancer case (excluded from the retained database) in the study actually took almost 37 hours. The excluded Communicable Disease case required over 15 hours. This time commitment is not uncommon for the follow-up of TB cases. In fact, one TB case can generate many hundreds of hours of follow-up, and since this is a mandated priority activity, it must take precedence over other activity.

Number of Contacts as Dependent Variable

For the dependent variable "Number of Contacts" the number of entries in the Service Delivery section of the Data Collection tool was used.[42] Panel B of Table 3 shows the findings concerning the Number of Contacts by Health Need for the trimmed population. For all types of cases (n=1094) the mean number of contacts was 1.8, ranging from a low of 1.5 in Maternal/Child Health (n=559) and Pediatrics < 4 (n=27) to a high of 3.5 in Mental Illness (n=22). No doubt

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[41] *The majority of CD cases are tuberculosis.*

[42] *In Table 3, 9 missing values were counted as 1.*

the preponderance of MCH cases is responsible for the low overall mean. There is surprisingly little difference in the number of contacts between program groups. Among program groups, the mean of 2.3 contacts per case for Senior Adult Health is the highest, Adult Health is the next highest with 2.2 contacts, while Parent/Child Health shows a mean of 1.6 contacts.

Average Time per Contact as Dependent Variable

Data concerning the Average Time per Contact for the trimmed population is presented in Panel B of Table 4. The overall mean Average Time per Contact (Total Time divided by Number of Contacts) was 101 minutes (n=1026). The number of cases differs from the previous number because not all cases in the database had entries in the "Number of Contacts" field. If according to the definition no significant contact took place, the number of contacts was given as 0. (*e*.g. A PHN might make a home visit, and find no one home.) Values varied from a low of 94 minutes in the Maternal/Child Health (n=523) and Pediatrics < 4 yrs categories (n=24) to a high of 115 minutes for Individual/Family Management (n=23) and High Risk (n=75). There is not a large difference between categories, however the Maximum column indicates a considerable range of difference within subgroups in both the Adult Health and Parent/Child Health Program groups. Together the Average Time per Contact and the average Number of Contacts for any given case type might be used to estimate a per-client cost for the different client groups.

Pre-Service Delivery Time as Dependent Variable

Pre-Service Delivery Time was defined as all time spent prior to actually providing the service. This category included activities such as making an appointment to visit, discussions with third party (family, other professionals, team members), preparation for the visit, and travel to the client's home if a visit was made. For the most part, the majority of time in the category was for travel time. No travel time was recorded in situations where no home visit was made; e.g. telephone counselling, counselling at school, refusal of service, client not found, etc.

Panel A of Table 6 presents the Pre-Service Delivery findings by Health Need for the trimmed population. The overall mean Pre-Service Delivery time (n=1094) was 39 minutes. Means for the Program groups ranged from a high of 50 minutes for Adult Health to a low of 33 minutes in Parent/Child Health. The range of variations is from 31 minutes in Maternal/Child Health (n=559) to 76 minutes for Mental Illness (n=22). In Mental Illness cases in the Adult Health Program, PHN's frequently must spend a considerable amount of time consulting with other professionals and family members. Travel is also likely to have been a factor in the Mental Illness category where face-to-face contact and a higher number of visits are necessary for satisfactory service delivery. The Knowledge Seeker results showed that 83% of the Mental Health group received home visits,

Table 6 Components of Total PHN Time for Trimmed Population

A

	PRE-SERVICE DELIVERY			
	# Cases	Mean	Maximum	St Dev
AH Program				
CA	6	45.8	70.0	19.9
CD	2	22.5	30.0	10.6
IFM	23	45.9	130.0	40.4
MH	5	57.0	95.0	32.9
MI	22	76.1	290.0	72.3
MS	99	44.8	205.0	46.7
Program	157	49.5	290.0	49.7
PCH Program				
HR	80	46.9	195.0	39.1
MCH	559	30.6	190.0	30.0
PED	27	31.1	180.0	39.3
PRN	23	54.6	140.0	40.6
Program	689	33.3	195.0	32.5
SAH Program				
SA	235	46.0	185.0	33.6
Program	235	46.0	185.0	33.6
SH Program				
PED	13	50.8	125.0	29.8
Program	13	50.8	125.0	29.8

B

	SERVICE DELIVERY			
	# Cases	Mean	Maximum	St Dev
AH Program				
CA	6	92.5	140.0	46.9
CD	2	102.5	135.0	46.0
IFM	23	98.3	320.0	76.2
MH	5	89.0	220.0	93.2
MI	22	139.1	370.0	95.1
MS	99	85.8	340.0	70.2
Program	157	95.7	370.0	76.0
PCH Program				
HR	80	93.3	300.0	71.0
MCH	559	64.6	425.0	61.6
PED	27	44.1	120.0	33.8
PRN	23	102.2	245.0	70.0
Program	689	68.4	425.0	63.3
SAH Program				
SA	235	101.8	330.0	73.8
Program	235	101.8	330.0	73.8
SH Program				
PED	13	59.6	165.0	47.5
Program	13	59.6	165.0	47.5

C

	POST SERVICE DELIVERY			
	# Cases	Mean	Maximum	St Dev
AH Program				
CA	6	91.7	165.0	44.2
CD	2	85.0	110.0	35.4
IFM	23	79.8	300.0	81.4
MH	5	75.0	190.0	70.1
MI	22	101.8	250.0	73.7
MS	99	59.1	250.0	50.8
Program	157	70.2	300.0	61.1
PCH Program				
HR	80	73.6	300.0	65.2
MCH	559	42.4	395.0	44.9
PED	27	59.4	200.0	42.4
PRN	23	72.2	215.0	49.7
Program	689	47.7	395.0	48.9
SAH Program				
SA	235	74.6	290.0	59.5
Program	235	74.6	290.0	59.5
SH Program				
PED	13	58.1	185.0	46.5
Program	13	58.1	185.0	46.5

in comparison to 67% of the MCH/PED group. In the Maternal/Child Health category, service for high-coping multiparous postpartum mothers consisted of one telephone contact, thus eliminating the need for time to be spent in travelling to the home. Higher-than-average means were found in the Parent/Child Health Program in High Risk and Prenatal cases where travel time would likely have been a factor.

Service Delivery Time as Dependent Variable

Service Delivery Time by Health Need for the trimmed population is presented in Panel B of Table 5. Service Delivery was defined as activities performed while the PHN was in direct contact with the client, for purposes of assessment and/or intervention during the course of the visit.[43] While the home is the most frequent location for contact, alternate locations such as schools may be the site for service delivery activities. A telephone contact is considered to be the equivalent of a home visit if counselling, teaching or information-sharing is provided over the phone and if the contact is recorded. Similarly, if significant client contact occurred in a location other than the client's home, this was also considered to be Service Delivery.

The overall mean for time spent in Service Delivery was 79 minutes. Both Adult and Senior Adult Health program groups showed mean times higher than the overall average, while Parent/Child Health was lower. Among the 3 program

[43] *The contact could be with the client, family member, or another caregiver.*

groups where N > 20, the highest mean of 102 minutes was found in Senior Adult Health, and the low mean was 68 minutes in Parent/Child Health. Among Health Need groups, the mean varied from 44 minutes for Pediatrics < 4 (n=27) to 139 for Mental Illness (n=22). With the exception of Mental Illness, the Adult Health case types were relatively consistent in the amount of time required. Medical/Surgical cases, most of which would be cardiac referrals from the Heart Institute, are quite straightforward, with an assessment tool to follow in providing the service. The extended time required for Mental Illness cases is not a surprising finding. Professionals dealing with clients who have a diagnosed psychiatric illness must be prepared to spend more time with these clients than with those who do not have similar health deficits. Within the Parent/Child Health Program group, providing service to the High Risk MCH and Prenatal categories required more than the average amount of direct service time. This is not unexpected, as these cases tend to be more complex than those in the general MCH category. In the Senior Adult program, where the mean is also greater than the overall mean, PHN's must adapt their timetable to the slower pace of their elderly clients.

Post-Service Delivery Time as Dependent Variable

Panel C of Table 5 shows the Post-Delivery Time by Health Need. In this category time was recorded for Post-Service Delivery activities which included follow-up phone calls to/from the client, referral to other professionals or agencies, case conferences, discussion with team or supervisor, recording, reports, and

post-delivery travel specific to the case (e.g. return of PKU specimens and records for Home Care Obstetrical cases). The mean for time spent in Post-Service Delivery activities for all cases (n=1094) was 57 minutes. Among the Program groups, the highest mean Post-Service Delivery Time of 75 minutes was shown in the Senior Adult Program, with the smallest mean of 48 minutes in Parent/Child Health. The time varied from 42 minutes in Maternal/Child Health (n=559) to 102 minutes for Mental Illness (n=22). Consultations with, or referral to, other professionals and agencies no doubt accounted for some of the additional time in more complex cases such as Mental Illness. Some of the variation in the amount of post-service delivery time spent was also likely due in part to the need for more extensive recording in these cases. If no problem is identified during the first contact, the simplified recording tools called "Record(s) of Assessment" can be used to document assessment and limited interventions for Maternal/Child Health, Prenatal, Senior Adult and Cardiac visits of an uncomplicated nature. The majority of the cases coded as Med/Surg are Cardiac in nature. As previously mentioned, at the time of the study, PHN's were being introduced to a new recording method which was based on both Betty Neuman's nursing model[44] and nursing diagnosis. The purpose for introducing the recording system was to meet the College of Nurses requirement that nurses base their practice on nursing theory, and also to align our service delivery more closely with courses being

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[44] *CON/RNAO. Standards of Nursing Practice for Community Health Nurses in Ontario. 1984*

taught at the University of Ottawa School of Nursing which was using Neuman in Community Health Nursing courses. By using the theory-based recording method it was hoped that PHN's who had not been exposed to nursing theories during their education would be able to incorporate these "new" concepts into their practice. No doubt some of the post-delivery time is accounted for in complex cases by the need to use the new recording method.

d. Summary of Descriptive Findings

From the preceeding description of the study findings we know that the overall mean Total PHN Time for the full study population was 208 minutes, and that when the outliers were trimmed, this was reduced to 175 minutes. For the dependent variable Total PHN Time, there was a considerable amount of variation among Program and Health Need groups, but for Number of Contacts and Average Time per Contact there was much more inter-group consistency. The full study population mean Number of Contacts of 2.04 was lowered to 1.8 by the trimming of the population. For the variable Average Time per Contact, trimming the population resulted in the reduction of the mean from 104 minutes to 101 minutes. For program costing purposes, the Average Time per Contact can be rounded to 100 minutes. When Total PHN Time was broken down into its component parts, only 45% of the time was found to be in the direct service delivery category.

While the above findings are a fairly complete description of referral management time by Program and Health Need groups, the study would not be

complete without an examination of factors which might account for this variation.

2. Variations in Total PHN Time

To explore the relationships between dependent and independent variables First Mark's Knowledge Seeker (KS) was used. This program uses a generalization on the ANOVA approach to perform a statistical analysis of the relationships between a dependent variable and a set of independent variables. KS differs from ANOVA in that, unlike ANOVA it does not require that all groups across all levels be the same to perform a reliable analysis. In the KS program, the data set is differentiated into homogeneous groups as different as possible from each other. The analysis is performed in levels, and proceeds level by level looking at previously-created groups for further splits until the splits are no longer significant. The default significance level is .05, or as defined by the user. Results are reported graphically in the form of an analysis tree with nodes made up of varying numbers of cases and types of variables showing significant splits and interactions. The analyst identifies the dependent variable, which is always used "as is", and selects the independent variables to be used for the analysis. In this study the dependent variables are continuous.[45] The predictor (independent) variables are always categorized either naturally by the program, or with intervals selected by the analyst. Several layers are generated in the analysis, with all important "splits" identified at each level. Splits are groupings of

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[45] *While the actual interval used to describe Time is 5 minutes, the underlying variable is, in fact, continuous.*

predictor variable categories for which the dependent variable values are significantly different from one another. The analyst is informed about the number of "important splits" found in each grouping, or "node". Independent variables are grouped either automatically by the program, or according to groupings defined by the analyst. Continuous predictor variables are categorized into 10 groups unless the analyst specifies otherwise, then in "Automatic" mode, if no significant difference for the dependent variable is found for adjacent categories, the categories are combined.

For the analysis which follows, I established groupings and boundaries for the independent variables, then used "Automatic" mode. The significance level was set for "Prediction" (.05), with Bonferroni adjustment set for 3 independent variables. For automatic stopping, the node size was left at 33, the optimal level determined by the program, and the minimum node creation size was set to 10. Because the purpose of this part of the analysis was to examine the relationships between variables, the full study population of 1143 cases was used. Also, because they present no problem in this type of analysis, the KS technique can handle the outliers.

Table 7 below shows the analyst-defined groupings that were established for the study variables.

Table 7 Variables and Their Analyst-Defined Groupings

VARIABLE	GROUPING/BOUNDARIES
Total PHN Time (Dependent)	Continuous
Number of Contacts (Dependent)	Continuous (cont'd)

Distance (km)	Continuous: 0 - 0.4 telephone contact only 0.4 - 10 10 - 25 25 - 40 40 - 55 55 - 80
Client Age (years)	Continuous: 0 - 5 5 - 19 19 - 45 45 - 65 65 - 80 80 - 99
Estimated Income	Continuous: $15,000 - $23,000 (Poverty line, family of 3 1988 $$) $23,000 - $41,000 (Mean Household Income, 1986 Census) $41,000 - $95,000 (cont'd)
Health Need	Categorical: HR (MCH) MCH MH (includes IFM) MI MS (includes CA and CD) PED PRN SA
Referral Source	Categorical: EXT_M (includes CLIN, DR, HOSP, VON) EXT_S (includes CAS, SSA, S/F, OTHER) HC (Home Care) INT (includes PHN Liaison, PHN Other)
PHN Education Type and Supervisor Education Type	Categorical: BSC, CERT, MAST
PHN Years Since Education and Supervisor Years Since Education	Continuous: 0 - 5 5 - 15 15 - 30
PHN Years of Experience	Continuous: 0 - 2 2 - 7 7 - 12 12 - 20 20 - 35
PHN Years with Supervisor	Continuous: 0 - 2 2 - 7 7 - 12 12 - 17
Supervisor Administration Experience	Continuous: 0 - 5 5 - 10 10 - 20
Supervisor Total PHN Experience	Continuous: 5 - 12 12 - 20 20 - 35

Before proceeding with the findings, a note of explanation about the handling of the variables "Referral Source" and "Health Need" is in order. Referral Source codes were grouped into generic categories. Four categories; i) External (Medical); ii) External (Social); iii) Internal, and iv) Home Care were created by assigning the actual Referral Source Codes to the new categories. The revised categorization shows the difference between referrals received from professional and other community sources, those generated through Public Health Nursing liaison and other internal sources, and those referred by the Health Department's Home Care Division. The grouping is important because of the difference in the amount of control that can be exercised over the demand. The number and type of referrals generated from an internal source such as PHN liaison is under the control of Health Department managers. The demand from external sources, accounting for a large portion of time, is less amenable to internal Nursing Division policy change, nor is it predictable. For Home Care cases, the number of contacts[46] is determined in 1 of 2 ways; i) by either the type of program, as in the case of the Obstetrical Program, where visits are made to the 5th postpartum day; or ii) by the Home Care Case Manager, who is responsible for determining both the frequency of visits and the length of service.

For the variable "Health Need", the Nursing Division's Case Type Codes were used but for ease of analysis, some categories of variables were grouped

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[46] *As will be shown later in the paper, Number of Contacts is a significant determinant of Total PHN Time.*

together. "Cancer" and "Communicable Diseases" were included in "Medical/Surgical". The category "Mental Health" includes the codes for "Mental Health" and "Individual/Family Management". The SPSSPC+ findings showed little difference between means for the 2 groups.

Given the volume of interesting output generated by KS from the study's database, it has been a challenge to select the most meaningful information for presentation. Within the body of the text I have selected decision-tree models that demonstrate the relationships which have the most relevance for administrative decision-making. For the other variables which were shown to be strong predictors of Total PHN Time I have included the first level of splits in the body of the text, with the complete models shown in Appendix C. Also, for the detailed models discussed in the text, the important splits not in the diagrams have been summarized and included in Appendix D.

The discussion which follows is organized according to the categories of variables from the conceptual framework. I will confine the discussion to the models which show "Total PHN Time" and "Number of Contacts" as the dependent variables. "Number of Contacts" is shown in the conceptual framework as a component of the dependent variable, however because of its importance as a predictor of "Total PHN Time", an analysis was run with "Number of Contacts" classified as an independent variable in relation to "Total PHN Time". To complete the section a proposal for modifying the PHN Referral Factor weighting system is presented. The outline below serves as a "roadmap" for the discussion

which follows:

1. Number of Contacts as a predictor of Total PHN Time
2. Client-Centred variables as predictors of Total PHN Time
   a. Distance
   b. Health Need
   c. Client Age
3. Provider-Centred variables as predictors of Total PHN Time
   a. Referral Source
   b. Program
   c. District Supervisor's Code
   d. Supervisor's Education Type
   e. Supervisor's PHN Experience
4. Client-Centred variable(s) as predictors of Number of Contacts
   a. Health Need
5. Provider-Centred variable(s) as predictors of Number of Contacts
   a. Referral Source
6. Model for weighting system.

To link the discussion to the KS decision-tree diagrams, a system consisting of alternating alpha and numeric characters has been "attached" to individual nodes in each of the larger diagrams. For each reference to a node, the variable group name is accompanied by an "address" which refers to the diagram being discussed. The address allows the reader to find the appropriate node in the figure. The "Address" system is as follows:

LEVEL 1	A...
LEVEL 2	1...
LEVEL 3	a...
LEVEL 4	i....
LEVEL 5	1a...
LEVEL 6	1b...

The structure of the tree in Figure 4 is typical of KS trees and demonstrates why, for this type of field study, the assumptions of classical

experimental design being analyzed with ANOVA and Regression are questionable. At Level 1 of the tree the best predictor is Number of Contacts. At Level 2 there are two different "best" predictors (Distance and Supervisor Education Type) depending on which Level 1 branch is examined. At Level 3 we find several branches with no further splits and 3 different splitting variables for 5 branches (Health Need, Estimated Income, and PHN Years Experience). Only 2 branches are split for Level 4, and only 1 branch for Level 5, but it is further split in Level 6. This tree is the antithesis of the classical "balanced design" usually sought in experiments in which ANOVA is to be the analytical tool. The structure indicates major interactions across the tree. The sizes and standard deviation of the groups differ dramatically.

For each of the decision-tree models the discussion begins with some general observations, then continues with details of the pertinent findings shown within the branches of the tree.

a. Number of Contacts as Predictor of Total PHN Time

Not surprisingly, the most important predictor of variations in Total Time is Number of Contacts (sig. $2.561E^{-016}$)[47] which alone explains 59.6% of the variance. No doubt this results from so many cases being in the [0,2) node. Later in this paper Number of Contacts will be presented as the dependent variable, but a brief look at the model in which it is treated as an independent

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[47] *This significance level is often referred to as a "p" value, which in this case means the probability that this split would have occurred in a process randomly generating times for various numbers of contacts.*

variable provides some useful information. The model in Figure 1 explains 69.9% of the variation in Total PHN Time. The strong positive relationship between Total PHN Time and Number of Contacts is clearly evident in the first level of the decision tree. Also, as the number of contacts increases, the diagram shows that the number of cases in the associated node decreases.

