Factors Affecting Utilization of Hospital Emergency Services

by

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First Reader _____

Second Reader _____

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I. Background and Problem

The provision of emergency services by hospitals has become a traditional component of the American health care system. Over the years, however, the role of the emergency department and the utilization of its services by the consumer has changed dramatically in response to the dynamics that affect the health care system as a whole.

The role of the emergency department can be defined in the following mission statement: "The primary mission of the emergency department is to provide responsive, high-quality emergency and nonurgent care in an effective, helpful and courteous manner that is consistent with the hospital's identity and humanitarian aims of the institution" (Cross 36). This statement sets the framework for the purpose of the emergency department and its strategic position within the hospital. It also identifies two types of care (emergency and nonurgent) which are to be provided.

This approach to defining the provision of emergency care can be partially attributed to the public's perception of what constitutes an

"emergency". The U.S. Department of Health, Education and Welfare has defined emergency services as "service(s) utilized in responding to a perceived individual's need for immediate care" (Cadigan and Bugarin 618). Thus, the decision as to whether a condition is emergency or nonurgent is left to the individual to decide. This discretion, however essential, can lead to an increased utilization of emergency departments for nonurgent conditions when the individual decides to seek treatment in an emergency department rather than delaying treatment by waiting for appointments at physician offices or clinics.

The following statistics document the increase in utilization of emergency departments. From 1954 to 1972, there was a four-fold increase in the per capita use of emergency departments in the U.S. (Lagoe and Jastremski 23). In 1988, over 86.6 million emergency department visits were reported (Koska 57) and the American Hospital Association estimated that the number of visits to the nation's 5,700 emergency departments would reach 90 million in 1989 (Olson 1). In southeastern Michigan, the number of emergency department visits has continued to increase slightly while the number of ambulance calls has

increased from 7 to 18 percent (Walther 5). These numbers, however, do not tell the whole story regarding the impact of the emergency department on the individual hospital.

Nationally, the number of inpatient admissions originating from the emergency department has increased by one-third over the past ten years resulting in 40 percent of all unscheduled hospital admissions (Weiner 2). It is estimated that the typical emergency department accounts for 3 to 5 percent of total hospital revenues and indirectly generates an additional 25 to 35 percent of hospital revenue through inpatient days, ancillary procedures, supplies, ambulatory care and follow-ups. In addition, the emergency department typically generates 20 to 30 percent of the hospital's laboratory and radiology revenues and 60 to 70 percent of intensive care admissions (Ranseen 72). Thus, the impact that the emergency department has on the financial status of the hospital are substantial and are usually considered by hospital administrators as an important revenue source.

The factors accounting for this increased use of emergency departments include both conditions that are external as well as internal to the

hospital. The external factors, while outside the control of the hospital, reflect health and social trends of our society. They include drug and/or alcohol abuse and related accidents and violence, an increase in the number of patients afflicted with AIDS and related complications, the disproportionate increase in the use of emergency departments as sources of primary care by the indigent, uninsured, and welfare recipients and the increased demands for emergency care by an increasing elderly population (Lagoe and Jastremski 23).

External Factors

Drug and alcohol abuse and related medical and traumatic conditions have led to a dramatic increase in the number of emergency department visits. The Drug Abuse Warning System (DAWN) reported a 500 percent increase in medical emergencies related to cocaine abuse and a 2,800 percent increase in medical emergencies related to crack nationwide from 1984 to 1988. In some cities like Detroit, the increase was even higher with 740 percent more cocaine emergencies and 4,900 percent more cases involving the use of crack (Walthers 6). The number of emergency cases

involving alcohol and other drugs has shown a similar, although less dramatic, increase.

The increasing number of AIDS patients has also led to an increased utilization of emergency services. While not a uniform increase nationwide, some areas of the country are experiencing epidemic numbers of emergency cases involving AIDS patients with the majority of that HIV-positive population due to intravenous drug abuse. The physical, social and financial constraints of this population predisposes them to repeat visits to the emergency department (Nordberg 35).

The availability of 24 hour service makes the emergency department a potential source of abuse by consumers. One of the reasons is that emergency departments accept all patients regardless of ability to pay and do not demand payment before treatment as is common practice at private physician's offices or clinics (Ranseen 70). As part of the Consolidated Omnibus Budget Reconciliation Act of 1985 (COBRA), legislation was adopted which prohibits the transfer of unstable emergency patients for economic reasons (known as "dumping") and, essentially, requires an appropriate medical screening examination for all

patients presenting for emergency treatment (Enfield and Sklar 579).

Due to the COBRA requirements, hospitals are obligated to evaluate all emergency patients regardless of their ability to pay. This has led to an increase in the use of the emergency department as a primary source of medical care by the uninsured and indigent who can be assured of treatment at no initial cost as opposed to care at a physician's office where payment may be required in advance. This shifting of the location of primary care occurs even though the cost of utilizing the emergency department for nonurgent care is far more expensive than the physician's office. The difference in expenses can be explained by the fact that hospitals provide more specialized and expensive services and are much more labor-intensive (with 24-hour coverage) than are physicians' offices. Studies have also shown that those receiving welfare benefits which covered all of the recipient's health care costs utilize the emergency department for nonurgent conditions almost twice as often as any other payment group (Dickhudt, et al 573).

Finally, the increase in the elderly population has resulted in an increase in the utilization of

emergency services by that group. There were 8.7 million visits (280 visits per 1,000 enrollees) to emergency departments by Medicare beneficiaries in 1987 which was a 36 percent rate increase from 1983 (206 visits per 1,000 enrollees) (Helbing, et al 149).

Internal Factors

Internal factors affecting utilization of emergency departments are those for which the hospital has more control. Studies have shown that patients' attitudes toward the hospital, in general, and the care they receive in the emergency department, in particular, were the major factors that affected use of a particular emergency department (Snell, et al 355). The three most important factors influencing patients' attitudes toward emergency departments are perceived quality of physicians, closeness to home, and waiting time (Costello 10).