Five nodes were created, ???[,0,2) (A), [2,3) (B), [3,4) (C), [4,7) (D), and [7,28] (E).[48] The second level of this model shows Distance splits to be significant in 4 out of 5 nodes, while the important split in the Contact [7, 28] (E) node is Supervisor's Education Type. While a full discussion of the relative importance of the measures of Distance is presented later in the paper, one aspect of this pervasive effect should be mentioned here. The Distance [0,0.4) nodes represent cases in which PHN contact did not include any travel time, therefore the impact of Distance as a predictor of both Number of Contacts and Total PHN Time is due in large part to the number of cases which received PHN service consisting of a single telephone contact. In the nodes with third level splits the important client-centred variables are Health Need (A1), (A3) and Estimated Income (A2). The only provider-centred split is PHN Years Experience in 2 of the nodes (B1) and (D2). It is interesting to note that all across this decision tree at the third

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[48] *KS uses ??? to indicate missing or unknown values and/or categories. Where a value or categories is unknown, KS places the case(s) in the node where the value for the dependent variable is most similar to the unknown. For continuous variables, the square [] bracket symbol indicates that the adjacent number is included in the node, and the round () bracket symbol indicates that the adjacent number is excluded. Thus in this case the A node contains cases with an unknown number of contacts and from 0 up to, but not including, 2 contacts.*

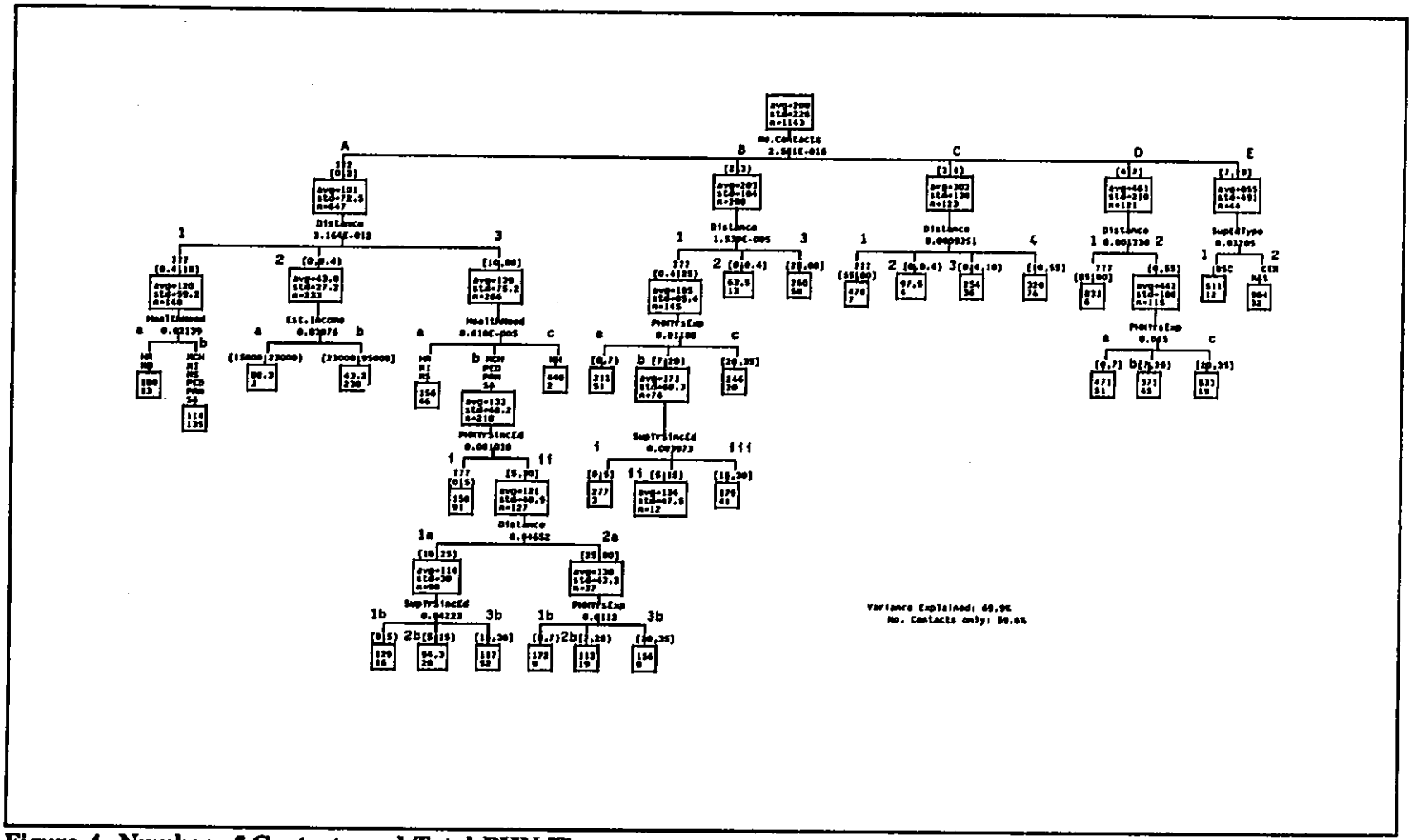

Figure 4 Number of Contacts and Total PHN Time

and subsequent levels, interesting splits at several levels occur in the provider-centred variables concerning the PHN and Supervisor. Despite the pervasive nature of this effect, because there is no definite directional trend in any of the variables, little importance can be attached to these findings.

The most interesting and extensive node in this tree is ???[0,2) (A) which has the majority of the cases (n=647). This node shows that for 57% of the referrals, PHN service consisted of a single contact. The mean Total PHN Time of 101 minutes for node (A) is identical to the average contact time as calculated by SPSSPC+. (see p. 55) Four hundred and four of these referrals were for MCH (Appendix D). An inverse relationship between Estimated Income and Total PHN Time is seen in the Distance [0,0.4) (A2) node (n=233). In the other 2 Distance nodes in this branch, i.e. A1 and A3, Health Need is the next important split, with different groupings for the [0.4,10) (A1) and [10,80) (A3) nodes. Distance is only the first of 5 interesting splits in this large node [???,0,2) (A). The other important first level splits are: i) Health Need (sig. 0.000209); ii) Program (sig. 0.0009838); iii) Referral Source (sig. 0.001589); iv) Client Age (sig. 0.01435). A summary of the other interesting splits not shown in this model can be found in Appendix C.

Distance shows as the second level important split in nodes [2,3) (B), [3,4) (C), [4,7) (D). In B, and C, there are [0,0.4) nodes but as expected they contain few cases. In this model, with the second level position of Distance as an

important predictor, it is possible to infer that the amount of time needed for travel is a contributory factor in the direct correlation between Total PHN Time and Number of Contacts.

To summarize the findings in this model, the strongest predictor of overall Total PHN Time is the number of contacts made by the PHN. As the number of contacts increases, there are fewer cases in each group. The majority of cases are managed with one contact, particularly in the MCH group. Distance shows as the next important level of split in this model. At the third and subsequent levels, there is no consistency across the tree. Given the overall demographic profile of the caseload (i.e. majority of cases are MCH), and the fact that few PHN clients receive more than 2 visits, the findings in this model are reasonable.

In the following discussion of the two important models, "Health Need and Total PHN Time" and "Referral Source and Total PHN Time", the variable "Number of Contacts" was excluded from the analysis.

b. Client-Centred Variations

Distance and Total PHN Time

Distance was shown to be a strong predictor of variation in Total PHN Time. (sig. $2.033E^{-011}$) Alone, it explains 15.9% of the variance. In fact, with "Number of Contacts" excluded, it is the strongest predictor of Total PHN Time. The KS output in Figure 5 shows the strong direct correlation between Distance and Total PHN Time. Much of this variance is due to the difference between

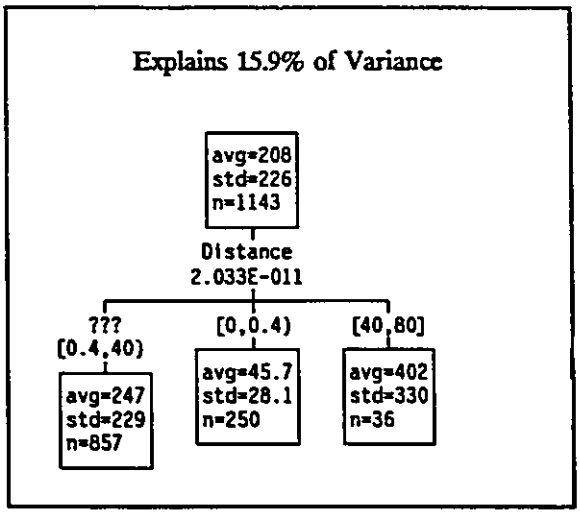

Figure 5 Distance and Total PHN Time

contacts by telephone and home visit. To isolate the telephone contacts (which are represented by 0 km. Distance) the category 0 - 0.4 km. was created, as the smallest non-zero distance was 0.5 km.[49] In the [0,0.4) Distance node where service consisted of phone calls to clients, the mean Total Time was 46 minutes (n=250). Within this group, which is 22% of the study population, most of the cases would have been in the Maternal/Child Health category. For parents of second and third babies a home visit was frequently not required, thus the only PHN contact was a single phone call. Figure 5 shows that of the clients who did receive service in their homes, 96% live within 40 km. distance from the central office. In this large group (n=857) the mean was 247 minutes. In the 40 to 80 km. group (n=36) the mean was 402 minutes. The small number of cases in the latter group reflects the lower density of population in the outlying areas of the region.

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[49] *If no home visit was made, or if service provision did not involve travel to the client's home (e.g.students seen at school), PHN's entered a "0" in the Distance category on the Service Delivery Form.*

Health Need and Total PHN Time

For planning purposes Health Need is the most important of the independent client-centred variables in the research model because programs are usually developed for groups whose health needs are the same. Alone, Health Need accounts for 8.74% of the variance, while the complete model explains 28.3%. As shown in Figure 6, the grouping of categories in the Health Need variable shows an interesting picture. At Level 1, the [MI] (C) node (n=27) has the largest mean of 441 minutes. The next highest mean is in the node [HR,MH,MS,PRN,SA] (A) (n=503) where 5 categories are grouped with a mean of 265 minutes. The grouping of these categories which span 3 program groups will provide a strong basis for revising the original staff deployment weighting system. The third node [MCH,PED] (B), with 54% of the cases, (n=613) has the smallest mean of 151 minutes. In this model at the second level in both large nodes, i.e. [HR,MH,MS,PRN,SA] (A) and [MCH,PED] (B) Total PHN Time is shown to vary directly with Distance. Referral Source is shown to be an important predictor in 3 splits at the third level: (A3, (B1), (B3), while PHN Age Preference and Health Need are the splitting variables in the [0,0.4) (A2) and [0,0.4) (B2) nodes of both the large branches. Three Level 4 splits are shown, District Supervisor Code (A3a), Health Need (A3c), and Supervisor's PHN Experience (B3a).

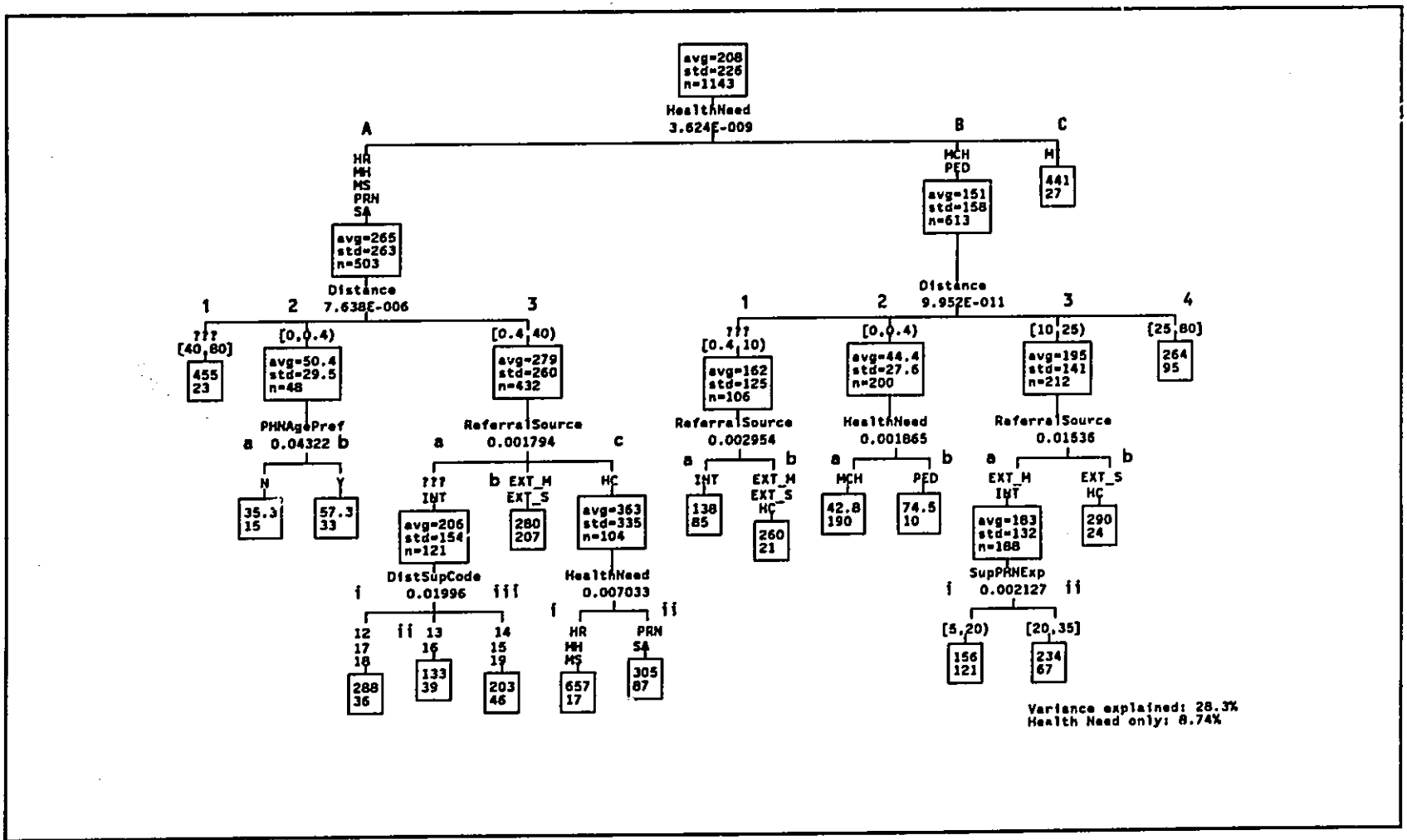

Figure 6 Health Need and Total PHN Time

In the [HR,MH,MS,PRN,SA] (A) group, only 10% of the cases are in the [0,0.4) (A2) group (n=48) which shows telephone contacts. For this small node the group mean was 50 minutes. The only descendant split shown for this node is the dichotomous variable "PHN Age Preference" in which PHN's were asked if they preferred working with a specific age group (sig. 0.04322). The results here show that if the response was "Yes", the mean service delivery time (57) was higher than if the answer was "No" (35). At 50 minutes, the group mean was somewhat higher than for the same Distance node (B2) in the [MCH] (B) group.

In the [MCH,PED] (B) node (n=613), where 33% of all the cases were by telephone contacts, the mean for the [0,0.4) (B2) node was 44 minutes. The impact of phone contacts with multiparous postnatal clients is shown by the descendant split in the [MCH] (B2a) node (n=190). The group mean is 43 minutes. Since the total number of MCH cases in the study is 573, this means that 33% of the incoming MCH referrals received service consisting of one telephone contact. For the PED (B2b) group (n=10), where the mean was 75 minutes, service may have consisted of a single telephone call, but was more likely to have been a face-to-face counselling contact with a child at school. In [MCH,PED] (B), 35% of the cases were grouped in the Distance [10,25) (B3) node. No doubt this high proportion is reflective of the demographic profile of suburban areas such as Kanata and Orleans, where a very large proportion of the population are families with young children. The remaining one-third of the

[MCH,PED] (B) cases were divided between inner city and rural Distance groups.

In the heterogenous [HR,MH,MS,PRN,SA] (A) node the non-telephone contact Distance split is at 40 km. Only a few cases were in the ???[40,80] (A1) node (n=23), where the mean of 455 minutes is considerably higher than any of the other second level groups. The largest number of cases (n=432), representing 86% of the cases in the [HR,MH,MS,PRN,SA] (A) node, lived less than 40 kms. from the central office. Examining the descendant splits in this group [0.4,40) (A3) provides further information. Referral Source is an important predictor (sig. 0.00174), with the Home Care [HC] (A3c) node (n=104) showing the highest mean of 363 minutes. This group subdivided further by Health Need (sig. 0.007033). The largest number of cases (n=87) were in the [PRN,SA] (A3cii) group, which had a mean of 305 minutes. The [HR,MH,MS] (A3ci) node (n=17) registered a much higher mean of 657 minutes. With only 16% of the Home Care cases, this small node used 30% of the Total PHN Time accounted for by node (A3c). External Sources, both Medical and Social categories [EXT_M,EXT_S] (A3b), with 207 cases, had the next highest node mean of 280 minutes. Within this node (A3) the smallest mean of 206 minutes showed in the ???[INT] (A3a) node (n=121). The descendant split for this node (A3a) is by District Supervisor Code, with 3 distinct groups (sig. 0.01996). The largest mean, 288 minutes which is considerable higher than the overall mean, was found in the [12,17,18] (A3ai) node (n=36). One of the traits shared by the districts represented by these District Supervisor Codes is the high proportion of

subsidized housing units which house low income families and many seniors.

Referral Source explains some of the third level variation in 2 of the [MCH,PED] (B) descendant groups as well, although the splits differ between groups. In the ???[0.4,10) (B1) node, the [INT] (B1a) node (n=85) shows a much smaller mean of 138 minutes than the [EXT_M,EXT_S,HC] (B1b) node (n=21) where the mean is 260 minutes. In the [10,25) (B3) node, External (Medical) and Internal are grouped in [EXT-M,INT] (B3a) node (n=188) with a mean of 183, while the other node [EXT_S,HC] (B3b) formed from External (Social) and Home Care sources (n=24) has a much higher mean of 290 minutes. The interesting finding here is that External referrals from social agencies and self-referrals are grouped in the node with Home Care cases, which are known to require much more than the average amount of time. Full health-need assessment of clients such as those from External (Social) sources requires much more time because there are as yet no standardized assessment tools for multi-problem families. Also, much more contact with other health and social service workers would likely be required where the referral source was a Social Service agency. The [EXT_M,INT] (B3a) node has a descendant split in which some of the variation is explained by a split (at 20 years) in the amount of PHN experience of the Nursing Supervisor.

In summary, this model shows 3 groups of Health Need, with Mental Illness cases forming 1 node, Maternal/Child Health and Paediatrics forming a second node, and all other case types grouped into the third node. The grouping

of the 5 categories in the large heterogenous node shows little difference in mean Total PHN Time for the included categories of cases. For the 2 large nodes, which represent 98% of the cases, Total PHN Time varies directly with Distance. Also, in these large groups, Distance and Referral Source show interesting but different splits. Telephone contact is used to a greater extent for the [MCH,PED] (B) group of cases. For the most part, internally generated cases account for smaller mean Total PHN Time than do other types of referral sources.