The primary concern of patients in emergency departments is the quality of the physician treating them. In this era of medical specialization, it is interesting to note the relatively recent advent of the emergency

physician. Traditionally, the physician working in the emergency department was in private practice full-time and worked in the emergency department to fulfill medical staff obligations or as a part-time job (Iserson 435). In 1961, four physicians in Alexandria, Virginia formed the first full-time emergency physicians' group. The American College of Emergency Physicians (ACEP) was formed in Lansing, Michigan in 1968 with the first emergency physician residency program beginning in 1971. ACEP's membership increased to nearly 10,000 by 1978 making it the 13th largest medical specialty society at that time (Hochbaum 10). Today, there are 75 emergency medicine residency programs in the U.S. with approximately 500 graduates annually. There are also 15 fellowship (post-residency) programs available in areas such as basic research, emergency medical services, aeromedicine, toxicology, critical care, and administration (Allison 772). Since 1980, there have been 6,615 diplomates of the American Board of Emergency Medicine with 37 percent of these (2,474) completing an emergency medicine residency program (Clinton 677). Studies have shown that 36 percent of all physicians working in emergency departments are now board certified in

emergency medicine with 88 percent of them U.S. medical school graduates as compared with 78 percent for all other medical specialties (Salluzzo 3).

Although specialization is not required for physicians working in the emergency department, institutions often follow the recommendations of ACEP for approving clinical privileges for physicians. The document, "Guidelines for Delineation of Clinical Privileges in Emergency Medicine," defines a qualified emergency physician and establishes a national standard of care (American College of Emergency Physicians 1218).

Emergency physician residency training programs have traditionally instilled in their graduates a responsibility to act as the patient's advocate and to "learn the importance of competence, compassion, communication, and conscience in serving the needs of emergency patients" while providing "exemplary emergency care" (Allison 772-773). Patient's perceptions of their quality of care and the quality of communication with their physician are a reflection of how successfully physicians achieve these goals. If the patient doesn't like the physician's attitude and believes that high quality care is not being

provided, the end result is often a lawsuit (Whitman 17). Because of the medical-legal risks that emergency physicians face with each patient, emergency physician residency training programs emphasize the need for the physician to be versatile, knowledgeable, skilled, and diplomatic in an attempt to overcome these problems before they develop (Clinton 679). While a one-year study of emergency department complaints at William Beaumont Hospital in Royal Oak, Michigan, a 927-bed teaching hospital, has shown that physician attitudes and communication skills are major causes of patient complaints (Schwartz and Overton 859), no published studies address the issue of patient satisfaction specifically with emergency physician specialists.

Since patients identify perception of the quality of physician as their primary concern (Costello 10), many hospital administrators have changed the physician staffing of emergency departments to that of emergency physician specialists. Whether this is done by hiring the individual physicians or by contracting with a physician group practice, the end result, hopefully, is an increase in the quality of care provided by the physician with an increased level

of satisfaction on the part of the patient. If the patient is pleased with the quality of care provided by the physician, he/she will likely return to that facility for future care.

Proximity to home was the second highest rated factor by patients. Emergency departments usually draw the majority of their patients from a radius up to 10 miles (Ranseen 70). By understanding the hospital's potential patient population and those patients' health care needs, hospital administrators can target those needs and develop special programs to increase utilization of emergency services. The development of "fast-track" programs for the prompt treatment of minor emergencies, pediatric clinics, special services for the elderly, and satellite after-hours clinics located in areas surrounding the hospital are all examples of innovative programs aimed at increasing emergency department utilization.

The amount of time spent waiting for emergency care was the third rated factor by patients. Studies have shown an inverse relationship between total wait time and the level of patient acuity (sicker patients are seen more quickly) (Abramowitz 449). Although the focus of the

emergency department is the treatment of critically ill or injured patients, the majority of patients seek treatment for nonurgent or primary care (Abramowitz 449). One challenge for emergency departments, then, is to treat the majority of their patients in a timely manner while still providing high quality care. Many hospitals have implemented changes in their emergency departments that have addressed this problem of waiting for treatment ("'No Waiting' Sells ER" 66). The development of new services has included the use of patient advocates who try to expedite treatment and maintain patient satisfaction (Reynolds 76), the implementation of streamlined admission processes, and the use of clinic-type settings for nonurgent conditions with a sliding scale fee structure ("Breathing New Life Into the ER" 39).

There are additional internal factors, such as innovative programs, which can possibly result in an increase in emergency department utilization. The commonality of these programs is that they enhance coordination and referral of emergency department patients. These programs include physician liaison programs, hospital-based telephone referral programs, and pre-hospital

Emergency Medical Services (EMS) training programs.

A relatively new program for increasing emergency department utilization rates for hospitals has been the implementation of physician liaison programs. The first physician liaison program was started by Humana, Inc. in Louisville, Kentucky in 1977 (D'Elia 4). Physician liaisons function in much the same capacity as drug company representatives in that they detail their product to the physician. In a physician detailing program, the physician liaison calls on the physician in his office to try to gain an increased share of each physician's hospital business. The physician liaisons identify and communicate physician and patient needs and relate those needs to the services that the hospital offers (Kinstler and Pol 139). The benefits of such a program are an increased number of admissions as well as increased physician satisfaction and improved physician-hospital relations. A carryover of this increased utilization of hospital services by the physician will be an increased utilization of the emergency department by the physician's patients since physicians will most often refer their patients to

the emergency departments of hospitals that they utilize most for other services (D'Elia 4).

Hospital-based telephone referral systems are another recent phenomena in health care. Emergency department nurses and physicians traditionally have given telephone advice to patients but the quality and consistency of such advice has varied (Verdile, et al 279). Along with this are the medicolegal ramifications that need to be considered. It has been found that the accuracy of telephone medical advice given by emergency department personnel is variable and may be harmful to the recipient of the advice (Verdile, et al 280). This is due to the sporadic and impersonal nature of the calls, the inability to judge the family's capability to provide information about the patient, and the unavailability of the patient's medical records. Once an emergency department staff member offers advice over the telephone, that staff member has assumed a duty and, thereafter, has a legal obligation to the caller and is responsible for any advice given. The staff member could even be considered to have abandoned the patient if the staff member stops giving appropriate advice and terminates the call (Verdile, et al 281). Because

of these potential problems, hospital-based telephone referral systems were developed which standardized the information given to callers to minimize the inherent medical-legal risks. Many hospitals have identified consumer-generated telephone inquiries as a way not only to answer health-related questions but to refer patients to other hospital services as necessary. This referral, then, benefits the patient and the hospital.