Client Age and Total PHN Time

The third significant client-centred predictor of Total PHN Time was shown to be client age, where the split occurs at 45 years of age. Client Age explained only 1.88% of the variance.

Figure 7 shows that the ???[0,45) group with 805 cases had a mean of 188 minutes, and that the [45,99] group (n=338) had a mean of 256 minutes. The standard deviation in the first group shows that there is a large variation in the amount of time spent. No doubt this is due both to the size of the group (70% of study population) and to the variety of cases it contains. More details can be obtained by having KS "force a split" into the user-defined groups.

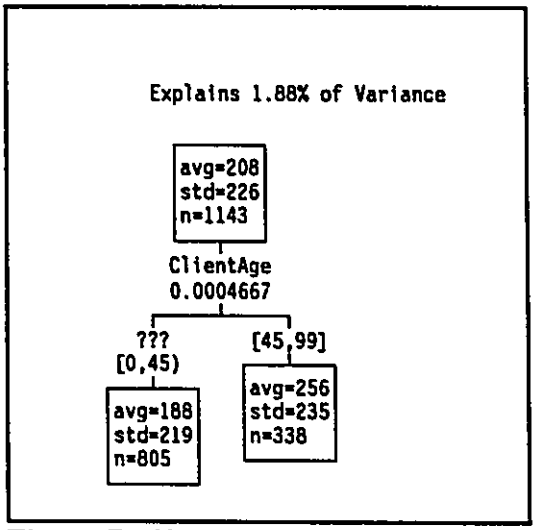

Figure 7 Client Age and Total Time

As Figure 8 shows, the placement of the split at 45 is largely a function of

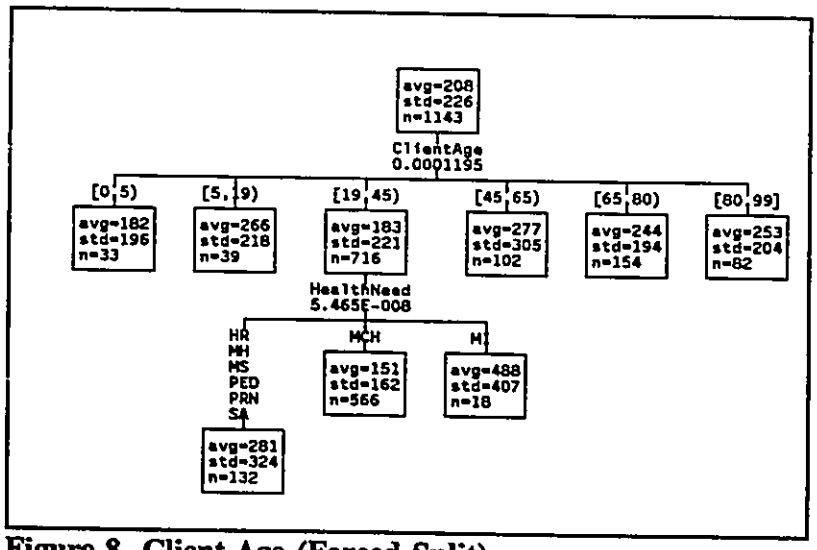

Figure 8 Client Age (Forced Split)

the MCH cases. A second split was forced, this time without specifying the groups, in the [19,45) node. It shows the impact of the MCH cases. There are other interesting splits in this large node, one of which is Estimated Income. As shown previously, Total PHN Time varies inversely with Estimated Income. There is no direct correlation between Client Age and Total PHN Time. With the exception of the [5,19) node, however, the higher than normal means are all seen in the over-45 group. The complete Client Age model with its descendant splits is included in Appendix C.

c. Provider-Centred Variations

Referral Source and Total PHN Time

With "Number of Contacts" excluded as an independent variable, Referral Source is the second strongest predictor of Total PHN Time. (sig. $1.576E^{-009}$) By itself it explains 10.6% of the variance. In the complete model shown in Figure 6 this increases to 32.7%. At the first level Referral Sources are split into 3 nodes, ???[EXT_M,EXT-S] (A), [INT] (B), and [HC] (C). The highest mean Total PHN

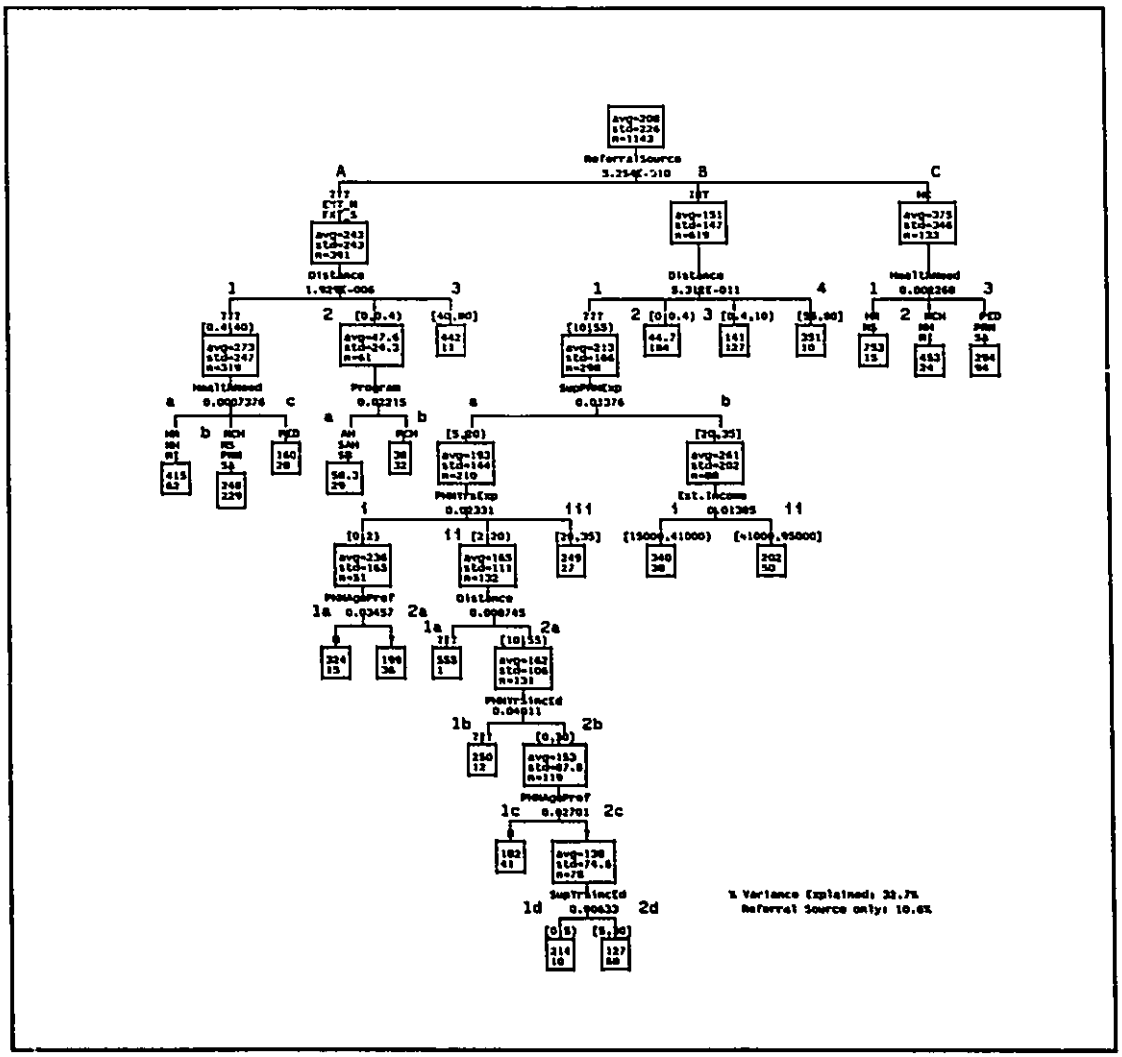

Figure 9 Referral Source and Total PHN Time

Time (375 minutes) at the first level of the tree is in the [HC] (C) node which has 133 cases. External Sources, both Medical and Social, are grouped in the ???[EXT_M,EXT_S] (A) node (n=391) with a mean of 243 minutes. At 619 cases, Internal Referral Sources [INT] (B) is the largest node, and has the smallest mean of 151 minutes. For nodes (A) and (B), Distance is the important second level split, while Health Need is the split for (C) which has the highest mean. At the third level there is no consistency, as 3 different variables, in 3

different branches (i.e. (A1), (A2), and (B1)) are shown as important splits. Extensive subsequent splits further explain some of the variation in internally generated referrals where distance is between 10 and 55 kms. and Supervisor's PHN Experience is between 5 and 20 years (node B1a).

In contrast to the Home Care node (C) where the most important predictor of Total PHN Time is Health Need, within both the External and Internal referral source groups, Distance is shown to be the most important split. Comparing the [0,0.4) nodes in the [EXT] (A) and [INT] (B) groups shows that for a higher proportion of cases (30%) in the Internal (B) group, service consisted of a single telephone contact than for the External (A) group (16%). In both groups the means are consistent with the earlier Total PHN Time for [0,0.4) nodes. While Distance continues to present as a strong predictor of Total PHN time, it is important to keep this finding in perspective. The Home Care node in this model helps to do that. One important feature of cases accepted for Home Care service is that they are never telephone contacts, therefore the majority of the cases which have Home Care identified as the Referral Source would be receiving home visits.[50] We also know that for Home Care cases the number of visits is usually higher than average, therefore if travel time was a major factor in determining the overall Total PHN Time, one would expect Distance to be identified as a predictor variable. There are 3 interesting splits in the Home Care

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[50] *While the Referral Source can be Home Care for cases other than those receiving Home Care services, the majority of Home Care-referred cases are for reimbursable Home Care services.*

node, but Distance is not one of them.

The model shows Health Need to be the most important predictor in the Home Care (C) group (sig. 0.002268). There is an interesting grouping of cases in the 3 descendant nodes of (C). The [HR,MS] (C1) node (n=15) has the highest mean Total PHN Time of 753 minutes. With 24 cases the [MCH,MH,MI] (C2) node has a mean of 453 minutes, and the remaining node, [PED,PRN,SA] (C3) with the largest number of cases (94) had the smallest mean of 294 minutes. There were no Mental Health cases, and no Paediatric cases referred for Home Care services, therefore the inclusion of MH in the [MCH,MH MI] (C2) node, and of PED in the [PED,PRN,SA] (C3) node is due to their respective adjacent positions relative to the other categories in these nodes. For the Home Care node (C) the other 2 first level predictors were Program (sig. 0.00979) and Client Age (sig. 0.01057).

In the branch where Referral Source is External (Medical and Social) (A), Distance is the first of 2 second level splits (sig. $1.929E^{-006}$).[51] In [0,0.4) (A2) node the split is between program groups. The PCH (A2b) group (n=32) has a mean of 38 minutes, while all other Programs form the [AH,SAH,SH] (A2a) node (n=29) with a mean of 58 minutes. In the Distance ???[0.4,40] (A1) node, Health Need is shown to be an important predictor of variation in Total PHN Time. The grouping of the cases here differs from earlier models. For the smallest group (n=28), node [PED] (A1c) the mean is 160 minutes. The next smallest mean of

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[51] *Health Need is the other important split. See Appendix for results.*

248 minutes is shown in the [MCH,MC,PRN,SA] (A1b) node (n=229). The mean here is higher than means noted earlier in the Figure 1 model for nodes which included the MCH category. This indicates that where the referral source is not PHN liaison for MCH cases, they tend to require more time. The final node in this group [HR,MH,MI] (A1a) (n=62) showed the highest mean of 415 minutes. From this grouping it is possible to suggest that when Distance can be ruled out as an important predictor, as far as the time required to handle the referrals is concerned, High Risk (Maternal/Child Health), Mental Health, and Mental Illness cases can be expected to use similar amounts of time.

In the Internal referral source group (B), while several levels of splits are shown in the ???[10,55) (B1a) node their importance is questionable. As in node (A), Distance is shown as the second level split, with Total PHN Time varying directly with Distance. The only important split at the third level in this branch (B) is in the variable Supervisor PHN Experience (sig. 0.01376). Node (B1) splits into 2 groups: [5,20) (B1a) and [20,35] (B1b) with the group with more Supervisory PHN experience registering a higher mean Total PHN Time. The [5,20) (B1a) group (n=210) is divided in a 3-way split in the PHN Years Experience (sig. 0.02331), but the split shows no definite directional trend. PHN's with less than 2 years, and those with more than 20 years show a higher mean Total PHN Time than the group [2,20) (B1aii). At a significance level of 0.01835, Estimated Income shows as an important split in the descendant branch of Internal Referral Source (B1a). The split here indicates that in this node more

time was spent with individuals whose income was lower than $41,000. Other second level predictor variables for [INT] (B) node include Supervisor's Education Type, District Supervisor's Code, Health Need, Program, and PHN Years With Supervisor. Appendix D shows the details of these and other splits.

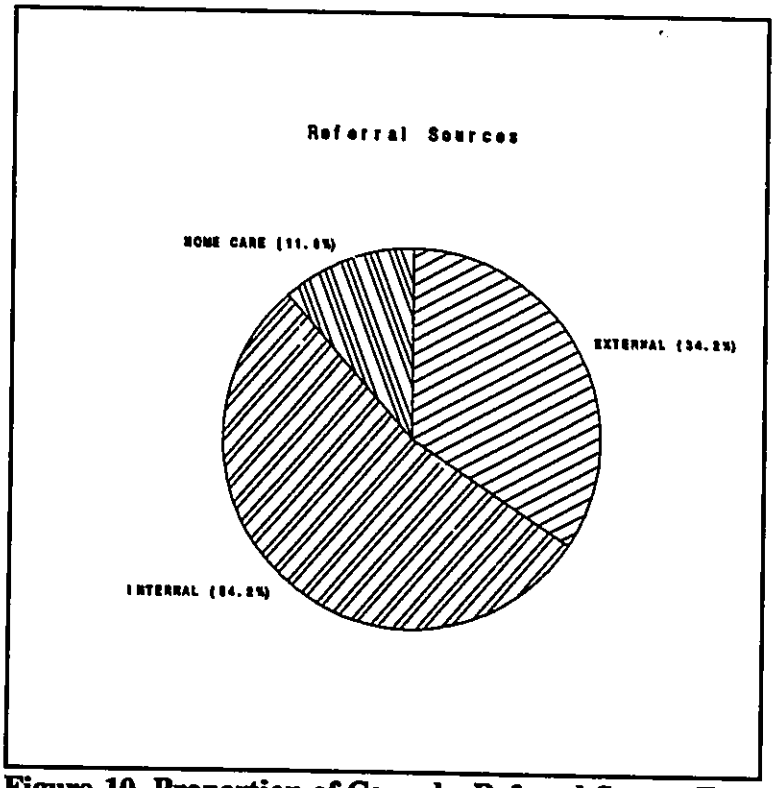


Figure 10 Proportion of Cases by Referral Source Type

Before leaving this model it is interesting to compare the overall difference between the types of referral sources and the amount of time spent in the referrals they generate. To show this comparison, pie charts were generated. Figures 10 and 11 show that the Internal referrals, representing 54.2% of all referrals, used 39.2% of the referral management time. External sources, both Medical and Social, are 34.2% of the cases, and used 39.9% of the time. Home Care was the source of 11.6% of cases and used 20.9% of the time.

In summary, the Referral Source model shows that the highest number of

cases are generated by internal sources, therefore policy changes that modify the volume of incoming cases have the potential for a significant impact on demand. The volume of cases is not the only consideration, however, as we have shown that externally-generated and Home Care cases require larger amounts of time to manage than do the internal-generated cases. The model has also served to further explain the apparent importance of the Distance factor.

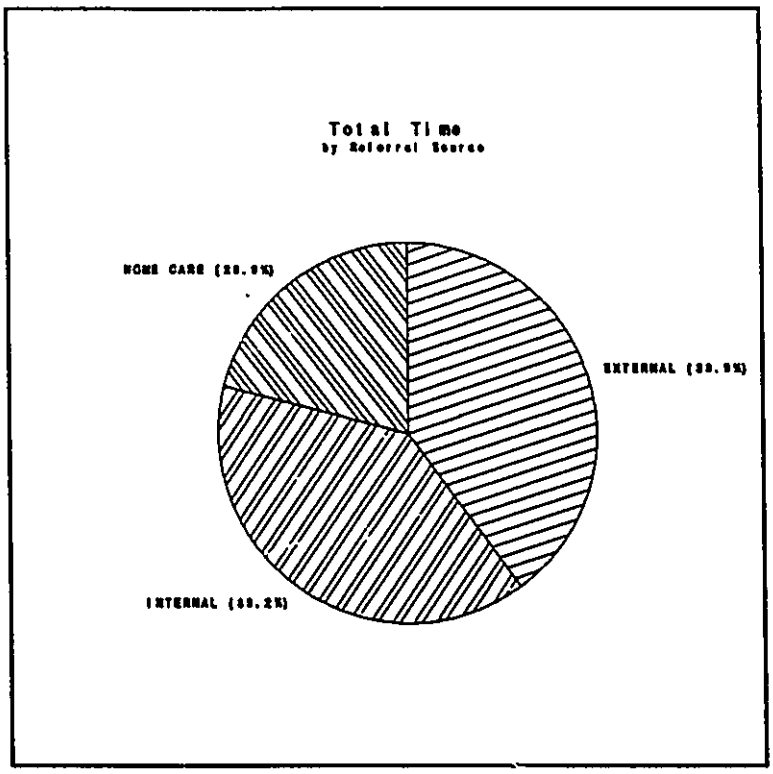


Figure 11 Proportion of Time by Referral Source Type

Program and Total PHN Time

Figure 12 shows the first level split for the variable "Program", which explains 5.01% of the variance in Total PHN Time (sig. $4.682E^{-007}$). In the upper diagram, which shows the KS 'automatic' results, the PCH and SH cases are grouped together. The lower diagram, showing the results when a split is forced by program, indicates that the few cases which fell into the School group (n=13) had a mean not significantly different from that of the Parent/Child Health group.

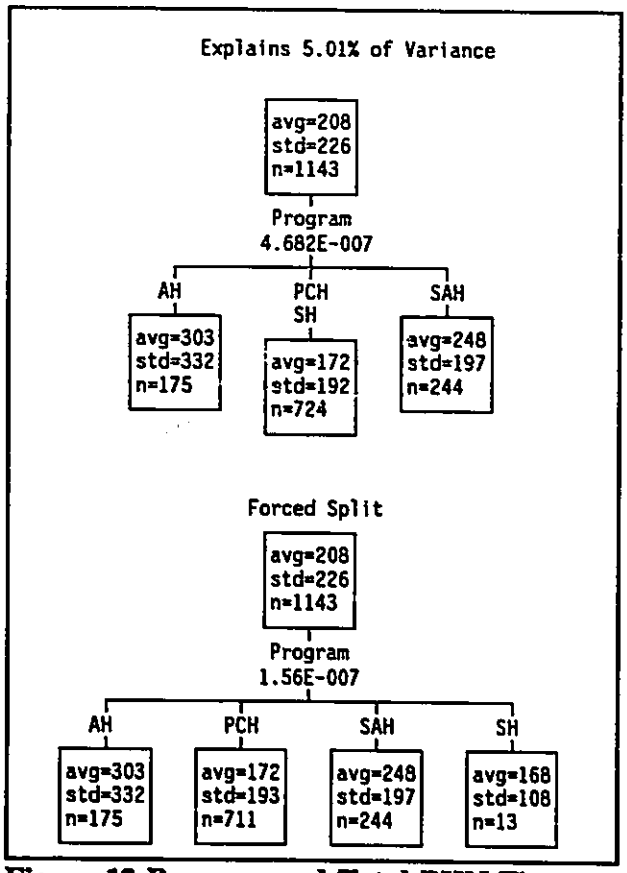


Figure 12 Program and Total PHN Time

The large Parent/Child Health and School Health node (n=724) had the smallest mean Total PHN Time, 172 minutes. Senior Adult Health, with 244 cases, was next with a mean of 248 minutes, while the Adult Health program (n=175) registered a mean of 303 minutes. Large standard deviations of 332 in the AH group and 192 in PCH show that a large amount of spread is present in these groups. In the PCH program High Risk cases, and the Obstetrical Program likely account for most of the spread. As mentioned previously, in the Adult Health Program, there is a greater likelihood that the time demand of incoming cases will be unpredictable. The Adult Health cases represent 15% of the total number, and required 22% of the total referral management time. Senior Adult cases, 21% of the total number used 25% of the time. Together, PCH and SH, with 63% of the cases, used 52% of the total referral management time. The full model with Program as the first level predictor explains 25.8% of variance. It is included in Appendix C.

District Supervisor's Code and Total PHN Time

District Supervisor's Code as a predictor of Total PHN Time has a significance of $5.839E^{-005}$. Figure 13, which shows District Supervisor's Code and Total PHN Time, explains 3.02% of variance. As well as linking the PHN with the supervisor, the District Supervisor's Code served to identify the geographic location of the case. The districts varied considerably in their demographic characteristics and their need for PHN service. By analyzing the database in 'automatic' mode, we can see that only 3 distinct groups are formed by KS. There was no significant difference in 5 of the 8 districts, so they were grouped together. District 19 was separated out, and the third node was formed by Districts 12 and 18. This last node is interesting because the 2 districts are quite different in nature. One of the districts covers a considerable amount of rural area as well as some urban, while the other, located centrally, is completely urban. As mentioned previously, what they do have in common is that each has a large number of subsidized housing units, including many Senior Citizens' buildings. To find the explanation for the difference, if we ask KS to look for the splits in Health Need in each group we get some interesting information. Figure 14 shows the Health Need split for District

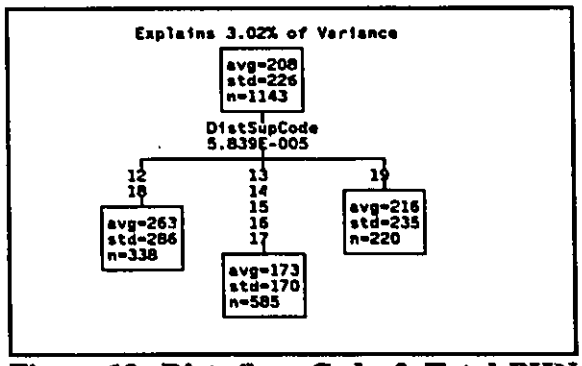


Figure 13 Dist. Sup. Code & Total PHN Time

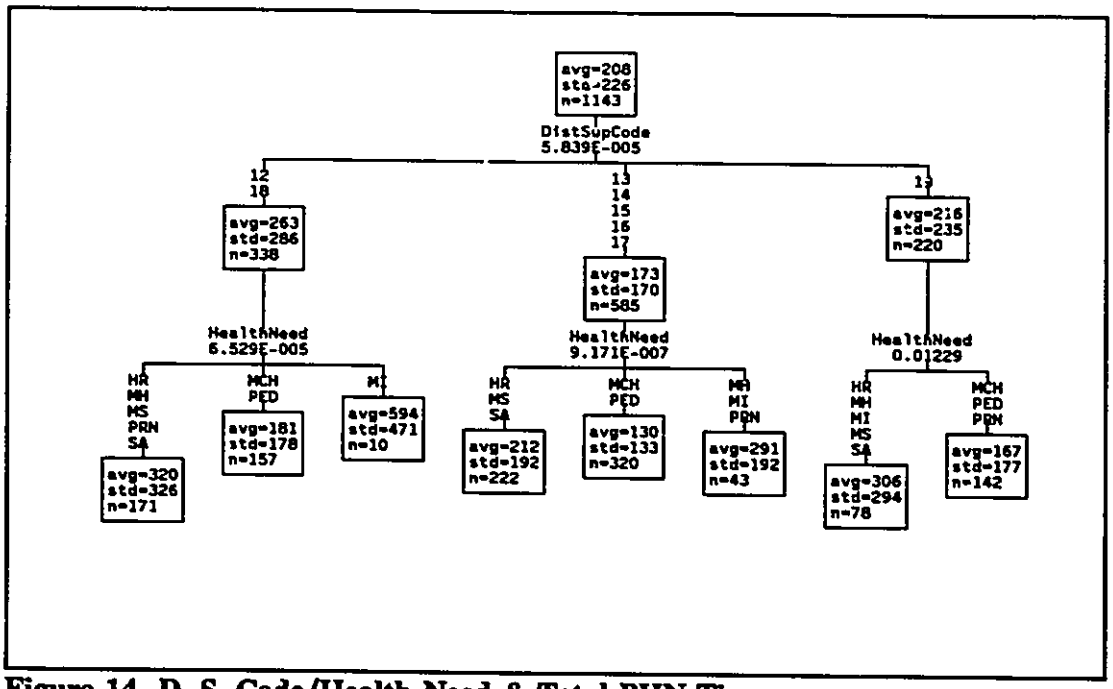


Figure 14 D. S. Code/Health Need & Total PHN Time

Supervisor's Code. In the District 19 node (n=220), which covers Orleans area, 65% of cases are in the [MCH,PED,PRN] node, with the remaining 35% in the [HR,MH,MI,MS,SA] node. In the large [13,14,15,16,17] node (n=585), 55% of the cases were MCH and PED, 45% were other case types. In the node of interest, i.e. [12,18] we see that only 46% of cases were MCH and PED, while 54% were other cases, which are all much more time-consuming. The full automatically-generated model for District Supervisor's Code as a predictor of Total PHN Time is provided in Appendix C.

Supervisor's Education Type and Total PHN Time

The Supervisor's Education Type (sig. 0.00194) was shown to explain only 1.11% of the variance. At the time of the study 2 supervisors had PHN Certificates, 3 had B.Sc.(Nsg), and 3 had Master's degrees, 2 in Education and 1

in Health Administration. In Figure 15 an interesting split is shown in the diagram which shows Supervisor's Education Type at the first level. In "Automatic" mode, KS grouped together supervisors who had completed a Master's degree with those whose academic preparation was a Certificate in Public Health Nursing. It is many years since nurses had the option of obtaining certificates in Public Health Nursing, therefore the supervisors who have this academic preparation are also very senior nurses, with many years experience. When a split is forced in this variable, we find that there is hardly any difference. The Certificate-prepared supervisor's group (n=237) showed a mean of 223 minutes, with a standard deviation of 276, while the Masters-prepared group (n=511) had a mean of 227 minutes and a standard deviation of 236. It is interesting to speculate as to the reasons for the grouping together of the Masters-prepared supervisors and those with the certificates. The finding could well be meaningless, with the explanation for the variance being elsewhere. See Appendix C for the full KS model which explains 24.4% of the variance.

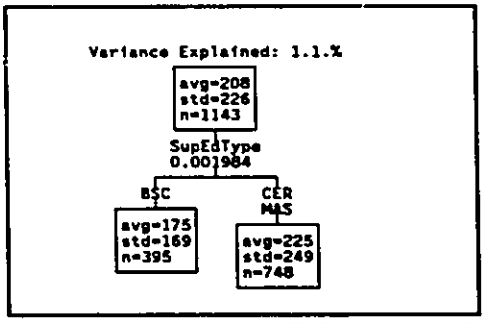


Figure 15 Sup's Education & Total PHN Time

Supervisor's PHN Experience and Total PHN Time

The last provider-centred variable which was a first-level predictor of Total PHN Time was the Supervisor's PHN Experience. Only 0.578% of the variance is explained by the variable, despite the significance of 0.02965. As shown in Figure

16, there is a split at 20 years. The diagram shows that where Supervisors had more than 20 years experience (n=523), the mean Total PHN Time was higher than in the node where Supervisor's PHN Experience was less than 20 years (n=192). As with the Supervisor's Education Type, I would be very cautious about attributing much real significance to the findings in this model. There are many possible alternate explanations which are more plausible than this finding. For the complete model, which explains 27.7% of the variance, see Appendix C.

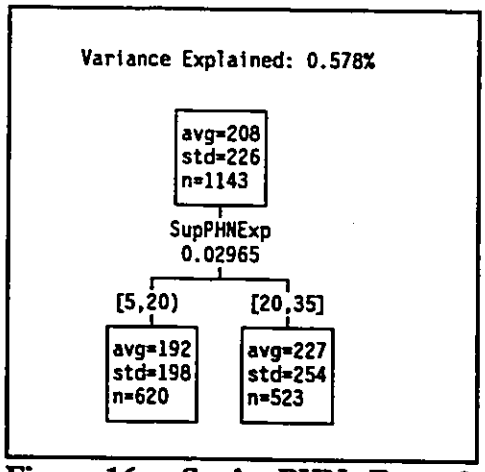


Figure 16 Sup's PHN Exp. & Total PHN Time

3. Number of Contacts as Independent Variable

"Number of Contacts" is both an important predictor of and a component of "Total PHN Time". Looking at the variables which cause it to vary will provide useful information for estimating the time required for referral management. Also, the number of visits was an important consideration when the weighting system for staff deployment was developed, therefore to either validate or revise the system more information about contacts is required. Setting "Number of Contacts" as the dependent variable will provide further useful information to use for proposing any necessary modifications to the weighting system.

The KS analysis was rerun with "Number of Contacts" as the dependent variable. The 68 cases with a value of 0 for "Number of Contacts", indicating that

no significant service delivery occurred, are included in the [0,0.4) node.[52] KS found 9 interesting splits when the analysis was run in 'automatic' mode.[53] Because it is a component of "Total PHN Time" detailed descriptions would be repetition of the earlier discussion. I have created a summary table of the findings for the 9 variables. Table 8 includes 2 sets of values; i) Distance included and ii) Distance excluded.

Table 8 Summary of Independent Variables and Number of Contacts

VARIABLE	VARIANCE EXPLAINED		SIGNIFICANCE	
	Distance	No Distance	Distance	No Distance
Referral Source	10.4%	10.5%	1.833E-***	1.785E-***
Distance	9.51%		4.589E-***	
Health Need	15%	8.13%	2.142E-***	2.06E-***
Program	7.15%	4.53%	1.044E-***	1.001E-***
Dist. Supervisor Code	2.57%	2.59%	0.0007371	0.0006907
Client Age	2.03%	2.05%	0.0009049	0.0008661
Sup's PHN Experience	0.875%	0.856%	0.01768	0.01938
PHN Yrs. Experience	1.17%	1.15%	0.02927	0.0314
PHN Yrs. With Sup.	0.0869%	0.781%	0.03034	0.04749

While Distance appears to be significant, because the only split occurs at 0.4, the grouping indicates that the explanation for this significance is in the difference between the telephone contact and home visits, therefore the value of Distance as a predictor of the dependent variable "Number of Visits" can be safely discounted. Despite the fact that there is little impact on the number of visits, the inclusion or exclusion of "Distance" has a definite effect on the total analysis, with

[52] *For some cases in which nursing interventions do not occur, PHN's do spend a considerable amount of time in the Pre-Service Delivery stage.*

[53] *In this analysis, all the settings remain the same: i.e. Bonferroni 3, Node size 33, and Node creation size 10.*

more impact on some variables than others. Comparing the "Variance Explained" columns, it is obvious that excluding Distance from the analysis has an impact, particularly on Health Need and Program. The models that follow show how the Distance it modifies the picture for some independent variables.

From the analysis summarized above, I have selected the most useful client-centred and provider-centred models for the discussion which follows. The important client-centred variable is Health Need, while the important provider-centred variable is Referral Source.

a. Client-Centred Variation in Number of Contacts

Health Need and Number of Contacts

Although KS found that, in order of significance, Health Need was the third in order of importance as a predictor of variance in Number of Contacts (sig. $2.142E^{-008}$), in the full model (i.e. Distance included) it also found that by itself it explained the greatest amount (15%) of the variance of any single variable. Figure 17 shows the 'automatic' KS model which explains 27.1% of the variance. In this model 3 nodes are formed at the first level; i) [HR,MH, MS,PRN,SA] (A), ii) [MCH,PED] (B), and iii) [MI] (C). The Mental Illness cases (n=27) are in [MI] (C) node with the largest mean of 4.3 contacts. The [HR,MH,MS,PRN,SA] (A) node (n=503) shows the next highest mean of 2.52 contacts per case, while the large [MCH,PED] (B) node (n=612) has a mean of 1.56 contacts. Although Distance shows at the second level in (A) node, and the third level in (B) node, its importance can be discounted in this model, as it is

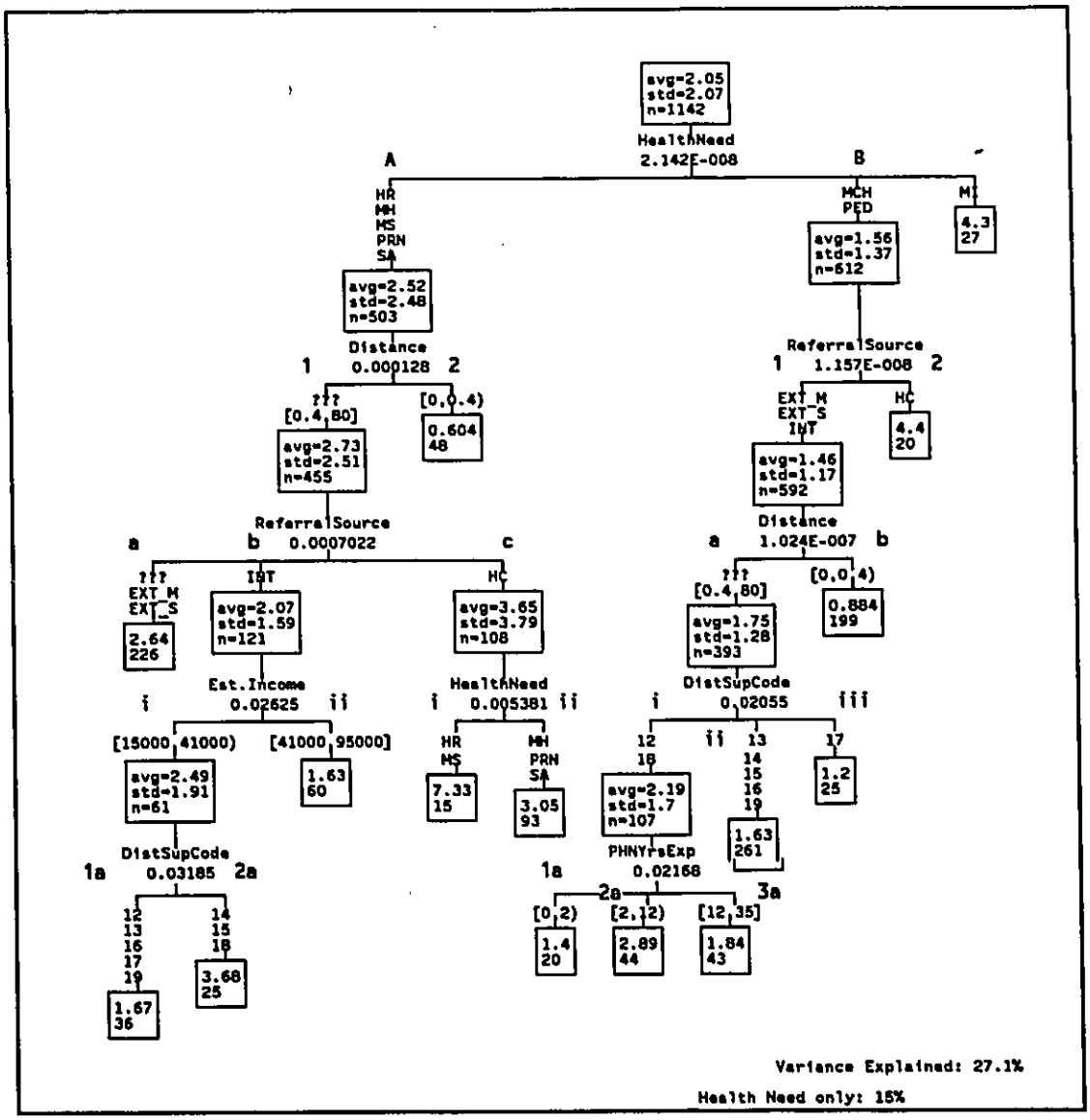


Figure 17 Health Need and Number of Contacts

obvious that the split is due to the difference between telephone contacts and home visits. Referral Source is the other variable which splits at second and third levels of the model. Subsequent splits beyond Level 3 include Estimated Income, Health Need, District Supervisor's Code and PHN Years Experience.

At the second level in [HR,MH,MS,PRN,SA] (A) node, Distance is shown as the important split, but the split is due to the difference between telephone and

face-to-face contacts. In this branch, in the ???[0.4,80] (A1) node, the important split is in Referral Source (sig. 0.0007022). Cases (n=108) in the Home Care node (A1c) needed an average of 3.65 contacts; differences in this node are explained primarily by differences in Health Need. The Health Need split for Home Care is made between [HR,MS] (A1ci) and [MH,PRN,SA] (A1cii), with the former showing a mean of 7.33 contacts, the latter a mean of 3.05. The next largest mean of 2.64 contacts was shown in the ???[EXT_M,EXT_S] (A1a) node (n=226). No further splits were found in this node. In the [INT] (A1b) node (n=121) of this branch, where the mean was 2.07 contacts, there are 2 additional interesting levels. In Estimated Income (A1b) (sig. 0.02625) the split occurs at $41,000, (the Mean Household Income from the 1986 Census for Ottawa-Carleton). The number of contacts appears to be inversely related to Estimated Income. One further split is found in node (A1bi) where Estimated Income is under $41,000 (n=61). Here District Supervisor's Code explains some of the variance. The districts in the node with the higher mean Number of Contacts are those where many of the Seniors' housing apartment complexes are located.

In the other large first-level node, i.e. [MCH,PED] (B), Referral Source is the next most important split, with a significance of $1.157E^{-008}$. The importance of the cases in the Home Care (B2) node (n=20) with a mean of 4.4 contacts in determining the Referral Source split, compared to the node mean of 1.46 for all other types of Referral Sources, is obvious. In the Distance ???[0,0.4) node (n=393) of the [EXT_M,EXT_S,INT] (B1) group of cases the appearance of the

District Supervisor's Code (sig. 0.02055) again suggests the presence of subsidized housing complexes as a factor in determining a higher-than-average mean Number of Contacts.