The development and implementation of pre-hospital Emergency Medical Services (EMS) training programs has also been identified as a way to increase utilization of emergency departments. The pre-hospital EMS system, which consists of a network of basic and advanced life support ambulances (most often situated in private or volunteer organizations or governmental services outside the hospital) and the Emergency Medical Technicians and Paramedics who staff those ambulances and provide patient care, provides a significant source of patients to the emergency department. Getting the members of that system involved with programs provided by the hospital helps develop a sense of teamwork and a pro-EMS attitude. The provision of Basic and Advanced

Emergency Medical Technician training programs, on-going education classes and Advanced Cardiac Life Support (ACLS) programs help to develop an allegiance with the pre-hospital EMS community (Ramsey 14).

All of the above mentioned factors, both external and internal, have been identified as potentially increasing utilization of emergency department services. While hospitals have little or no control over the external factors, they have substantial control over the internal factors. Thus, the selection of internal factors that will best suit the needs of an individual hospital is vitally important to the success of the programs/factors selected as well as to the increased utilization of hospital emergency services.

The focus of this project is an assessment of the impact of internal factors on the utilization of emergency services at McLaren Regional Medical Center in Flint, Michigan. Several of the internal factors mentioned previously (emergency physician specialists, pre-hospital EMS training programs, and a telephone referral program) have been implemented at McLaren within the past five years. To date, no evaluation has been completed

to determine the association, if any, between these new services and the utilization of the emergency department at McLaren.

II. Hypothesis and Research Design

Based upon a review of the literature, many factors can affect utilization of hospital emergency departments. Three of the internal factors already discussed (emergency physician specialists, pre-hospital EMS training programs, and a telephone referral program) have been implemented at a large regional medical center in Flint, Michigan. The null hypothesis of this project is that none of these identified internal factors have had a statistically significant effect on increased utilization of emergency services at McLaren Regional Medical Center. Because each of these programs has been implemented at different times, a variation of the interrupted time series design will be used to assess the importance of each of these on the dependent variable following their introduction.

Dependent Variable

The dependent variable (emergency department utilization) is operationalized as the number of patients admitted into McLaren Regional Medical Center's emergency department for treatment. Data

regarding the total number of emergency department patients are examined retrospectively on a monthly basis from January 1, 1982 to June 30, 1991. This primary data is obtained from the Emergency Department at McLaren Regional Medical Center.

Independent Variables

The first independent variable is the pre-hospital EMS training program which was implemented in September of 1987. McLaren has had approximately 150 graduates from its Basic EMT and Paramedic programs since 1987. Two other Flint hospitals, Flint Osteopathic Hospital and Hurley Medical Center, also have Basic EMT and Paramedic training programs (Hurley's Basic EMT program is sponsored by Mott Adult High School and held at Hurley) (see map on page 22). There are other Basic EMT training programs conducted throughout Genesee County at local volunteer ambulance services. The total number of graduates from these programs since September of 1987 is currently unavailable.

The influence that pre-hospital EMS care providers (Basic Emergency Medical Technicians and Paramedics) have over the patients' decision for

hospital destination varies. Patients generally have the right to be transported to the hospital of their choice. This right, however, is not absolute and is affected by the patient's condition and the availability of hospital beds (either beds in general or beds in a specific specialty area). If a hospital that is requested by the patient is unable to accept that patient due to a lack of beds or does not provide services in a specialty area that the patient requires (such as a burn unit or psychiatric unit), the EMT and/or Paramedic can decide the best alternative choice for hospital treatment. If an EMT/Paramedic is familiar or comfortable with a particular facility because they trained there, the impact that a pre-hospital EMS training program can have on those decisions may be reflected in an increased number of patients being brought by ambulance to the Emergency Department. This situation, however, is most likely to vary when the EMT/Paramedic has some discretion over the hospital destination.

A breakdown of the numbers of EMT/Paramedic graduates from McLaren and the other area programs, although desirable, is unknown. If records were available which indicated where each

EMT/Paramedic was trained who brought a patient into McLaren's emergency department by ambulance, a direct association between ambulance patients and the EMS training program could be investigated. Due to the limitations of the existing data, the effects of the EMS training program on emergency department utilization will be measured by assessing changes in the monthly number of emergency department patients following implementation of the EMS training program.

The second independent variable that will be examined is the staffing of the Emergency Department with emergency physician specialists which was implemented in August, 1988. As noted previously, there were no studies found that addressed the specific issue of patient satisfaction with emergency physician specialists although the quality of the physician treatment received was reported by Costello (Costello 10) to be the primary concern of patients in emergency departments. It is assumed that emergency physician specialists will increase patient satisfaction since quality of care is likely increased by the use of physicians specifically trained in emergency care. If patients are pleased with the quality of physician care

received, they may be more likely to return in the future for additional care and may report to others their positive experiences relating to the quality of physician care. This may be reflected in increased numbers of patients being treated in the emergency department. The effects of the emergency physician specialists on emergency department utilization will be measured by looking at changes in the monthly number of emergency department patients following implementation of the emergency physician specialists.

The final independent variable (the telephone referral program) will be defined as the number of calls received monthly by Ask-A-Nurse. The McLaren Ask-A-Nurse program, which was implemented in April of 1990, has maintained records of all calls received as well as records of the number of Ask-A-Nurse calls that were referred to any Emergency Department and the number of those referrals that were treated in McLaren's Emergency Department. Ask-A-Nurse personnel do telephone follow-up calls the following day to those patients who were advised to go to any Emergency Department to determine how many came to McLaren for treatment. This number, however, does not account for those callers who were not referred by

Ask-A-Nurse to an Emergency Department but who decided to go there for treatment instead of waiting for treatment in clinics or physician's offices. Because of this, the total number of Ask-A-Nurse calls was felt to be a more accurate measure of activity and was used to operationalize the independent variable instead of the number of Ask-A-Nurse referrals to the Emergency Department. The data relating to the Ask-A-Nurse program is examined retrospectively on a monthly basis from April 1, 1990 to June 30, 1991.