By forcing a split for Health Need in the 2 nodes which are mixed, we are able to determine that there is indeed little difference between the categories. The results of the forced split will, however, be valuable for program planning purposes so they have been included here in Figure 18. To complete the analysis for the [HR,MH,MS,PRN,SA] (A) and [MCH,PED] (B) nodes, KS was asked to identify interesting splits in each of the forced nodes, but none of major significance were found that are not already accounted for in the primary model

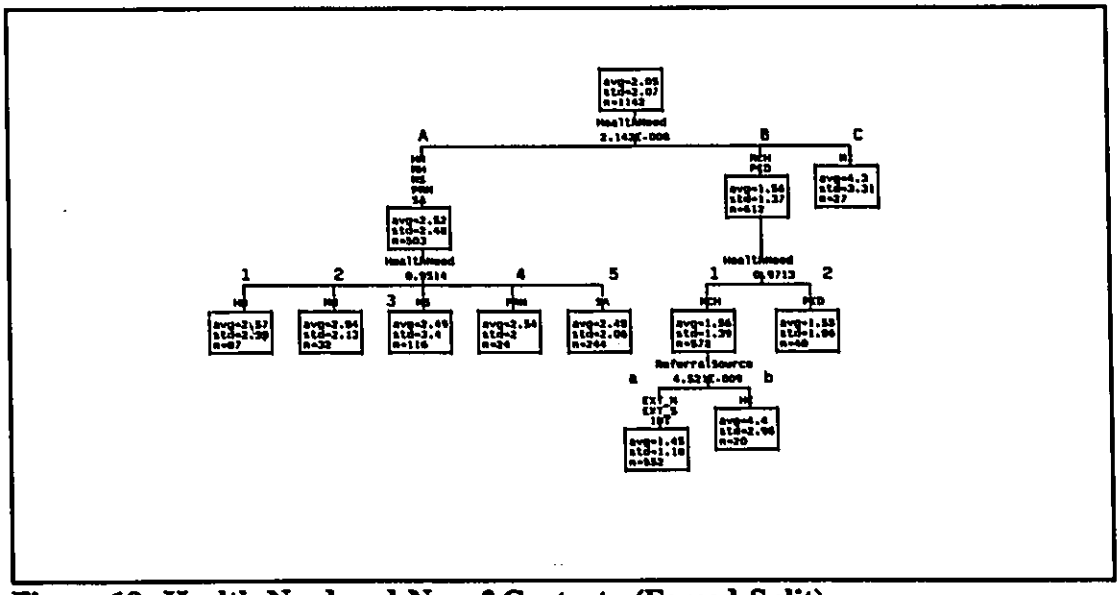


Figure 18 Health Need and No. of Contacts (Forced Split)

shown above in Figure 18.

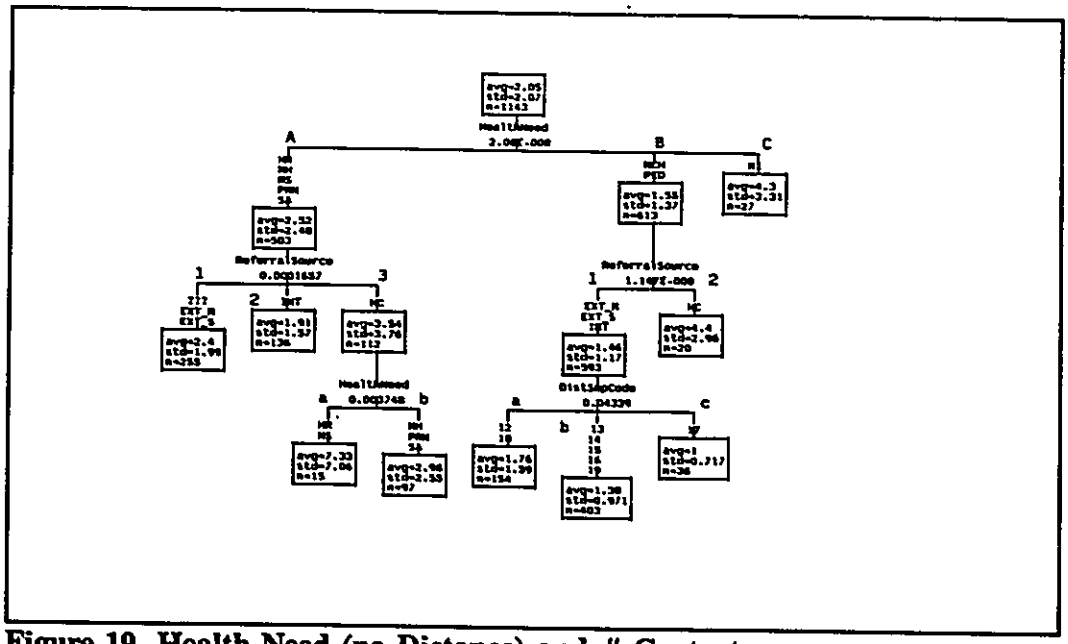


Figure 19 Health Need (no Distance) and # Contacts

The Health Need model was sensitive to the inclusion or exclusion of the Distance variable in the analysis. Figure 19 shows the second model for Health Need with Distance excluded. In this model the Variance explained decreased to 8.33%, and the optimal model explained only 20.6% of variance. Only 3 levels are shown in the later model, with the Referral Source [HC] (A3) node of the [HR,MH,MS,PRN,SA] (A) group showing a second Health Need split, and the Referral Source [EXT_M,EXT_S,INT] (B1) node of the [MCH,PED] (B) group showing a split by District Supervisor Code. The 48 cases in the Distance [0,0.4) (A2) node from Figure 17 are distributed through the Referral Source categories, with 29 in ???[EXT_M,EXT_S] (A1) and 15 in the [INT] (A2) node and 4 in [HC] (A3). The change in the mean Number of Contacts in the ???[EXT_M,EXT_S] (A1) node was -9%; in the [INT] (A2) node -8%. In the

latter group, the change had the effect of eliminating further important splits in the node. The model in Figure 14 had several additional splits in both the large nodes which have been eliminated in Figure 19. In the ???[EXT_M,EXT_S] (B1) node of the [MCH,PED] (B) group, the diffusion of the cases from node [0,0.4) (B1b) of Figure 14 eliminated the split in the District Supervisor Code [12,18] (B1a) node. At -20%, the difference in this node was greater than in the others.

As shown in Figures 20 and 21, comparing the proportions of cases and contacts tells an interesting story. Mental Illness cases, which represent 2.4% ofthe total number of cases in the study, account for 5% of the contacts; the Maternal/Child Health and Pediatrics, with 54% of the cases, had 41% of the contacts, and the heterogenous [HR,MH, MS,PRN,SA] (A) node used 54% of the contacts with only 44% of the cases. While we do know that the majority of Maternal/Child Health cases require only a single contact, and that as many as one-third of these contacts are by telephone contact only, the sheer volume of the demand in this program has to be given due consideration in program planning. Because much of the demand is

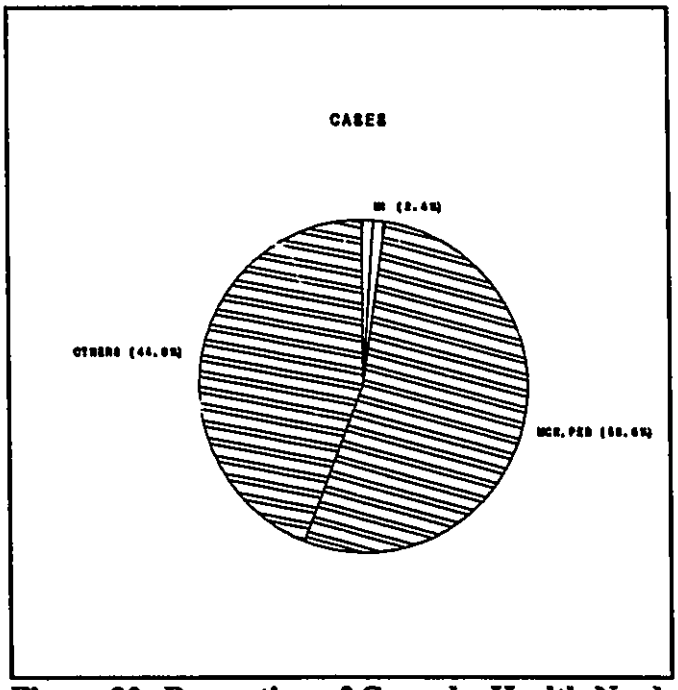


Figure 20 Proportion of Cases by Health Need

generated internally through PHN liaison activity, it is theoretically possible to exert more managerial control for this program, but this is mitigated by the community's expectations concerning service delivery to the families of new infants, and by the needs of the infant population. Professional counselling assistance for young parents, particularly in marginal families, is very important if children are to get the start that we know will improve their chances in life. Careful attention to selecting the cases which should receive individual attention from PHN's will ensure that service is provided to those who need it, rather than to families of all newborns, regardless of need.

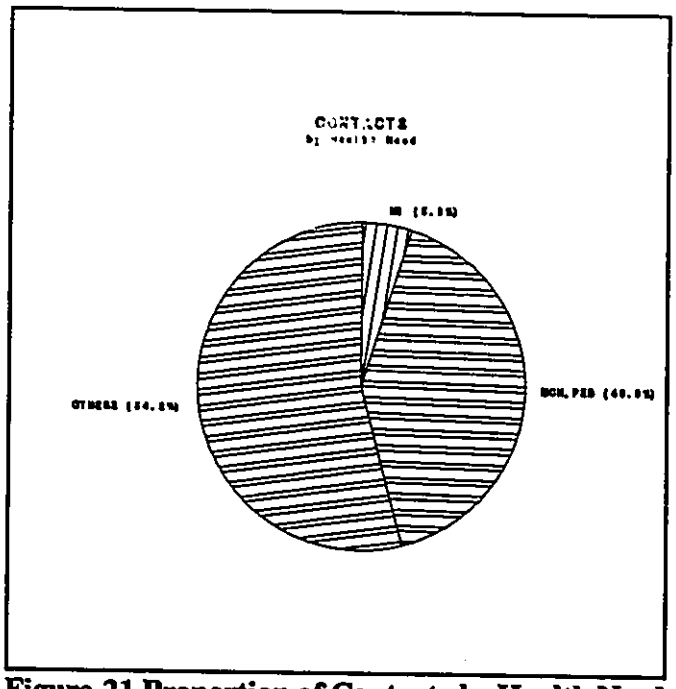


Figure 21 Proportion of Contacts by Health Need

With the information shown above for the identified client groups, managers might give consideration to developing a means, insofar as possible, for predicting an appropriate standardized number of contacts for each case type.

b. Provider-Centred Variation in Number of Contacts

Referral Source and Number of Contacts

As with the Total PHN Time model, Referral Source is shown to be the

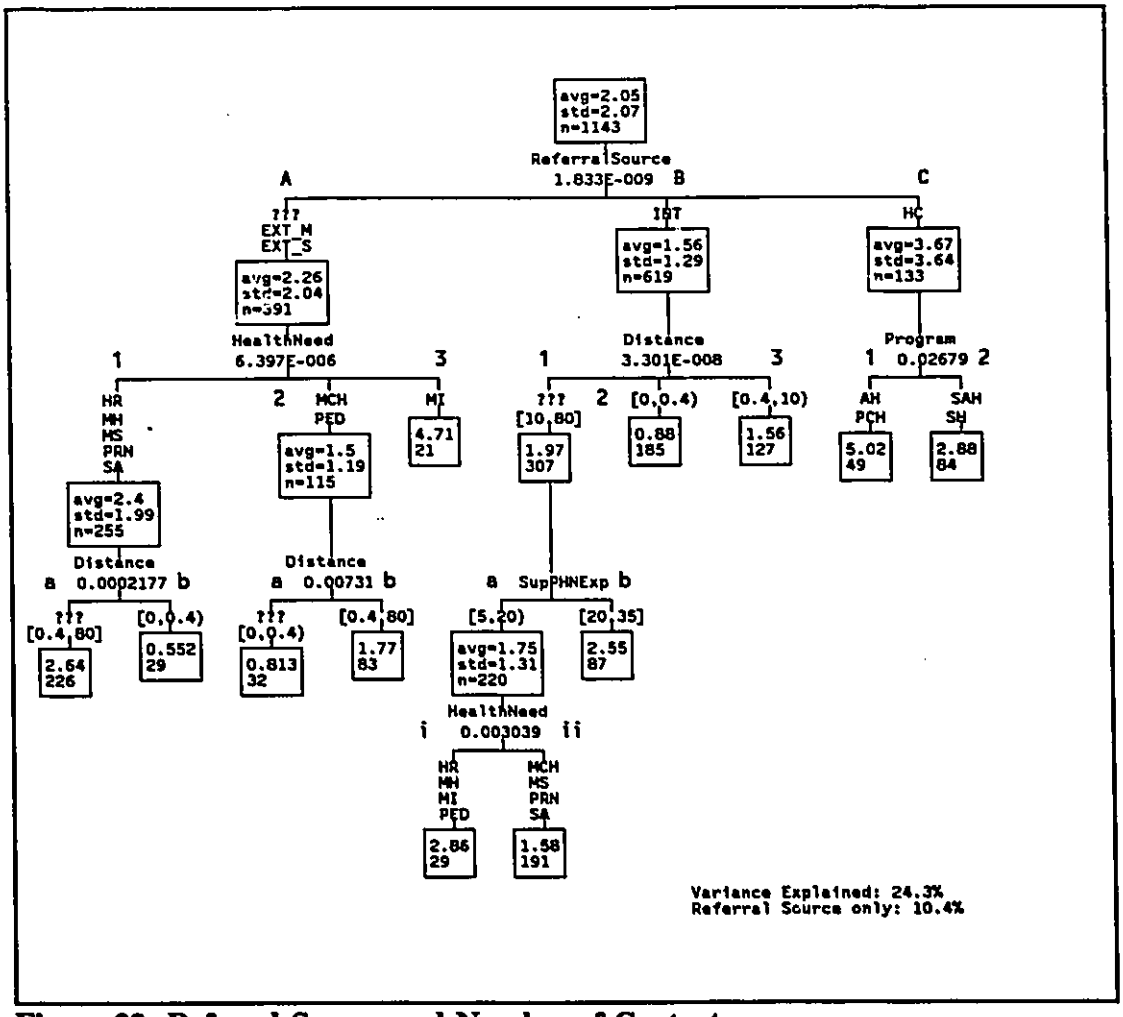


Figure 22 Referral Source and Number of Contacts.

one of the most important predictors of variation in Number of Contacts (sig. $1.833E^{-009}$). Alone, it explains 10.4% of variance, and in the full model (with Distance included) 24.3% of variance is explained. Figure 22 is the full model, including Distance. In the 3-way first level split, the mean for the Home Care (C) node (n=133) is the highest at 3.67 contacts. Some of the variance in this group is further explained by Program, with the theird-level split showing between [AH,PCH] (C1) and [SAH,SH] (C2).

The ???[EXT_M,EXT_S] (A) node (n=391) shows the next highest mean of 2.26 contacts. Second level splits in this branch (A) are in Health Need. Mental Illness (A3) at 4.7 contacts has the highest mean (n=21). The next highest mean of 2.4 contacts is shown in the [HR,MH,MS,PRN,SA] (A1) node (n=255). The [MCH,PED] (A2) node, with 115 cases, has the smallest mean of 1.5 contacts. The only notable third level splits in this branch are for Distance, therefore not important.

The [INT] (B) node (n=619) has the lowest mean of 1.56 contacts. At the second level, where Distance is the important split, node ???[10,80] (B1) (n=307) with a mean of 1.97 contacts, shows further splits. Some of the variance is explained by Supervisor's PHN Experience, where the split is at 20 years, and there appears to be an inverse relationship. One further split, i.e. in Health Need is seen in the Supervisor's PHN Experience [5,20) (B1a) node (n=220) where 2 nodes [HR,MH,MI,PED] (B1ai) and [MCH,MS,PRN,SA] (B1aii) are formed.

In Figure 23 which shows the Referral Source/Number of Contacts model with Distance excluded, the impact of removing Distance is less than in the Health Need/Number of Contacts. In fact, for the single variable, "Referral Source", the variance explained increases slightly, from 10.4% to 10.5%, while the net loss for the full model changes from 24.3% to 20.3%. The Home Care node (C) remains the same in both models, but the subsequent splits for the other 2 nodes show differences. In ???[EXT_M,EXT_S] (A), Distance has been replaced in [MCH,PED] (A2) as a third level split with Supervisor's Years Since Education,

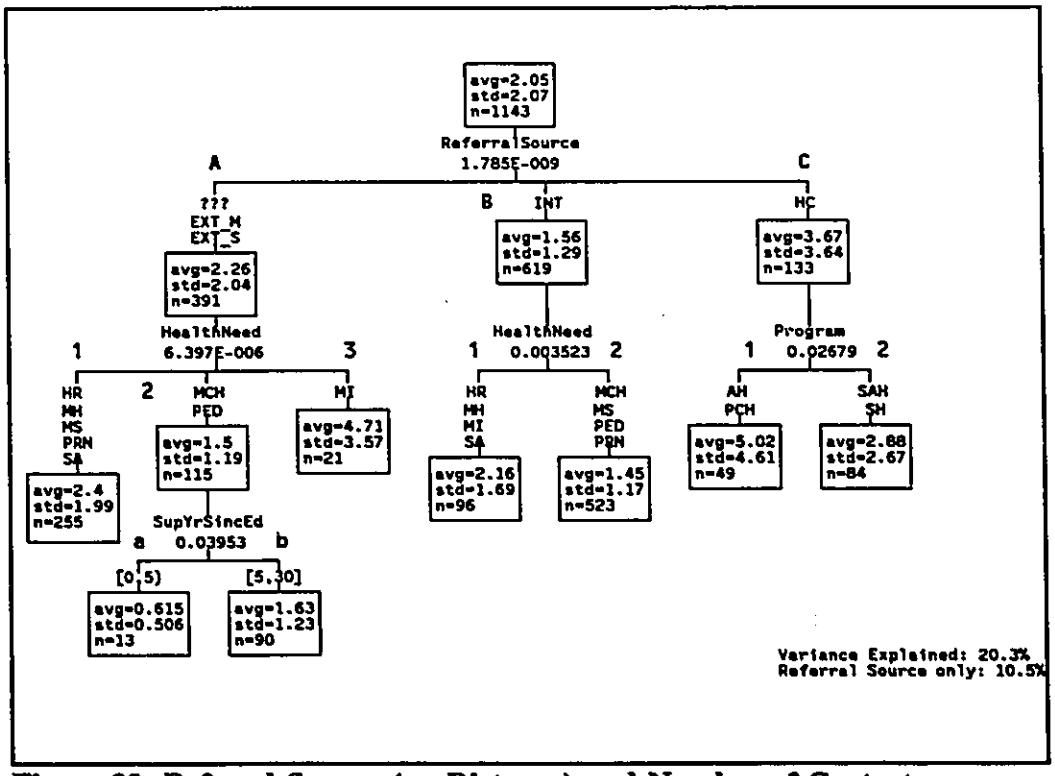


Figure 23 Referral Source (no Distance) and Number of Contacts

where the split comes at 5 years. No third level splits are shown in [INT] (B).

4. Summary of KS Findings

"Number of Contacts" in both its independent and dependent modes, was shown to be a very important factor in the determination of the amount of time required to manage public health nursing referrals. Not unexpectedly, as an independent variable directly influencing the dependent variable "Total PHN Time", it was shown to be the more important than any of the factors included in the study as independent variables. To provide substantiating data for the modification of the staff deployment weighting system, it was analyzed as the dependent variable. When analyzed as a dependent variable, "Number of Contacts" was shown to be sensitive to a number of independent variables, at least

2 of which have importance for management purposes. Not surprisingly, the 2 independent variables, "Health Need" and "Referral Source", as well as "Distance", were also shown to be important predictors of variation in "Total PHN Time".

From a managerial perspective Health Need has the most importance.Of the client-centred variables which were shown to contribute to variation in Total PHN Time. In several of the models, categories of Health Need were grouped together, showing that their requirement for PHN time is similar. The Health Need findings show that to accurately predict demand for PHN services, the weighting system must be adjusted for some types of cases. The other client-centred variables which accounted for some of the first-level variation in Total PHN Time were Distance and Client Age. While Distance ranked high as a predictor of variance in Total PHN Time, much of the variance was attributable to the difference between telephone contacts and home visits. Particularly in the PCH program this effect was in evidence, as this program can make use of telephone contacts for one-third of its incoming referrals. Estimated Income was not of first-level importance, but in some models it showed an inverse relationship with Total PHN Time in smaller nodes at the lower levels.

Provider-centred variables which strongly influenced Total PHN Time were Referral Source, Program, District Supervisor Code, Supervisor's PHN Experience and Supervisor's Education Type. Of these, Referral Source is of considerable value to managers. Given that in some categories, the majority of cases are generated by (internal) PHN liaison activity, some control can be exerted to

decrease the demand. The findings for District Supervisor's Code showed some interesting differences which can be linked to the demographic profile of the respective districts. While the findings concerning the Supervisors educational preparation and experience are interesting from a speculative point of view, they could in fact be an 'artifact' of the design study, therefore cannot be considered conclusive. What is interesting is that no variables having to do with the direct service-providers, i.e. public health nurses, are evident in the first 2 levels of any of the models. If a 'productivity approach' with the service providers being the study population had been used for this study, more conclusive evidence concerning variations attributable to the different characteristics of the professionals and their immediate supervisors might have resulted.

5. A Modified Weighting System

From the beginning of this research project, my goal has been to extract information which could be used either to validate the staff deployment weighting system, or to modify it so that its accuracy would be improved. The findings presented above give some valuable hints about the direction that should be taken, but more useful data can be obtained by using KS as a decision-support tool. The final step in this project will be a proposal to modify the weighting system on the strength of the findings reported here. As mentioned previously, the weighting system relied heavily on 2 facets of PHN time: i) Total Time; and ii) Number of Contacts. Since Number of Contacts is such an important determinant of Total PHN Time, KS in "user mode" can be used to extract the

information required to propose changes to the weighting system. All the settings mentioned previously have been left at the same settings, but I have used the "Forced Split" command to specify user groups for this analysis.

In Figure 24 below, I have made Number of Contacts the dependent variable, and then specified Health Need groups within Program groups. Further refinement of the weighting system might be considered by using the Referral Source data, so where there is at least a difference of 1 contact, categories have been shown at Level 3. There was no breakdown by Health Need for the Seniors program because there was only 1 Case Type Code for Health Need in this

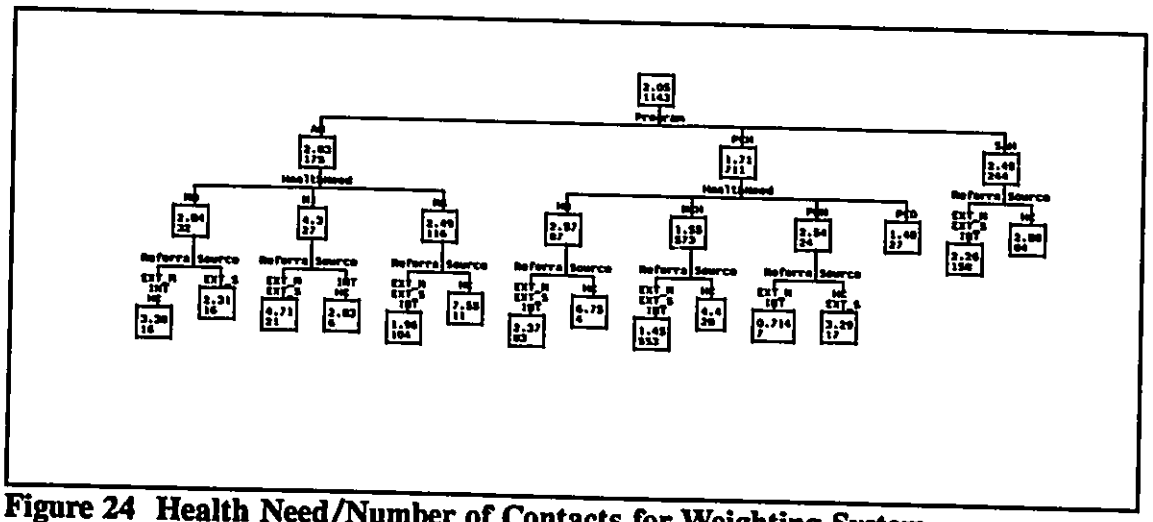


Figure 24 Health Need/Number of Contacts for Weighting System

Program group. I looked at Client Age and Referral Source in the Seniors group, but found little variation, however I did include the Referral Source information in the diagram even though the difference was less than 1 contact.

To modify the weighting system so that it might serve a useful purpose in the present service delivery mode which is based on 4 lifecycle groups, several

changes are necessary, especially since the present program configuration is different than the one that was in effect when the staff deployment system was used in a general program. Case Types should be realigned to the present program configuration. Also, the study findings indicate that there should be an adjustment made to the weightings assigned to the different Case Types. Finally, the information from Figure 24 about the number of contacts can be used to modify the relative values assigned to each weighting category. Since the number of contacts is such an important aspect of Total PHN Time, one approach might be to simply round the mean Number of Contacts by Health Need category, and thus derive a new system.

With mean Number of Contacts used as the basis for modifying the weighting system, several approaches are possible. Because the values are small, the group means could be either rounded to whole numbers or to the nearest 1/2. Alternatively, the classic Maternal/Child Health newborn visit could be used as a "benchmark" weight of 1, with all others then receiving proportional weights. A weighting system within each program group might also be devised. Because the number of visits increases dramatically if the case requires Home Care services, with any of these methods it would be advisable to consider adding a second level where Home Care is the referral source. Table 9 shows the 3 general alternative weighting systems mentioned above. Model One is based on the Number of Contacts rounded to the nearest whole number, Model Two is Number of Contacts rounded to the nearest 1/2, and Model Three uses the Maternal/Child

Health newborn contact as the benchmark.

Table 9 Proposed Revisions to Weighting System

Health Need/Program	Model One	Model Two	Model Three
Adult Health Program			
Mental Health	3	3	2
Mental Illness	4	4.5	3
Medical/Surgical	2	2.5	1.67
Parent/Child Health Program			
High Risk	3	2.5	1.67
Maternal/Child Health	2	1.5	1
Prenatal	3	2.5	1.67
Paediatric < 4	1	1.5	1
Senior Adult Health Program			
Senior Adult	2	2.5	1.67

To test the weighting systems, I compared the time estimate from each of the models, including the original, with the actual time as reported in the study. In Table 10 below, Column 1 is the District Supervisor's Code, and Column 2 is the actual amount of time used in referral management, divided by the number of PHNs in the district. At the bottom of the chart (Row marked "ALL") I have shown the calculation for the overall population, with the Total PHN time divided by the 88 PHN positions. To derive time comparisons for models one and two, I estimated the time using 100 minutes as the overall Average Time per Contact[54] and rounded the Number of Contacts to whole numbers for Model One, and to .5 for Model Two. For Model Three, which uses MCH cases as a benchmark, I used the mean of the trimmed MCH population (94 minutes). The original

[54] *The actual Average Time per Contact for the trimmed population was 101 minutes, but I chose to round this to 100 minutes to simplify the calculations.*

model had a range of times, so I estimated the time by choosing the middle of each range. To evaluate how effective each model is for predicting the amount of time required, I then calculated the percentage difference between the estimate shown in the model and the actual time required. As Table 10 shows, Models One and Two are much more accurate in predicting the amount of time required for referral management than either the original model, or Model Three.

Table 10 Comparison of Models to Actual Time

DSC	ACTUAL	ORIGINAL		MODEL ONE		MODEL TWO		MODEL THREE	
12	2350	3562	52%	1747	-26%	1767	-25%	1109	-53%
13	2507	6030	141%	3400	36%	3407	36%	2138	-15%
14	2016	4895	143%	2550	26%	2583	28%	1804	-11%
15	1485	2919	97%	1800	21%	1757	18%	1102	-26%
16	2924	4284	47%	3475	19%	3125	7%	1960	-33%
17	2064	4149	101%	2443	18%	2279	10%	1429	-31%
18	3358	5113	52%	2900	-14%	2788	-17%	1749	-48%
19	3402	4813	41%	3379	-1%	3054	-10%	1915	-44%
ALL	2703	4468	65%	2776	3%	2630	-3%	1650	-39%
AVERAGE DIFFERENCE			84%		10%		6%		-32%

In the last line of Table 10 the average difference between Districts is shown. Although there is little difference between Models One and Two, Model Two appears to be slightly more accurate in its predictive ability. Therefore, for a generalized program organized by lifecycles it would be the Model of choice.

V. CONCLUSION

A. Overall Summary of Findings

The primary purpose of the study, i.e. a description of the variations in referral management time in a generalized public health nursing setting, has been achieved. As shown in the conceptual framework, it was hypothesized that both client-centred and provider-centred variables would cause variations in PHN referral management time. Also, as shown by the bi-directional arrow between the independent variable groups in the model there was an implied expectation of strong interaction between the groups because the programs are in fact based on client attributes such as age and health need.

Of the client-centred group of variables, Health Need was shown to be a highly significant predictor of both Total PHN Time and Number of Visits. An interesting grouping of categories of Health Need emerged in the KS models. While Distance was found to be statistically significant, much of its importance had to do with the difference between home visits and telephone contacts. Client Age was shown to be a predictor of variations in Total PHN Time, but no definite overall directional trend was found. Total PHN Time was shown to be inversely related to Estimated Income in some sub-groups. While this rough measure of socioeconomic status must be viewed with caution, another geographically-based variable, District Supervisor Code, was also shown to be an important predictor of Total PHN Time. Together, these 2 variables support the hypothesis that PHN

referral management time is influenced by the client's socioeconomic status.

Provider-centred variables which accounted for variations in Total PHN Time included Referral Source, Program, Supervisor's Education Type, and Supervisor's PHN Experience. Of these, Referral Source has the most importance for management purposes. Variations in Total PHN Time and Number of Contacts were both strongly associated with Program group categories. Strong associations between Supervisor's Education Type and Supervisor's PHN Experience were demonstrated, but these findings must be interpreted with caution. More interesting is the absence of any strong consistent association between the dependent variable and any direct provider (i.e. PHN) independent variables.

Number of Contacts was originally conceived of as a component descriptor of the overall dependent variable, however the KS analysis showed that if Number of Contacts was treated as an independent variable, because of the preponderance of cases receiving only 1 PHN contact, it explained 60% of the variance in Total PHN Time. Its impact on Total PHN Time is a "given", but since the percentage of variance explained by this variable was so much higher than any other independent variable, Number of Contacts had to be considered as both an independent and a dependent variable.

The findings in this field study can only be considered typical of how public health nurses of the Ottawa-Carleton Health Department use referral management time. Because each agency is specific as to how its client groups are

formed, no claim is made that the findings can be generalized beyond the agency. However, for 2 of the traditional PHN client groups, namely Maternal/Child Health and Senior Adult, it may be relatively safe to assume that other public health agencies would likely use the similar amounts of time.

B. Policy Implications

The information in the study was useful in evaluating the staff deployment weighting system which gave rise to the research. When the original system was compared with the study findings, it was obvious that changes were necessary in order to validate its methodology. At the end of the preceding chapter I proposed a revised staff deployment weighting system based on the findings of this study. While this system evolved from a generalized public health nursing program the concepts it embodies could readily be adapted for use in other programs or settings. Staff deployment is a problem that is not unique to public health agencies, rather it is shared by many community health and social services which use outreach workers for service delivery. By applying quantitative techniques similar to those described in this paper, managers in these agencies can accurately predict the time required to meet the potential demand.

With the information gained from the descriptive part of the study, average or unit costs can be derived for the service provided in different programs. For example, to obtain a conservative estimate of the time required to handle incoming referrals in the MCH group (Parent/Child Health program), use the average Contact Time for the MCH clients of 94 minutes, (Panel B in Table 4)

multiplied by the average Number of Contacts (Panel B, Table 3) of 1.5 for a result of 141 minutes (2.35 hours) then multiply this by the expected number of clients in a given time period to estimate the required service time. From the predicted time required, the actual staff costs can also be calculated. For this part of the exercise, it is important to remember that service delivery time is only one component, albeit a large one, of total paid time, therefore it is important to factor in the non-service delivery time. As mentioned earlier (see page 4), only 110 hours per month per PHN (or 1320 per year) are available for service delivery. Total paid time is 1820 hours. (35 hours X 52 weeks) To fully account for program costs, the 'overhead' cost of the non-service time must be allocated to service time. To do this, each service delivery hour should be costed as 1.4 paid hours. To return to the example of the MCH unit cost, we can estimate the per-client cost by applying the current hourly PHN rate to 3.3 hours (2.35 X 1.4) of paid time.

Both Average Time per Contact, and Number of Contact information can be useful for supervisors and staff PHN's. Supervisors can use the information in the orientation new staff, in monitoring caseloads, and in evaluating PHN performance. PHN's will find the information useful because they can compare their own use of referral management time with that of their colleagues.

Because hospitals and other inpatient health care settings have beds with which to determine their capacity, they have little difficulty stating their maximum patient load. In community settings beds cannot be used to "cap" the client load.

During periods of cost containment, the information contained in the study might be used to allocate costs among competing program demands. For example, in order to effectively allocate costs a manager could set a maximum amount of time to be used for each client group. By applying the information about the average time per case, an estimated total number of cases for each case type could be established. Incoming referrals beyond this number could then be put on a waiting list until the total number of currently active cases was reduced through discharges to below the established maximum.

The problem of quantifying professional services is by no means unique to public health nursing. In order to compete successfully for scarce program funds, any manager in any service agency which uses outreach workers must be able to both accurately account for and forecast the use of professional time.

APPENDIX A - DATA COLLECTION INSTRUMENTS

1. FORM I - PUBLIC HEALTH NURSE PROFILE

2. FORM II - NURSING SUPERVISOR PROFILE

3. FORM III - SERVICE DELIVERY FORM

4. Memos and Instructions for use of Data Collection Instruments

FORM I CODE # N: 164

PUBLIC HEALTH NURSE PROFILE

Instructions:

The CODE number found at the upper right corner of this form is a confidential identifier which you will use on the SERVICE DELIVERY FORM. You must also record your Supervisor's Code Number on each SERVICE DELIVERY FORM.

1. Please complete the information below and return this form to the Researcher as soon as possible.
2. Record your Supervisor's Code on the label provided, and affix it to the inside cover of your casebook.

Education:

RN & PHN Cert. _____ B.ScNsg _____
RN, PHN Cert. & B.Sc.Nsg. _____
Other (Specify) _____

How many years have elapsed since you completed your last professional education degree/diploma? _____

Experience:

How many years of Public Health Nursing experience do you have? _____

How many years have you worked with your present supervisor?_____

How many years of non-Public Health Nursing experience do you have?____

Do you prefer working with any particular client age group?
No ___ Yes ___
If yes, check all that apply and number in order of preference:
0 to 4 _____ 5 to 14 _____
15 to 24 _____ 25 to 64 _____
65 and over _____

District Supervisor's Code Number _____

REFERRAL STUDY

==========

FORM II CODE S

==========

NURSING SUPERVISOR PROFILE

Instructions:

To ensure confidentiality a CODE Number, found at the upper right-hand corner of this form, is the only identifying link being used in the study. This CODE number will be recorded by the PHN on the SERVICE ACTIVITY Form which will be attached to the incoming referrals that are selected as part of the study.

1. Please complete the information below and return it to the Researcher as soon as possible.
2. Provide your Public Health Nurses with your Code number.
3. To ensure that you have a record of your Code number, a label is provided for you. Please retain the label to the end of the study, in case you have to provide new staff with your number.

Education:

RN & PHN Cert. _____ B.ScNsg _____
RN, PHN Cert. & B.Sc.Nsg. _____
Other (Specify) _____

How many years have elapsed since you completed your last professional education degree/diploma? _____

Experience:

How many years of experience as a Public Health Nursing Supervisor in Ottawa-Carleton do you have? _____

Including your supervisory experience, how many years of Public Health Nursing experience do you have? _____

FORM III - Page 1

CLIENT CODE - 0671

SERVICE DELIVERY FORM

For each significant contact, record the time spent, in increments of 5 minutes, for all categories of activities which apply. Examples of the activities which might be included are given below, with detailed guidelines for each category on the reverse side of this form. Please return the completed form when the case is discharged, or after 3 months, whichever is sooner.

Date Case Assigned: _____ Return Date: (3 months) _____

Contact	1	2	3	4	5	6	7	8
PRE SERVICE DELIVERY								
Client Contact Making appointment								
3rd Party Contact Contact with family, other professionals, discuss with team, etc.								
Other Activity (all other activities) Preparing for visit								
Travel to visit								
SERVICE DELIVERY								
Client Contact Assessment Intervention								
3rd Party Contact Contact with family, other professionals during visit								
Other Activity (all other activities)								
POST SERVICE DELIVERY								
Client Contact Follow-up phone calls to/from client								
3rd Party Contact Referral to other professional, case conference, discussion, with team/supervisor family member, etc.								
Other Activity (all other activities) Recording, including return reports, etc. Return travel (PKU, record)								

MCH Clients only: Assessed as High Risk Yes ___ No ___

Total Number of Client Contacts _____ Distance from Central Office _____ Kms.
(Client's Residence)

THANK YOU

REFERRAL STUDY

FORM III Page 2 CLIENT CODE --0671

MASTER CONTROL FILE

When the case is assigned, complete this page of FORM III using the information provided on the referral. Once the information is complete, remove this page and submit it to the researcher by placing it in the designated container in the Central Clerical Area. To ensure client confidentiality, this form will be stored in the secure storage area of the central office. Page 1 of the SERVICE DELIVERY FORM is to be retained with the client record until discharge, or 3 months, whichever is sooner.

CLIENT'S SURNAME _____ FIRST NAME _____
ADDRESS _____ Census Tract # _____
CITY _____ Postal Code _____

CLIENT'S AGE _____

REFERRAL INFORMATION:

Who initiated the referral? (Check one only.)
Self/Family ____ Home Care____ Physician____ School____
Hospital ____ CAS ____ Soc. Serv. Agency ____ VON ____
Clinic (Cancer, etc) _____ Other (Specify)_____

PHN Liaison _____ PHN (other than Liaison) _____

Centralized Caseload Book Classification:

Check one:

Mental Illness ____	Cancer ____
Home Care ____	Communicable Disease ____
Senior Adult ____	Mental Health ____
MCH/CAS High Risk ____	Prenatal ____
Pediatrics ____	Ind/Family Mgt. ____
Medical/Surgical ____	Mat/Child Health ____

NURSE CODE _____* SUPERVISOR CODE_____*

To be completed by PHN assigned to the case.

* N.B. This code is the number assigned to each staff person for the purpose of the study by the researcher, NOT the team code.