Secondary Analysis

Secondary data regarding emergency department utilization of other area hospitals was obtained from the Greater Flint Area Hospital Assembly (GFAHA). The GFAHA is a regional office of the Michigan Hospital Association (MHA) and provides coordination of MHA services for hospitals in Genesee, Lapeer, and Shiawassee Counties. This data will be used to compare the utilization of emergency services at McLaren with the utilization of emergency services at St. Joseph Hospital, an area hospital of similar size which does not

possess any of the independent variables being examined in this study.

A null hypothesis that the means of McLaren's and St. Joseph's emergency department visits will be equal will be measured using two-tailed t-tests. An alpha level greater than .05 will be criteria for rejection of the null hypothesis.

Analysis

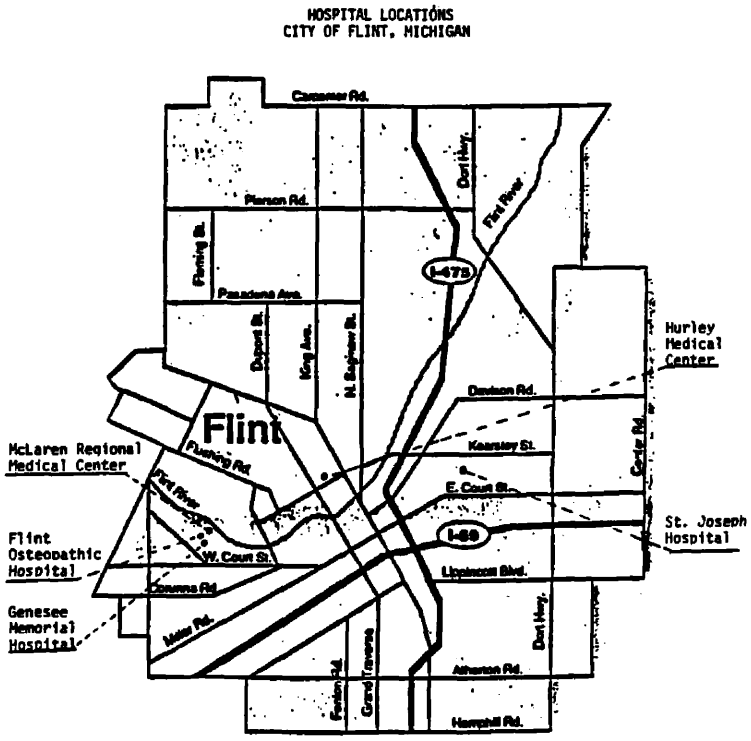
A variation of the interrupted time series design will be followed utilizing t-tests to determine statistical significance based on changes in the dependent variable following the introduction of the independent variables. The null hypothesis will be rejected if the obtained value of t exceeds the value of t at the .05 level (see the Technical Note on page 51 for the formula of the t-test used in this study's analyses).

Bivariate regression will be performed on the independent variable that can be quantified (Ask-A-Nurse calls) and the dependent variable (Emergency Department patients) to determine their relationship. An alpha level less than or equal to .05 will be criteria for rejection of the null hypothesis.

If the null hypothesis is rejected and some or all of the identified internal factors are found to have had a statistically significant effect on increased utilization of emergency services at McLaren Regional Medical Center, the results of this study could have policy implications for those responsible for finding ways to increase the utilization of hospital emergency services. Factors that increased the use of the emergency department in a community hospital will have been identified and the implementation of those independent variables could be considered for use by other facilities.

III. Presentation of Data

The monthly totals of patients admitted to the Emergency Departments of McLaren Regional Medical Center and St. Joseph Hospital in Flint were collected from January 1, 1982 to June 30,1991 to compare the utilization of emergency services at one hospital with all three independent variables (McLaren) with another hospital of comparable size with none of these independent variables (St. Joseph). McLaren Regional Medical Center is a 436-bed acute care facility while St. Joseph Hospital is a 423-bed acute care facility (see the map below for Flint hospital locations).

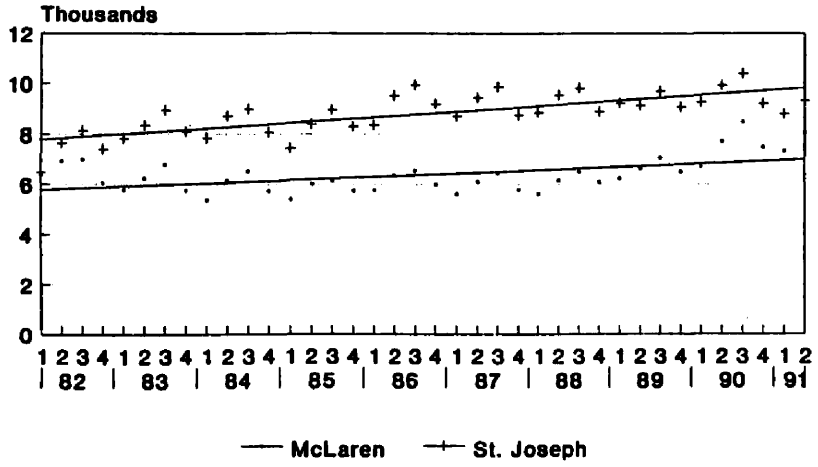


The total numbers of patients admitted to both hospital's emergency departments are summarized in Table A. Table A depicts the data by quarters rather than monthly because of the large number of data points. Fitted trend lines are used in Table A and all subsequent graphic tables.

As Table A indicates, St. Joseph Hospital has greater emergency department utilization at every data point. The reasons for St. Joseph's consistently greater number of emergency department patients are uncertain. Location, marketing, and other internal and external factors could be hypothesized as the reasons but the exact causes are not known and are beyond the scope of this paper.

Table A

Emergency Department Visits
(By Quarter)



Time Periods 1, 2, 3, and 4 with Trend Line

The focus of this paper is, instead, how the implementation of various internal factors by McLaren (the three independent variables being examined) can reverse the trend of emergency department visits to approach the utilization rates of a hospital that has traditionally had higher utilization.

As can be seen, the first quarter of 1982 shows the difference between the two hospitals as less than 100 patients. From that time on, however, the trend of St. Joseph's emergency department utilization increases more steeply than does McLaren's with the quarterly difference growing to more than 3,000 patients at one point. Seasonal variations appear to be the same for both hospitals with increased numbers of emergency department patients in the second and third quarters of each year and decreased numbers in the first and fourth quarters of each year.