M E M O R A N D U M

TO: Supervisors and Team Leaders

FROM: Verna Wilson

DATE: August 12, 1987

SUBJECT: Referral Study

Before beginning data collection on the time required to manage referrals, I need some information about the professional staff. The system of alphanumeric coding that I have devised will ensure confidentiality for all parties in the study.

Instructions

1. Each Supervisor completes a NURSING SUPERVISOR PROFILE, and provides the number recorded on her form to Public Health Nurses in her team(s). The attached label is retained by the Supervisor for future reference.
2. Each Public Health Nurse completes a PUBLIC HEALTH NURSE PROFILE.
3. PHNs record the Supervisor's Code Number on the label provided. This label is then to be placed on the inside cover of the Casebook. It will provide a ready reference for accurate recording of these two Code numbers on the SERVICE DELIVERY FORM during the course of the study.
4. All forms are to be returned to me in the envelope provided.

THANK YOU FOR YOUR CO-OPERATION

M E M O R A N D U M

TO: A. Thompson, Acting Director of Nursing

FROM: Verna Wilson

DATE: September 8, 1987

SUBJECT: NURSING DIVISION PARTICIPATION IN REFERRAL MANAGEMENT STUDY

The preliminary phase of my research project, comprising the collection of information concerning the education and experience of public health nurses and supervisors who are directly involved in the management of referrals, has been completed. If it meets with your approval, I would like to begin the final data collection phase: i.e. collecting information on the amount of time spent in managing referrals. During the course of devising this study, I have consulted with H. Caloren and Dr. Dunkley who have provided valuable assistance. According to Dr. Dunkley, because this study does not directly involve the clients of Nursing Division there is no need for the Health Department Research Ethics Committee to review the proposal.

Details of the process of collecting the data, and an estimate of the cost to Nursing Division are included with this Memo.

Verna

cc. H.C.

REFERRAL STUDY -- DATA COLLECTION PHASE

Timetable

1. Starting Date: September 14, 1987.
2. Completion Date: (estimate) Dec. 31, 1987.

N.B. The completion date will depend on how quickly the appropriate number of referrals in each category is obtained.

Process

1. A SERVICE DELIVERY FORM will be attached to each incoming referral by the Central Clerks.
2. When the case is assigned to a PHN, Page 2 of the SERVICE DELIVERY FORM will be completed by the PHN (the identifying information could be completed by the District Clerk). Page 2 is then submitted to the Researcher by forwarding through the usual channels. The completed Page 2's will be collected in a receptacle which will be stored in the secure central file area. This part of the SERVICE DELIVERY FORM serves as the MASTER CONTROL FILE.
3. Page 1 of the SERVICE DELIVERY FORM remains with the Health Record until the case is discharged, or until 3 months have elapsed from the time the referral is received. As the PHN manages the case she will use Page 1 of the SERVICE DELIVERY FORM to record the actual amount of time she spends on the case.
4. When the case is discharged, or when 3 months have elapsed, Page 1 of the SERVICE DELIVERY FORM is submitted to the researcher.
5. Provision has been made on the form for 8 significant contacts; if more are made, the PHN carrying the case will request a second SERVICE DELIVERY FORM from the researcher.
6. If the case is transferred from one PHN to another, the case is considered to be a 'new' case by the second PHN. A second SERVICE DELIVERY FORM will be initiated: the referral source in this case is PHN (other than Liaison).

Referral Study - Benefits

The data collected during this study will provide valuable information for decision-making for both administration and public health nurses. Examples of these benefits are given below.

For Public Health Nurses:

1. Planning Caseload: When the average amount of time required to manage each type of referral is known, a PHN will have information that will help her determine what she can fit into her caseload.
2. Comparison: For new nurses who do not have an accurate picture of how much time they should allocate for each type of referral, the study will show the current Nursing Divison standard practice.
3. Time by Type of Activity: Case management consists of a variety of activities. Nurses will find it useful to know how much time is required for each type of activity.

For Nursing Administration:

1. Planning: Knowing the amount of time required for each type of case will allow more accurate predictions in making program-related decisions.
2. Costing Programs: Estimates of the cost of programs will be more accurate if standard times for various activities by case types are known.
3. Performance Appraisal: When the standard time required for the various activities involved in referral management is known, the information can be used as a baseline in evaluating PHNs.
4. Program Evaluation: Monitoring activity in programs is an important element of evaluation. The information obtained in this study will serve as a useful baseline for further study. For example, repeating the collection of the same data in 1988 would provide information concerning the impact of the change to age-specific program groups.

Cost of Referral Study
(Nursing Division)

Using the standard formula, the sample size has been determined for each of ~~5~~ 4 groups.

Referral Type	Number
MCH	404
MCH HR	80
Adult	179
Sr. Adult	179
TOTAL	842

PHN Time
Cost of familiarization with study:
88 PHNs X 15 min. — 22 hrs.
Complete Pge. 2
842 X 5 min. — 70 hrs.
Complete Pge. 1

MCH 404 X 5 min.	34 hrs.	
HRMCH 80 X 20 min.	27 hrs	
Adult 179 X 15 min.	45 hrs.	
Sr.Ad 179 X 20 min.	60 hrs.	
TOTAL		166 hrs.
TOTAL PHN Time		258 hrs.

Clerical Time
842 X 5 min. — 70 hrs.

Cost
PHN:
258 X $19.22 = $4,959.00
Clerical:
70 X $9.00 = $630.00

TOTAL: $5,589.00

M E M O R A N D U M

TO: Nursing Division Staff

FROM: Verna Wilson

DATE: Sept. 14, 1987

SUBJECT: Referral Study

At long last I am ready to begin the main part of the research for my thesis, and again I am asking for your help. Your input to date has been very useful, and the activities you identified have all been incorporated into the data collection instrument.

If I were still in the district, I would be asking 'How will this study help me in my work?' While the idea for the study evolved from the methodology we have been using for staff deployment, I am hopeful that the information gained will also prove to be useful to district PHNs in the following ways:

1. Planning Caseload: Knowing the average amount of time required to manage each type of referral will help in caseload management.
2. Comparison: Current Nursing Divison standards for the amount of time spent in various types of cases will help new nurses by providing them with a basis for comparison.
3. Time by Type of Activity: Case management consists of a variety of activities. It will be useful to know how much time is required for each type of activity.

In anticipation of your co-operation, I would like to thank you for helping me with my research. I hope you will not find that the study adds too much to your already heavy workload. I am convinced that we need the information I am collecting, or I would not persist with this study at this particular time in our Nursing Division history. Please call me if my instructions are unclear, or if you have any questions.

REFERRAL STUDY -- DATA COLLECTION PHASE

INSTRUCTIONS

1. Clerical staff will attach a SERVICE DELIVERY FORM to each incoming referral.
   If the case is assigned to a student, the SERVICE DELIVERY FORM is to be detached from the referral and returned to the central clerical area for reuse.

2. PHN completes Page 2 of the SERVICE DELIVERY FORM (the identifying information can be completed by the District Clerk).

3. As soon as Page 2 is completed the PHN forwards it through the usual channels to the Researcher.

4. District clerks will deposit the completed Page 2's in the box marked 'REFERRAL STUDY' which will remain in the secure central file area.

5. The PHN retains Page 1 of the SERVICE DELIVERY FORM with the Health Record until the case is discharged, or until 3 months have elapsed from the time the referral is received.

6. Each time any activity relating to the client is performed, the PHN records the amount of time spent in the appropriate section of the SERVICE DELIVERY FORM.
   Detailed instructions for completing the form are printed on the back of Page 1 of the form.

7. When the case is discharged, or when 3 months have elapsed from the time the case was assigned, Page 1 of the SERVICE DELIVERY FORM is to be forwarded to the researcher.

8. Provision has been made on the form for 8 significant contacts; if more are made, the PHN carrying the case will request a second SERVICE DELIVERY FORM from the researcher.

9. If the case is transferred from one PHN to another, the case is considered to be a 'new' case by the second PHN. A second SERVICE DELIVERY FORM will be initiated: the referral source in this case is PHN (other than Liaison).

Timetable

1. Starting Date: September 14, 1987.
2. Completion Date: (estimate) Dec. 31, 1987.

N.B. The completion date will depend on how quickly the appropriate number of referrals in each category is obtained.

REFERRAL STUDY ADDITIONAL GUIDELINES 09/23/87 (125)

1. Riverside Project referrals, or any other referrals that do not require a 'significant contact' are not included in the study.
2. Do NOT try to estimate the amount of time you have already spent on a case for which you receive a second referral that will not result in additional work being done.
   Example: Newborn referrals that come after a case has been completed as an Early Obstetrical Discharge case are not included.
3. If a second referral is received that WILL require further involvement on an already-open case, begin counting the time spent from receipt of the second referral.
4. If no form is attached to a new case, please obtain one from the Clerical Division - occasionally some referrals, including Priority Home Cares, have slipped through the net.
5. Page 2. To save PHN time, the District Clerk can complete the identifying information in pencil so that it can be erased and the form re-used if the case is assigned to a student.
6. In the space for "Return Date" (top of Page 1), record the date 3 months from the time you receive the referral - this is the date by which the form is to be returned if the case remains open.
7. For cases where the only significant contact is a telephone contact, mark N/A in the space for "Distance from Central Office".
8. A case that is transferred from one PHN to another should be treated as a new case by the receiving PHN.

a) Regular Transfers due to move of Client - District Clerks will be asked to add a new Service Delivery Form to the record. Complete as for a new case.

b) Transfer due to PHN staffing change (e.g. new PHN, caseload is transferred) - To ensure that the second PHN knows which cases are included in the study, the first PHN is requested to leave Page 1 of the Service Delivery Form on the record. The new PHN will begin a new Service Delivery Form, using her assigned Identifying Code, and submit the original Service Delivery Form (Page 1) to the researcher with the new Page 2.

9. PHN transferring from 1 District to another - Because the Supervisor's Code also is an indicator of the District, it is important that any PHN who transfers from one Team to another uses the Code of the Supervisor of the District in which the client resides.
10. If a Service Delivery form is initiated, and the case is subsequently transferred to a student, forward the Service Delivery Form to the researcher at the time of the transfer.
11. If more than 8 contacts are made, a second Page 1 of the Service Delivery form is to be used - forms which have no numbers on them will be available from Clerical Division. PLEASE add the Client Code on the second Page 1, as it will not be pre-stamped with the number.

THANK YOU

Vienna.

MEMORANDUM

TO: District PHN Staff

FROM: Verna Wilson

DATE: November 4, 1987

SUBJECT: Referral Study

Since mid-September we have been attaching my Data Collection Tool, called the SERVICE DELIVERY FORM, to referrals as they come in. To date, there have been approximately 1150 forms attached to referrals. I need your help, as not all of the Page 2's of these forms have been returned to me. The total returned, counting all page 2's, and the completed forms, comes to between 600 and 700, so there are quite a few that have not made it back to me.

Because I need a specific number of each category of case, the forms will continue to be attached to all but Maternal/Child Health cases until I reach the appropriate number (I have enough MCH cases).

I do appreciate your co-operation in completing this study. I will keep you posted on my progress. I have begun to enter data into a computer database and soon will be able to begin analysis of the incoming data.

Thanks again.

APPENDIX B - LEXICON OF VARIABLES

Dependent Variable	Description	Source
Total Time (Continuous)	Time spent with, or on behalf of, the client for whom service was requested. Measured in minutes (least time, 5 min), the total amount of professional time used in providing PHN service to the client.	Form III - Sum of all time sections, Service Delivery Form, Page 1
Pre-Service Delivery Time (Continuous)	Time spent in activities done prior to client contact.	Form III - Sum of Pre-Service Delivery section of Page 1 of Service Delivery Form
Service Delivery Time (Continuous)	Time spent in activities done during the course of the client contact. Includes time spent on behalf of client.	Form III - Sum of Service Delivery section of Page 1 of Service Delivery Form
Post-Service Delivery Time (Continuous)	Time spent on activities completed after the actual delivery of service but which are directly related to providing service to the client.	Form III - Sum of Post Service Delivery section of Page 1 of Service Delivery Form
Number of Contacts (Continuous)	The total number of contacts with or on behalf of the client during the course of service delivery. Includes 3rd-party contacts.	Form III - Total Number of Client Contacts, Page 1, Service Delivery Form
Average Time per Contact (Continuous)	Derived by dividing total time by number of contacts.	Form III -Service Delivery Form, Pg. 1

Independent Variables	Description	Source
Client Centered		
Reason for Referral (Categorical)	RMOC H.D. Nursing Division Classification of types of referral was used to identify the reason for the referral. The 5-year old classification is consistently applied through the use of standard definitions for client problem categories.	Form III, Page 2 - Centralized Caseload Book Classification section
Age (Continuous)	Measured in years. For Maternal/Child category, the mother's age was requested.	Form III, Page 2 - Master File section
Income (Continuous)	The Canada Census (1986) Average Income by Census Tract was used as an approximate estimate of the socioeconomic status of the study population.	"Profiles" Ottawa-Hull: Part 2, Canada Census 1986
Distance (Continuous)	For those clients visited in their home, the distance from the central office to the client's home was used as an approximate measure of the impact of travel on the amount of time required to deliver the service. Service provided by telephone contact was measured as 0.	Form III - Service Delivery Form: Distance from Central Office question, Page 1
Provider Centered		
Agency (Categorical)	The source of the referral was recorded using categories currently in use in the Nursing Division.	Form III - Service Delivery Form, Page 2: Referral Information section

Supervisor Education (Categorical) and (Continuous)	The educational preparation of the public health nurse's supervisor and the amount of time elapsed since the supervisor's last formal education.	Form II - Nursing Supervisor Profile: Education section
Supervisor Experience (Continuous)	The number of years experience in administration in public health nursing and the total number of years of public health nursing experience.	Form II - Nursing Supervisor Profile: Experience section
Supervisor/Nurse Influence (Continuous)	The amount of time the nurse had worked with her present supervisor was used as an indirect measure of the supervisor's influence on the amount of time spent by the nurse on each client.	Form I - Public Health Nurse Profile: Experience section, Years with Supervisor question
Public Health Nurse Education (Categorical) and (Continuous)	Educational preparation of the nurse providing the service and number of years since completion of her last professional education.	Form I - Public Health Nurse Profile: Education section
Public Health Nurse Experience (Continuous)	The years of experience in public health nursing.	Form I - Public Health Nurse Profile: Experience section, PHN experience question

Public Health Nurse Preference (Categorical)	Nurses responses to the question of whether they preferred to work with a specific age group. If the answer was 'yes', the preferred age group was recorded.	Form I - Public Health Nurse Profile, questions about preference for working with an age group

APPENDIX C - ADDITIONAL KNOWLEDGE SEEKER MODELS

1. Distance and Total PHN Time

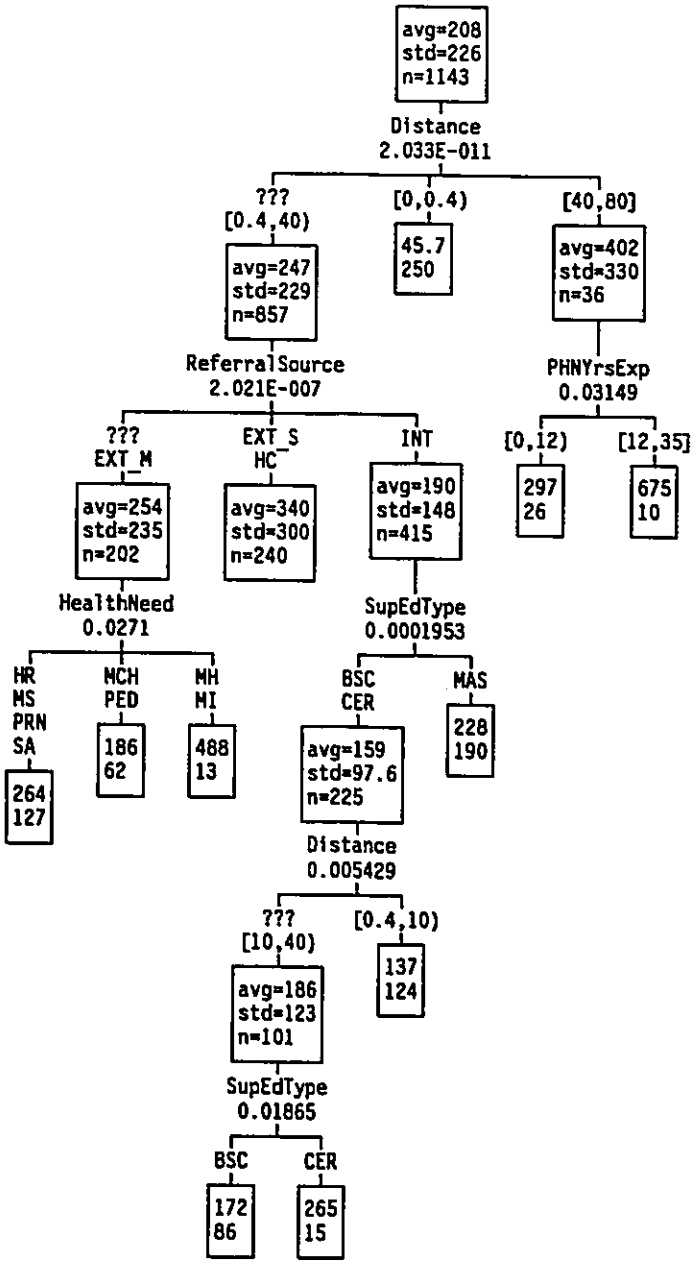
2. Client Age and Total PHN Time

3. Program and Total PHN Time

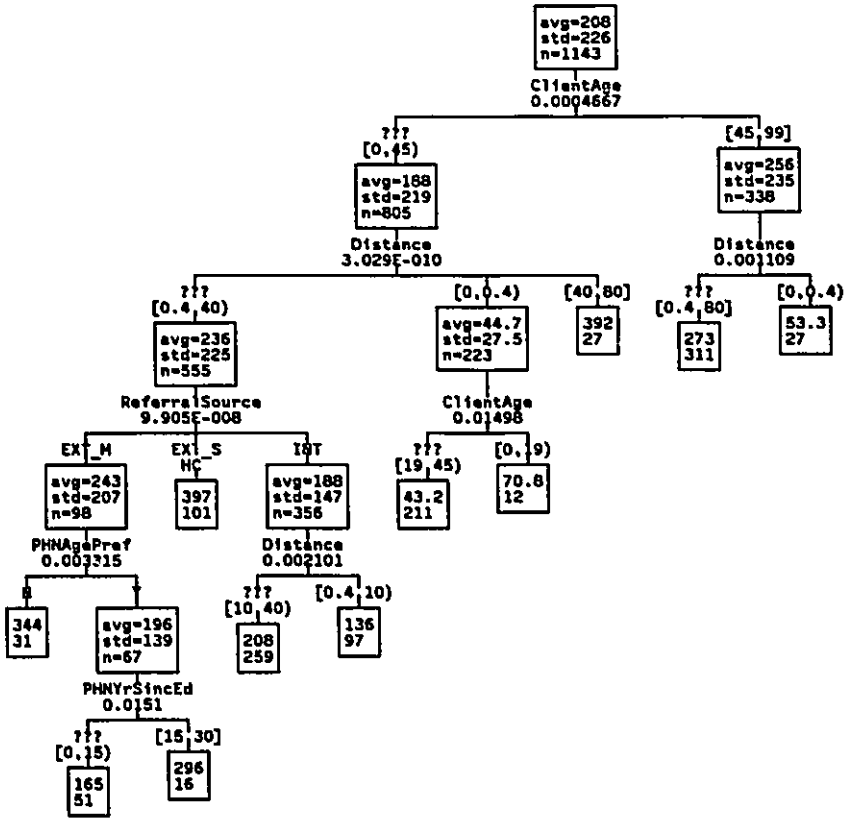
4. District Supervisor's Code and Total PHN Time

5. Supervisor's Education Type and Total PHN Time

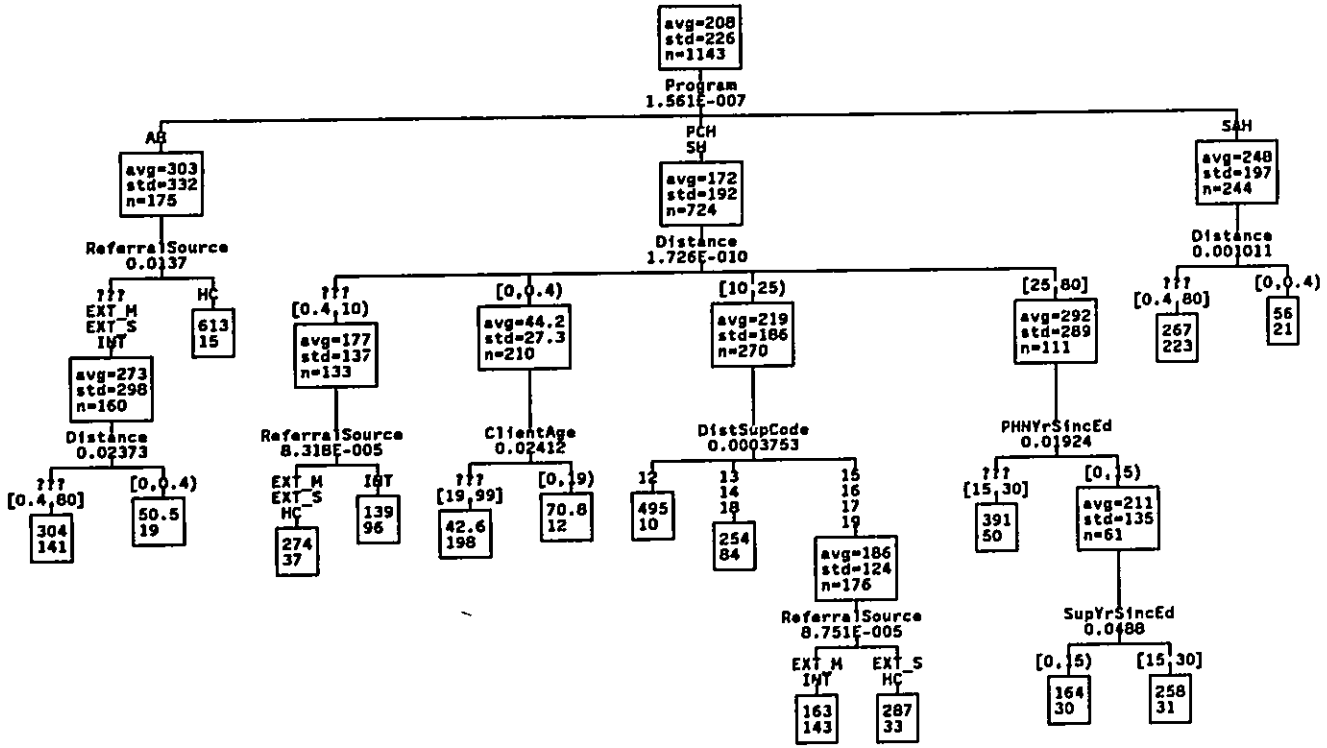
6. Supervisor's PHN Experience and Total PHN Time



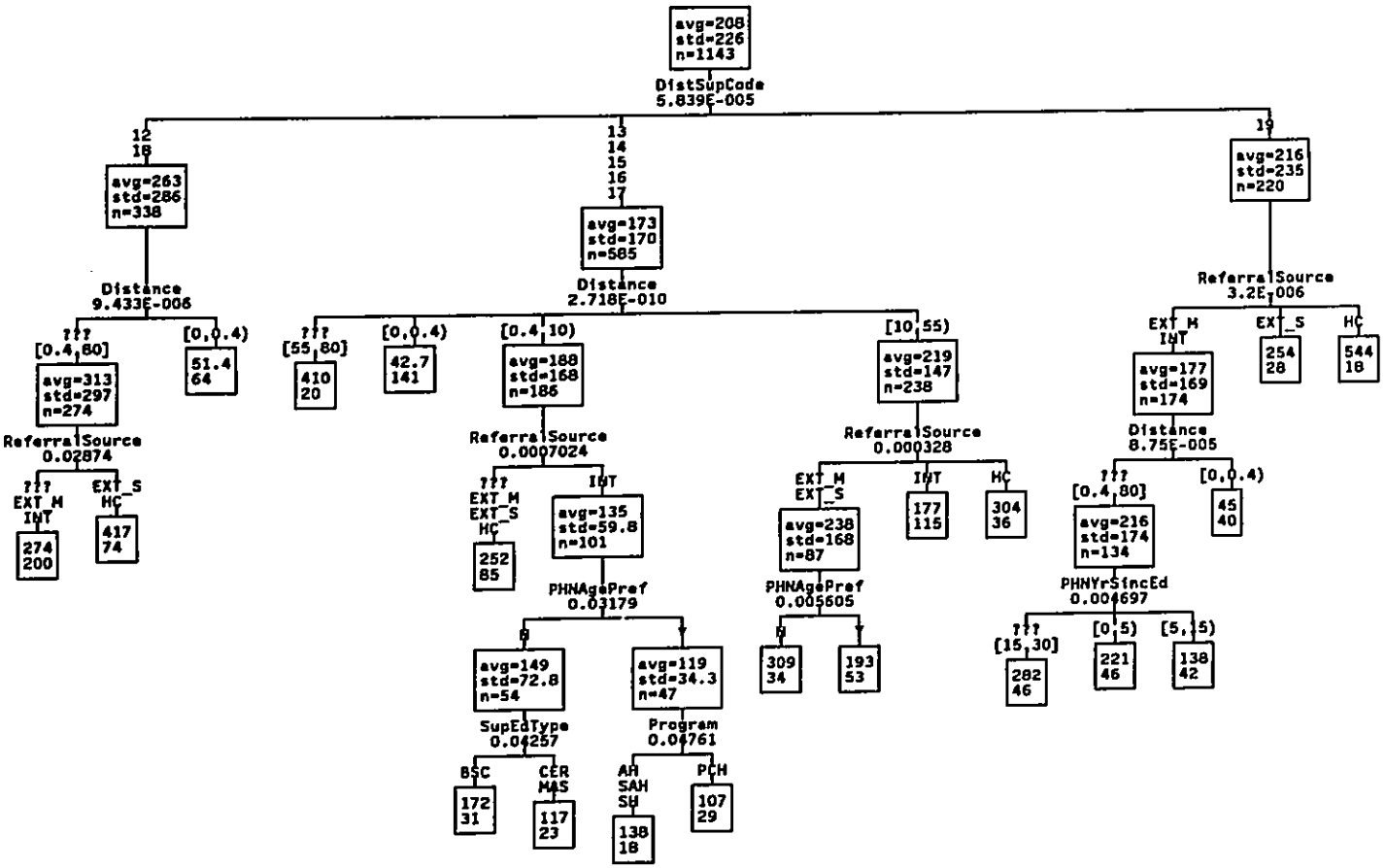
1. Distance and Total PHN Time



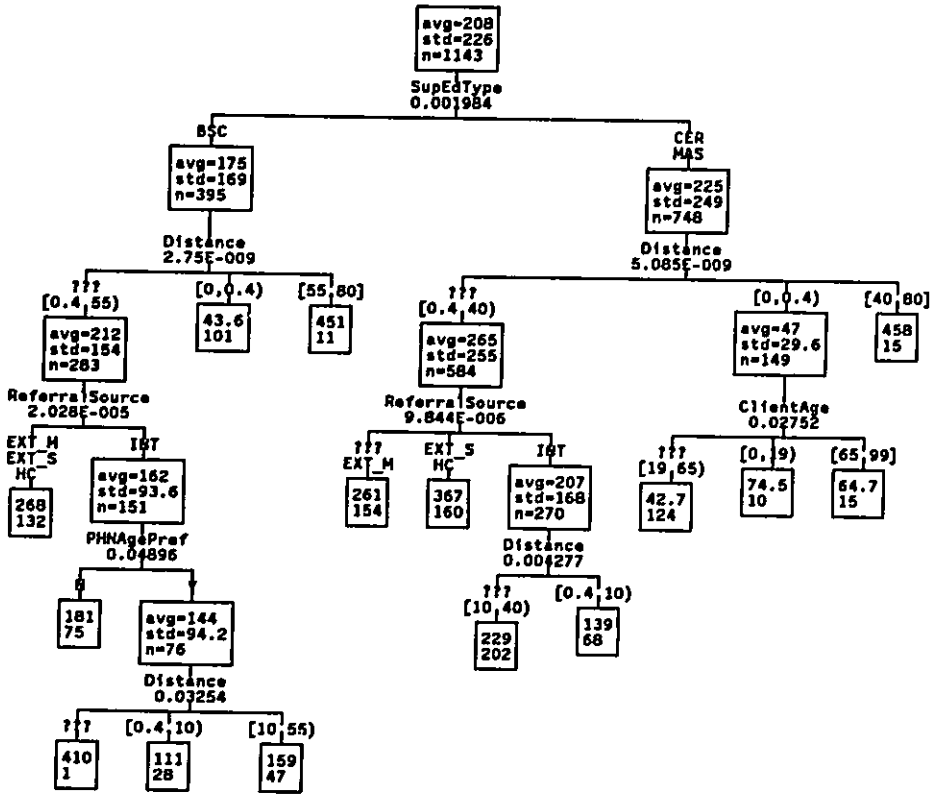
2. Client Age and Total PHN Time



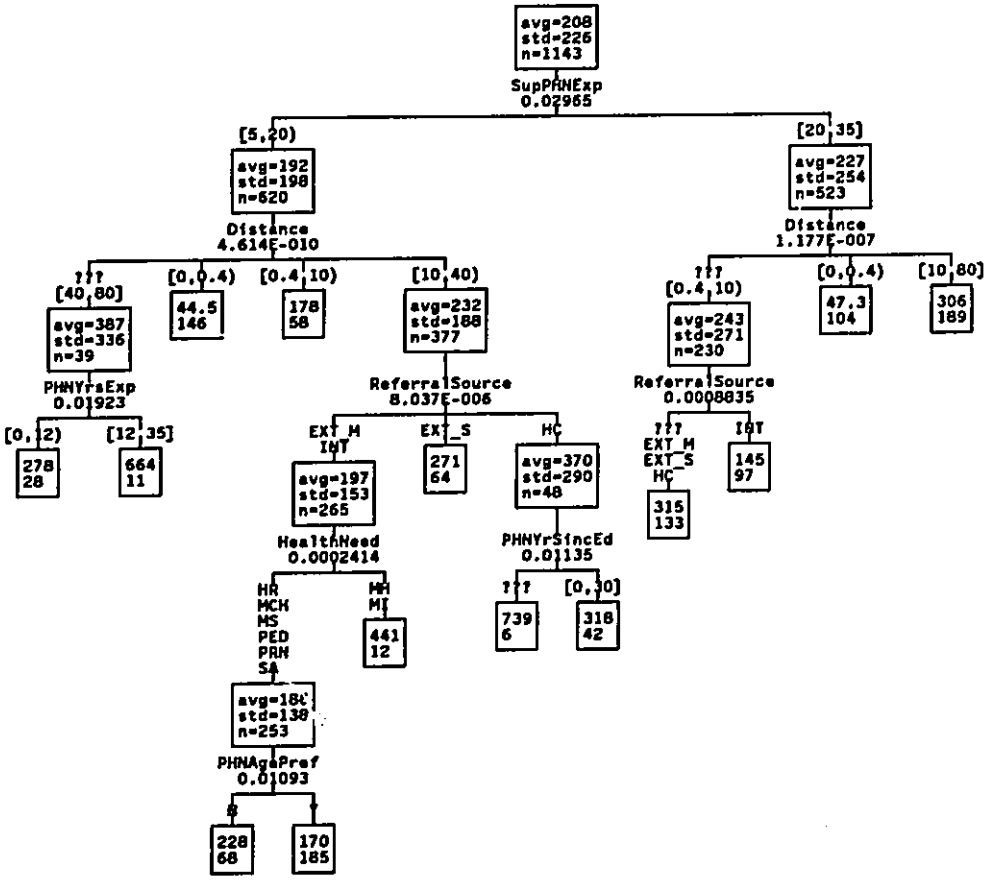
3. Program and Total PHN Time



4. District Supervisor's Code and Total PHN Time



5. Supervisor's Education Type and Total PHN Time



6. Supervisor's PHN Experience and Total PHN Time

APPENDIX D - OTHER IMPORTANT KS SPLITS

1. # Contacts/Total PHN Time Model

2. Health Need/Total PHN Time Model

3. Referral Source/Total PHN Time Model

1. # CONTACTS/TOTAL PHN TIME MODEL

NODE AND VARIABLE	GROUP AND SPLIT	MEAN AND # OF CASES	
No. Contacts [???, 0, 2]			
HEALTH NEED	HR, PED, SA	110	157
(0.000209)	MCH	89.7	404
	MH, MI, MS, PRN	134	86
PROGRAM	AH, SAH,	119	179
(0.009838)	PCH	93.3	468
REFERRAL SOURCE	???, EXT_M, EXT_S,	117	225
(0.001589)	HC	91.7	422
	INT		
CLIENT AGE	[0, 19]	130	39
(0.01435)	???, [19, 45]	95.1	474
	[45, 65]	121	43
	[65, 80]	96.8	58
	[80, 99]	123	33
No. Contacts [???,0,2] Distance [10,80]			
PROGRAM	AH, SH	188	37
(0.0006764)	PCH, SAH	132	229
PHN AGE PREF.	N	161	70
(0.005987)	Y	132	196
PHN YRS. SINCE ED.	???, [0, 5]	156	115
(0.008215)	[5, 30]	126	151
PHN YRS. EXPERIENCE	[0, 7]	143	139
(0.01948)	[7, 20]	118	79
	[20, 35]	164	48
No. Contacts [2, 3]			
PHN YRS. EXPERIENCE	[0, 7]	222	79
(0.003448)	[7, 20]	175	101
	[20, 35]	250	28
SUP EDUCATION TYPE	BSC, CER	183	100
(0.02613)	MAS	221	108

PHN YRS. SINCE ED. (0.04003)	???	261	20
	[0, 30]	197	188
No. Contacts [2, 3] Distance ???, [0.4, 25]			
DISTRICT SUP CODE (0.02538)	12, 17, 18	224	56
	13, 14, 16, 19	183	83
	15	101	6
PHN EDUCATION TYPE (0.04266)	BSC	187	116
	CER, MAS	230	29
No. Contacts [2, 3] Distance ???, [0.4, 25] PHN Yrs Exp [7, 10]	BSC	160	57
	CER, MAS	208	17
PHN ED TYPE (0.02638)			
No. Contacts [3, 4]			
REFERRAL SOURCE (0.003579)	EXT_M, INT	269	78
	EXT_S, HC	361	45
SUP EDUCATION TYPE (0.006954)	BSC, CER	271	73
	MAS	348	50
DISTRICT SUP CODE (0.008999)	12, 14, 16, 18	303	75
	13, 15	206	21
	17, 19	376	27
PHN YRS EXPERIENCE (0.01105)	[0, 2]	354	27
	[2, 12]	261	66
	[12, 35]	346	30
No. Contacts [3, 4] Distance [0.4, 10]			
SUP YRS SINCE ED (0.01914)	[0, 15]	92.5	2
	[15, 30]	274	25
REFERRAL SOURCE (0.02152)	EXT_M, EXT_S, HC	283	25
	INT	190	11

SUP PHN EXPERIENCE	[5, 20]	189	9
(0.02705)	[20, 35]	276	27
No. Contacts [4, 7]			
PHN YRS SINCE	???	671	10
EDUCATION	[0, 5]	489	30
(0.001214)	[5, 15]	385	39
	[15, 30]	463	42
PHN YRS EXPERIENCE	[0, 7]	486	55
(0.0149)	[7, 20]	385	46
	[20, 35]	568	20
No. Contacts [4, 7] **Distance [0, 55]**			
PHN YRS. EXPERIENCE	[0, 7]	471	51
(0.045)	[7, 20]	371	45
	[20, 35]	533	19

2. HEALTH NEED/TOTAL PHN TIME MODEL

NODE AND VARIABLE	GROUP AND SPLIT	MEAN AND # OF CASES	
HR,MH,MS,PRN,SA			
Distance [0.4,40]			
DIST. SUP. CODE	12,18,19	333	211
(0.03666)	13,14,15,16,17	227	221
HR,MH,MS,PRN,SA			
Distance [0.4,40]			
Referral Source			
???,INT			
SUP. ED. TYPE	BSC, CERT	170	71
(0.01998)	MAS	257	50
DISTANCE	[0.4,10]	156	49
(0.02961)	[10,40]	240	72
MCH,PED			
Distance [0,0.4]			
CLIENT AGE	[0,19]	74.5	10
(0.02052)	[???,19,99]	42.8	190
MCH,PED			
Distance [10,25]			
Ref. Source			
[EXT_M,INT]			
SUP ADM EXPER.	[0.10]	163	128
(0.01873)	[10,20]	227	60
PHN ED TYPE	BSC	165	136
(0.02056)	CERT,MAS	231	52

3. REFERRAL SOURCE/TOTAL TIME MODEL

NODE AND VARIABLE	GROUP AND SPLIT	MEAN AND # OF CASES	
Home Care			
PROGRAM	[AH,PCH]	516	49
(0.00979)	[SAH, SH]	292	84
CLIENT AGE	[0,65]	290	85
(0.01057)	[???,65,99]	524	48
Internal			
SUP ED TYPE	[BSC,CER]	127	350
(0.000365)	[MAS]	181	269
DIST SUP CODE	[12,17,18,19]	181	309
(0.00173)	[13,14,15,16]	120	310
HEALTH NEED	[MCH,PRN]	136	480
(0.00766)	[HR,MH,MI,MS,PED,SA]	202	139
PROGRAM	[AH,SAH,SH]	198	88
(0.02798)	[MCH]	143	531
PHN YRS WITH SUP	[0,2]	169	309
(0.03962)	[2,17]	133	310
Internal			
Distance			
[???,10,55]			
EST. INCOME	[15000,41000]	253	95
(0.04041)	[41000,95000]	194	203
Internal			
Distance			
[???,10,55]			
SUP PHN EXP			
[5,20]			
PHN YRS SINCE ED	[???,15,30]	231	80
(0.04845)	[0,15]	170	130

???,EXT_M,EXT_S

HEALTH NEED (0.0003774)	[HR,MH,MS,PRN,SA]	261	255
	[MCH,PED]	162	115
	[MI]	462	21

???,EXT_M,EXT_S
Distance [0,0.4]

HEALTH NEED (0.03826)	[HR,MCH]	33.7	27
	[MH,MI,MS,PED,PRN, SA]	58.7	34

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