Looking at these totals for various time periods illustrates different trends than are seen for the overall period. These time periods reflect the implementation of the independent variables as follows:

1.) January 1, 1982 to December 31, 1987

(before any of the independent variables at

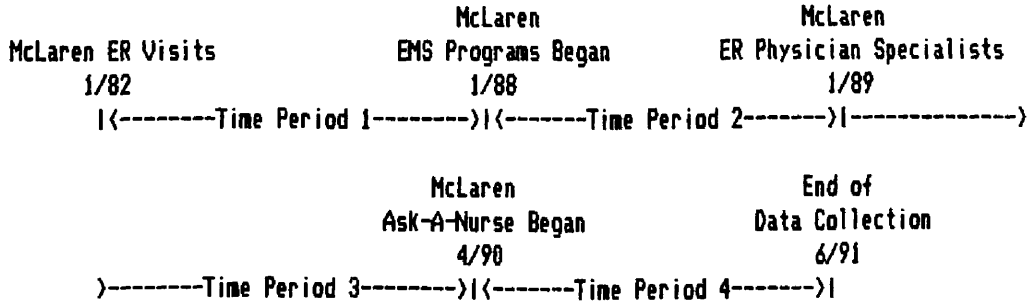
McLaren are implemented)

2.) January 1, 1988 to December 31, 1988 (following the implementation of the pre-hospital EMS training program in September of 1987 and allowing for a three month lag period before any effects are expected)

3.) January 1, 1989 to March 31, 1990 (following the implementation of the staffing of the Emergency Department by emergency physician specialists in August of 1988 and allowing for a four month lag period before effects are expected)

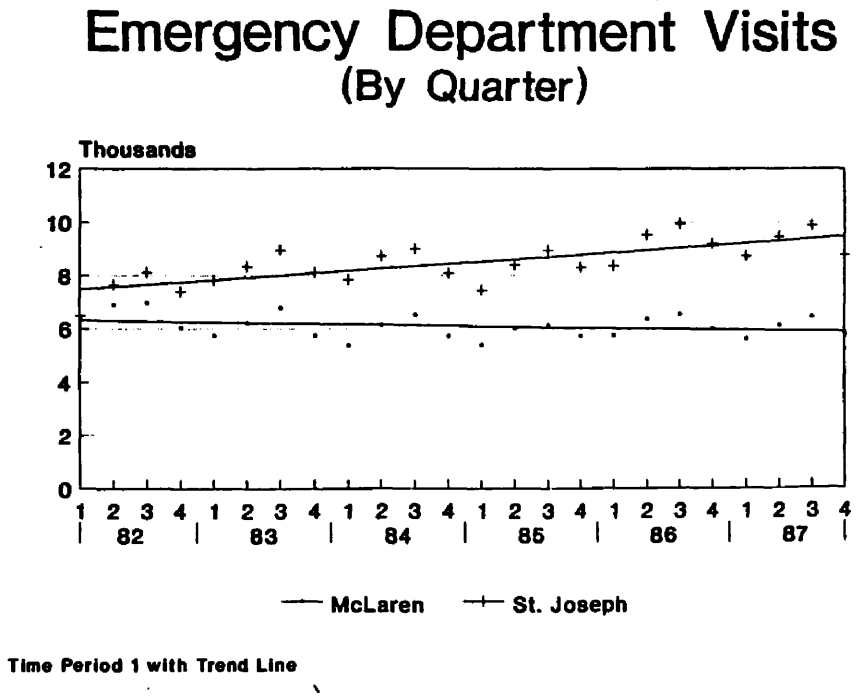
4.) April 1, 1990 to June 30, 1991 (following the implementation of the Ask-A-Nurse program in April of 1990).

A graphic representation of the implementation of these variables over these time periods is presented below.



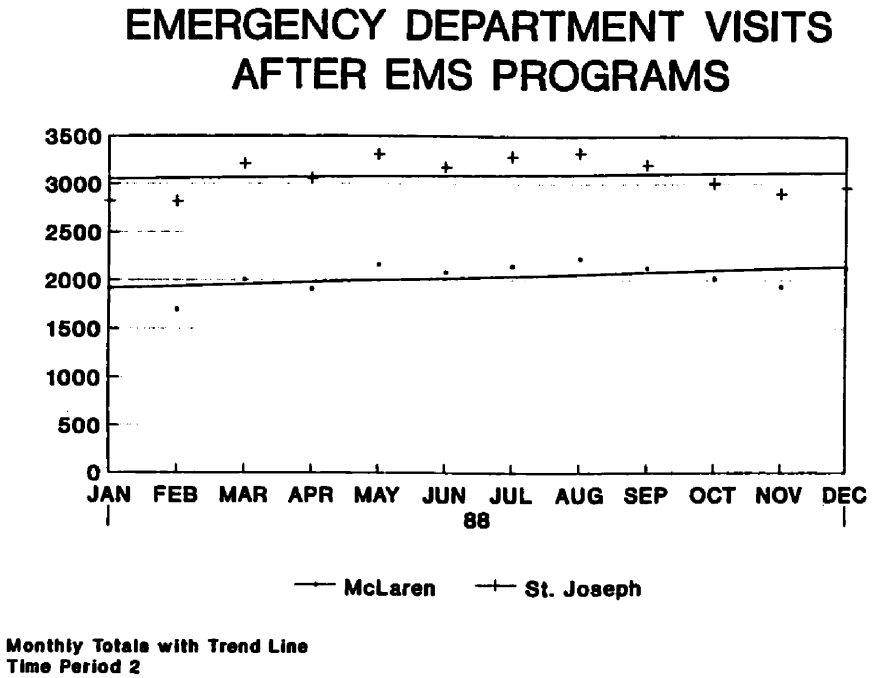
Using these four time periods as reference points changes the slope of the trend lines for both McLaren and St. Joseph. During the 72 observations of the first time period (before the independent variables are implemented), the overall slope of the trend line for St. Joseph rises while McLaren's shows a decline (Table B).

Table B



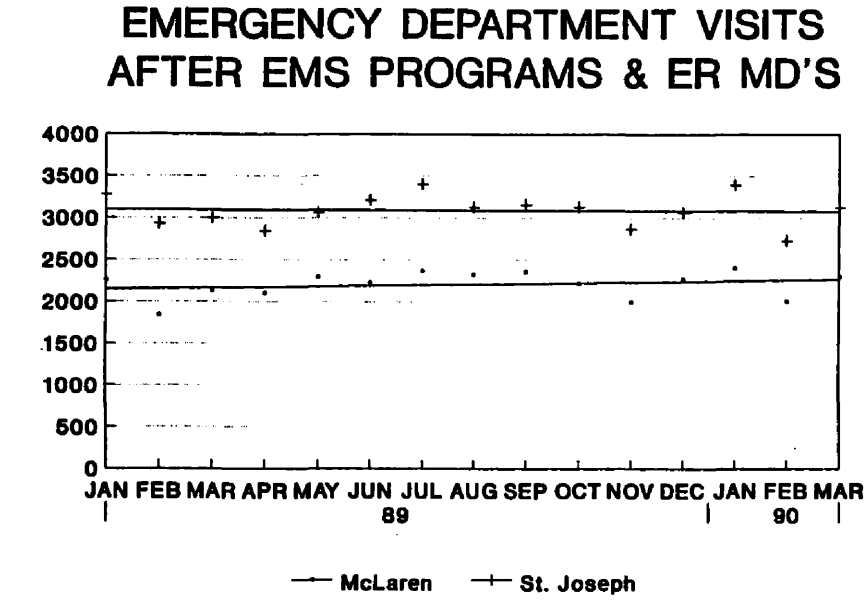
Following the implementation of the pre-hospital EMS training programs during the second time period (12 observations), both hospital's slopes increase with McLaren's increase being more dramatic (Table C).

Table C



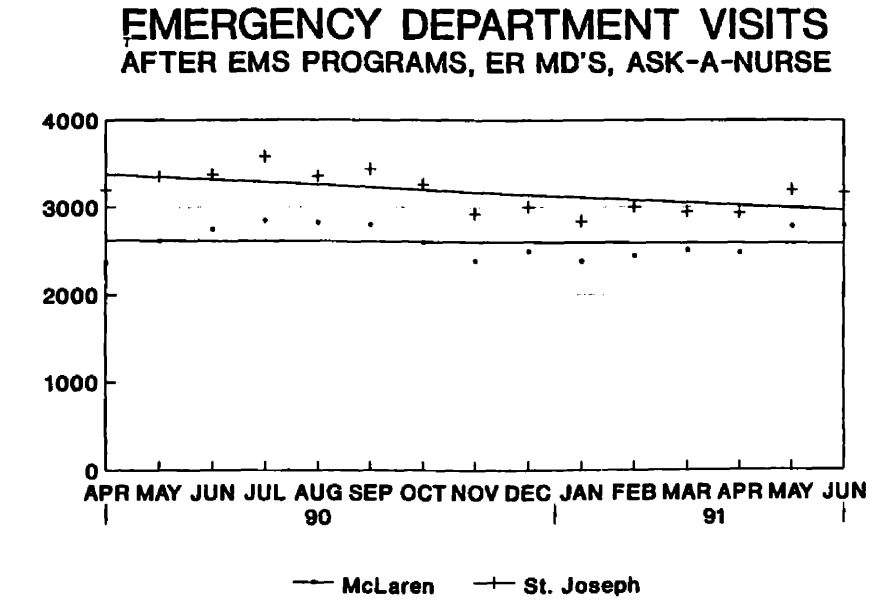
The implementation of the emergency physician specialists and the continuation of the pre-hospital EMS training programs marks the beginning of the third time period. During this period's 15 observations, St. Joseph's slope flattens while McLaren's continues to increase (Table D).

Table D



During the final time period following the implementation of the Ask-A-Nurse program and the continuation of the other two independent variables (15 observations), St. Joseph's slope is showing a decrease while McLaren's is showing a slight increase. Given the seasonal variations that are seen for both hospitals, St. Joseph's market shows a steady decline while McLaren's market is relatively stable (Table E).

Table E



The means for emergency department visits for McLaren and St. Joseph were grouped by the time periods previously listed. Using t-tests, the obtained t value exceeded the value of t at the .05 level in all instances (time periods 1, 2, 3, 4, and total visits for the entire period) leading to a rejection of the null hypothesis. A summary of t-test results are included as Table F.

Table F

T-Tests of the Means of Emergency Department Visits Between McLaren and St. Joseph

Time Periods	DF	t_{obt}	H_o
1	142	-18.7158	Reject
2	22	-15.5001	Reject
3	28	-13.6613	Reject
4	28	- 7.7243	Reject
All	226	-10.6292	Reject

T-tests were then used to examine the means of emergency department visits at McLaren and St. Joseph individually in order to compare the mean of one time period with the mean of the next period. The null hypothesis is that each hospital's means will be equal each time period.

An alpha level greater than .05 will be criteria for rejection of the null hypothesis.

T-test results for St. Joseph Hospital are summarized in Table G. Rejection of the null hypothesis between time periods 1 and 2 is reflected in the increase in emergency department visits over these two time periods as shown in Tables B and C. Acceptance of the null hypothesis between time periods 2 and 3 and between time periods 3 and 4 is reflected in the slight increase, leveling off and decline in emergency department visits over the final three periods as shown in Tables C, D, and E.

Table G

T-Tests of the means
of Emergency Department Visits
for St. Joseph Hospital (between time periods)

Time Periods	DF	t_{obt}	H_o
1 & 2	82	-2.8891	Reject
2 & 3	25	0.0098	Accept
3 & 4	28	-1.0835	Accept

Because the implementation of the EMS training program and the emergency physician specialists

can't be operationalized in any quantifiable form, a variation of the interrupted time series design is used to look at McLaren's t-test results. Rejection of the null hypothesis for McLaren will lead to acceptance of the research hypothesis that the implementation of the EMS training program and the emergency physician specialists contributed to an increased utilization of emergency services at McLaren.

T-test results for McLaren are summarized on the following page in Table H. Acceptance of the null hypothesis between time time periods 1 and 2 is reflected in the slight decline and subsequent slight increase in emergency department visits during these two time periods as shown in Tables B and C. Rejection of the null hypothesis between time periods 2 and 3 and between time periods 3 and 4 is reflected in the increase and leveling off of emergency visits over the final three periods as shown in Tables C, D, and E. This use of the interrupted time series design demonstrates the changes in the dependent variable as statistically significant following the introduction of the independent variables during these time periods.

Table H

T-Tests of the Means
of Emergency Department Visits for
McLaren Regional Medical Center
(between time periods)

Time Periods	DF	t_{obt}	H_o
1 & 2	82	0.0919	Accept
2 & 3	25	-2.9811	Reject
3 & 4	28	-6.2965	Reject

Bivariate regression was used to examine the relationship between the dependent variable and the operational values of the independent variable that could be quantified (the Ask-A-Nurse program) during time period 4 from April 1, 1990 to June 30, 1991 (following implementation of McLaren's Ask-A-Nurse program). With an R Square value of .10048 (10.048% of the variation in the dependent variable can be explained by the independent variable used in the equation), the number of Ask-A-Nurse calls was not significant with $p > .05$ ($p = .2497$).

Based on all of the previous calculations, the null hypothesis would be rejected. The association between the independent variables of

the pre-hospital EMS training program and emergency physician specialists were statistically significant with the increased utilization of emergency services at McLaren Regional Medical Center while the effects of the remaining independent variable, the Ask-A-Nurse program, was not statistically significant.

IV. Summary of Data

During the time period of January 1, 1982 to December 31, 1987, St. Joseph Hospital had greater utilization rates each month with the differences between St. Joseph and McLaren Regional Medical Center's monthly Emergency Department patient census increasing from less than 50 patients to more than 1000 patients. This increase is difficult to account for. There were no major changes experienced by either institution during this time period which may have impacted emergency department use such as changes in hospital administration. The physical plant as it related to the Emergency Departments expanded at McLaren yet remained the same at St. Joseph. Interestingly, both Emergency Departments were staffed by the same group of emergency physicians (Genesee County Out-Patient Association).

One variable that was not analyzed that may have had an effect on McLaren's Emergency Department patient census in general is its proximity to Flint Osteopathic Hospital (FOH) (see map on page 22). FOH, an affiliate of St. Joseph Health Systems (a consortium of hospitals and other health care providers which includes St.

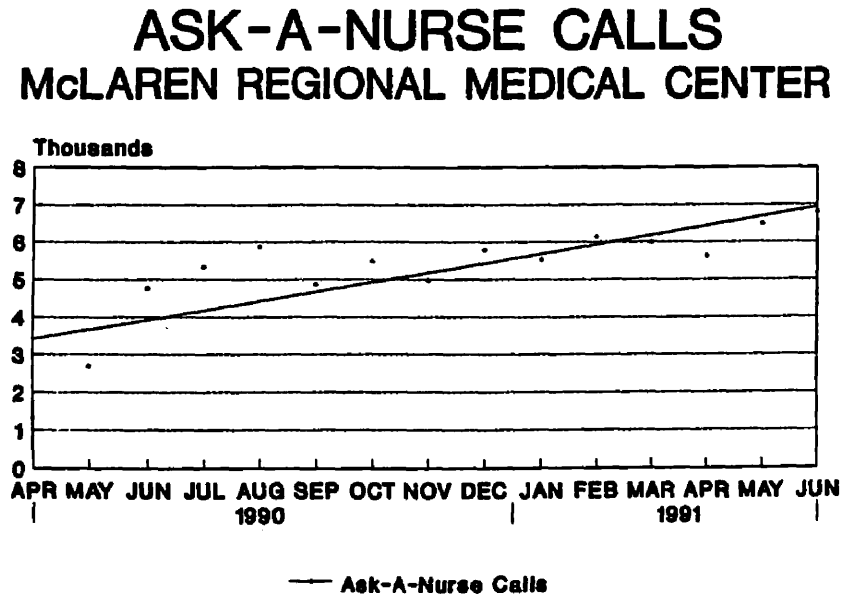
Joseph Hospital and is headed by St. Joseph's President) is a 359-bed acute care facility that is located on the southwest corner of Beecher Road and Ballenger Highway in Flint. Being across the street from a facility of similar size could reduce the number of patients choosing McLaren for their emergency services needs. St. Joseph Hospital, on the other hand, is the only hospital on the eastside of Flint. This geographic location, which was identified as an external factor, could also be a major factor in explaining the monthly differences between the two institutions.

After the introduction of the various independent variables in 1988, however, the trends for each hospital reversed. St. Joseph's monthly emergency department totals began to flatten out and, in the last time period, decline while McLaren's totals began to increase during the third time period starting in 1989 (following implementation of the EMS training program and the emergency physician specialists) and showed an even greater increase in the final time period (following the implementation of the Ask-A-Nurse program). Since the changes for McLaren between each of these time periods was significant (the

obtained value of t exceeded the value of t at the .05 level), the implementation of the independent variables, as a group, may have had a positive impact.

Since the implementation of the McLaren Ask-A-Nurse program in April of 1990, the total number of calls received by Ask-A-Nurse each month has steadily increased. These monthly totals with a fitted trend line are illustrated in Table I. While the trend appears dramatic, there was no statistically significant difference between Ask-A-Nurse and the number of Emergency Department patients during this time period.

Table I



Monthly Totals with Trend Line
Time Period 4

Informal discussions held over the last three months of 1991 with Emergency Department personnel indicated that they felt the implementation of the Ask-A-Nurse program had resulted in an increase in the number of patients seen in the Emergency Department. This subjective view is noteworthy because of the number of patients who tell Emergency Department staff that they had called Ask-A-Nurse for advice before coming in for treatment.

Since the Ask-A-Nurse program, individually, was not found to be statistically significant and accounted for only 10% of the change seen in the dependent variable, the increase in the number of emergency department patients at McLaren can be attributed to the combined effects of the EMS training program, the emergency physician specialists, and the Ask-A-Nurse program. The decrease in St. Joseph's emergency department utilization over these same time periods cannot be adequately explained by the introduction of the independent variables at McLaren.

The identification of other factors (such as the St. Joseph Hospital Family Practice physician residency training program) that may have influenced the changes in utilization at St.

Joseph Hospital could offer an explanation. Other factors, whether internal to St. Joseph or external, and their appropriate measurement are currently unavailable. Regardless of the reason, however, the utilization of emergency services at St. Joseph Hospital has decreased dramatically since April of 1990. Further study of emergency department utilization patterns at St. Joseph and McLaren over the next few years may aid in identification of factors impacting utilization and their effects.

In summary, the null hypothesis that none of the independent variables (pre-hospital EMS training programs, emergency physician specialists, and Ask-A-Nurse program) would have a statistically significant effect on the increased utilization of emergency services at McLaren Regional Medical Center has been rejected. It has been shown, using t-tests with a variation of the interrupted time series design that the relationship between the pre-hospital EMS program and the emergency physician specialists and the number of Emergency Department patients is statistically significant. The relationship between the Ask-A-Nurse program and the number of Emergency Department patients is not statistically

significant (p = .2497) with an R Square value of .10048 indicating that only 10% of the change seen in the dependent variable can be explained by the introduction of this independent variable.

V. Discussion

While this study focused on three internal factors that can affect utilization of hospital emergency services, there are many other factors that could be examined in the future. These factors include a newly established physician liaison program, the physical expansion of McLaren's emergency department as part of a major building project, the establishment of various McLaren satellite specialty care centers, the planned implementation of an emergency medicine physician residency training program, and the possible consolidation and relocation of St. Joseph Hospital and Flint Osteopathic Hospital as part of a major reorganization of St. Joseph Health Systems' hospitals. In addition, one factor that was examined in this study, the Ask-A-Nurse program, could be followed over the next few years to determine if the differences between Ask-A-Nurse calls and emergency services utilization has become statistically significant. The other two factors that were examined in this study, the pre-hospital EMS training program and the emergency physician specialists, could be reevaluated in additional ways to determine

whether they continue to be significant in increasing utilization of emergency services.

The physician liaison program at McLaren began in the summer of 1990. The purpose of this program is to increase physician utilization of patient services at McLaren, including the emergency department, through aggressive marketing of McLaren to physicians and the development of programs to meet the needs and/or desires of the physicians. A study of physician utilization rates of McLaren services before and after the implementation of the physician liaison program could show the effect on utilization of the emergency department through physician referral.

A $60-million expansion of the physical plant at McLaren was begun in the fall of 1991 with an expected completion date in 1993. While this expansion will not increase the total number of inpatient beds, it will result in a greater proportion of monitored and critical care beds. The emergency department will also undergo a major expansion. With these improvements in the physical plant and an increase in high-technology equipment, it would be of interest to ascertain the public's perceptions of McLaren and determine if those perceptions have changed due to the

expansion. If the public feels that McLaren is progressive, that may lead to an increase in hospital utilization including the emergency department. A perception that "better facilities" equals "better care" could be examined not only with the public but with the pre-hospital EMS providers to determine if this influences their decision on where to seek medical treatment.

The development of various satellite programs by McLaren has been underway for some time. A Sports Medicine Center and an Occupational Medicine/Urgent Care Center are the two newest facilities, both opening in the fall of 1991. The impact of these Centers on the utilization of emergency services at McLaren could be measured in the future by examining the number of referrals to the emergency department from these programs.

McLaren currently has residency training programs in Radiology, General Surgery, Orthopedic Surgery, and Internal Medicine. A physician residency training program in emergency medicine is being developed with implementation expected in July of 1993. Analysis of emergency department utilization rates following the implementation of this program may show that such a training program has resulted in an increase in those rates.

The proximity of Flint Osteopathic Hospital was mentioned previously as a possible influence on the utilization of emergency services at McLaren. St. Joseph Health Systems, FOH's parent corporation, has announced plans to consolidate the operation of its various hospitals (Flint Osteopathic Hospital, St. Joseph Hospital, Genesee Memorial Hospital, and Wheelock Memorial Hospital) into a single facility and relocate south of Flint in rural Grand Blanc Township. While the plans now are for the emergency departments to remain open at St. Joseph's and FOH's current locations even though inpatient services are relocated, it remains to be seen what impact these changes will have on their emergency services' utilization as well as McLaren's. Examining the utilization of emergency services at all Flint/Genesee County hospitals before and after the implementation of these changes would reflect the impact that they have had.

The impact of McLaren's pre-hospital EMS training program could be re-evaluated in the future by surveying EMT/Paramedics to determine their source of training as well as the amount of discretion they have in selecting which hospital they transport patients to for emergency care. By

quantifying this independent variable, it would provide a more definitive answer to the impact of the EMS training program on emergency department utilization.

The impact of emergency physician specialists on utilization of the emergency department could also be quantified in the future by surveying patients following treatment in the emergency department. Questions regarding the patients's perceptions of the quality of physician care received, the quality of communication with the emergency department physician, and the physician's attitude toward the patient could be presented to determine patient satisfaction with these aspects of their care and the relationship between patient satisfaction with emergency physician specialists and the utilization of emergency services.

The impact of the Ask-A-Nurse program on emergency department utilizaion could also be re-evaluated by use of a survey. All emergency department patients could be questioned regarding their use of the Ask-A-Nurse program for health care information and referral. The total number of patients who state they called Ask-A-Nurse prior to coming to the emergency department could

then be identified. This figure would be a more precise reflection of the impact of the Ask-A-Nurse program on emergency department utilization and may result in the Ask-A-Nurse program being statistically significant.

In conclusion, the use of various internal factors that are available to hospital administrators is well documented. The ability of administrators to select those factors that may work best for their individual organization is challenging but the rewards for increasing the utilization of their Emergency Department and, as a result, of their hospital itself make it worth the effort.

Technical Note

The following Student's t-Distribution formula was used in the calculation of t-values in this study:

Hypothesis Tested	Parameter	Statistic	Standard Error of the Statistic	Test Statistic	*Degrees of Freedom
$H_0: \mu_1 = \mu_2$	$\mu_1 - \mu_2$	$\bar{X}_1 - \bar{X}_2$	$s_{\bar{x}_1-\bar{x}_2} = \sqrt{\frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1+n_2-2}\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}$	$t = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{s_{\bar{x}_1-\bar{x}_2}}$	$n_1 + n_2 - 2$

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