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## Did GPs Ever Spare the ER?

by

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### Abstract

In Canada there has recently been increased public and political debate surrounding the reasons for the continued overcrowding seen in hospital emergency rooms (ERs) around the country. One theory is that ER overcrowding is due to a shortage of family physicians (GP). The theory goes that if patients have medical problems and no GP, they will go to an ER in order to receive treatment contributing to overcrowding. The question then is whether or not ERs have become substitute GPs?

Only a historical analysis can answer this question. While many opinions exist on the subject no attempts have actually been made to correlate the number of GPs with ER use through time. Data was obtained from: hospital archives, Kingston Public Library Special Collections, Statistics Canada and the Ontario Physicians Human Resource Database on the number of ER visits and the number of GPs in the city of Kingston, Ontario, from 1961 to 2006.

Regression analysis was used to look for a correlation between the number of GPs in Kingston and the number of ER visits over the past forty-five years. The population of Kingston during this time period was used as a controlling variable. Regression analysis showed that there was a historical correlation between the number of ER visits and the number of GPs in Kingston. Therefore, it appears that GPs have spared the ER from overcrowding.

### Introduction

Recently, Canada's health care system has come under criticism by the media and by Canadian's themselves. Two of the biggest concerns are the decreased number of family doctors (GPs) in Canada and emergency room (ER) overcrowding. Most estimates place the number of Canadians without a GP at around four to five million and a study published in 2007, estimated that approximately 1000 people a day in Ontario *spend over 7.5 hrs waiting to be seen in hospital ERs*. The Canadian Broadcasting Corporation (CBC) recently aired a documentary entitled "Desperately seeking Doctors" in which they stated, "Without family doctors millions clog up the country's hospital Emergency Departments". So have people been using the ER as a GP substitute? Some studies have claimed that there is a relationship between ER visits and continuity of care. For example, a study published in the Canadian Medical Association Journal (CMAJ) in November 2007 entitled "Continuity of primary care and emergency department utilization among elderly people" found that "increased rate of emergency department use was associated with a lack of primary physician." So far, however, there has been no attempt to directly correlate the number of GPs in a city with the number of

ER visits. So we shall attempt to see if there is a historical correlation between the number of GPs and the number of ER visits in Kingston, Ontario.

Why look at Kingston? Kingston is a mid-sized city with a population of over 150,000 people. Kingston has only two hospitals, the Kingston General Hospital (KGH) and the *Hôtel Dieu* Hospital (HDH), each deals with various levels of acuity. Kingston also has readily available historical data as both KGH and HDH have extensive archives extending back into the early 1900s, as does Kingston Public Library.

### Determining the Number of ER Visits & GPs

Determining the number of ER visits was fairly straightforward as both KGH and HDH record the number of ER visits each year in their annual reports, KGH began doing so in 1960. By taking the sum of these two values we obtain the total number of ER visits in Kingston, Ontario for each year. Determining the number of GPs in Kingston was slightly more difficult. Neither the *Canadian Medical Association* (CMA) nor the *College of Physicians and Surgeons of Ontario* (CPSO) maintained these types of records. They did, however, suggest the *Ontario Physician Human Resource Database* (OPHRD) as a potential source. The OPHRD publishes annual reports on physician numbers in Ontario. However, the database was only started in 1992. Obtaining data from before this time required some creative thinking. Kingston Public Library keeps a collection of Kingston Phone Books dating back to the late 1800s in its special collections. Thus, in order to obtain the number of GPs in Kingston from 1960 to 1992 yearly counts were made of the number of GP and family doctor listings during those years. Determining the population was difficult as well as no accurate yearly count of the Kingston population exists from 1960 to 2007. In fact, it was not until 2001 that Kingston was classified as an urban center by census Canada and yearly estimates were made. However, census data on Kingston's population does exist for every five years from 1961 to 2001. The data obtained (Table 1): number of GPs, number of ER visits and population was then plotted to look for any general trends, see Figure 1. In general there is an upward trend to all variables.

Year	KGH Er	HD Er	Total ER	GPs	Population
1960	9865	13805	23670	43	
1961	10055	13798	23853	49	63419
1962	19184	14660	33844	47	
1963	23552	14800	38352	52	
1964	28283	16435	44718	55	
1965	33002	17687	50689	47	
1966	31286	18053	49339	58	71540
1967	31223	17541	48764	57	
1968	32997	18209	51206	58	
1969	35423	20988	56411	67	
1970	36602	26386	62988	63	
1971	35912	30861	66773	84	85877
1972	39250	33430	72680	79	
1973	44806	35527	80333	86	
1974	45248	36637	81885	92	

1975	47335	39647	86982	80	
1976	38439	39173	77612	90	90741
1977	38512	46585	85097	93	
1978	43229	38244	81473	93	
1979	44547	37555	82102	88	
1980	45710	38773	84483	93	
1981	46003	39002	85005	103	114982
1982	47851	40527	88378	91	
1983	48237	42338	90575	99	
1984	45831	47959	93790	104	
1985	41444	51551	92995	110	
1986	42208	54550	96758	119	122350
1987	39352	53503	92855	131	
1988	39353	51848	91201	149	
1989	38080	50793	88873	170	
1990	40392	51253	91645	173	
1991	40687	52090	92777	176	136401
1992	39889	50072	89961	174	
1993	39162	49793	88955	172	
1994	39432	48289	87721	174	
1995	39187	46447	85634	190	
1996	38552	44774	83326	192	143416
1997	47819	32242	80061	190	
1998	50192	34361	84553	184	
1999	52529	35622	88151	186	
2000	52014	37019	89033	180	
2001	50985	36048	87033	191	152652
2002	50826	37127	87953	209	154439
2003	48648	33384	82032	210	155676
2004	47540	34516	82056	209	156123
2005	47088	36355	83443	219	155685
2006	46777	36357	83134	211	154971

Table 1: Data obtained on the number of emergency room visits to *Kingston General Hospital (KGH)*, *Hôtel Dieu Hospital (HDH)*, population and the number of General Practitioners (GPs) in Kingston, Ontario from 1960 to 2006.

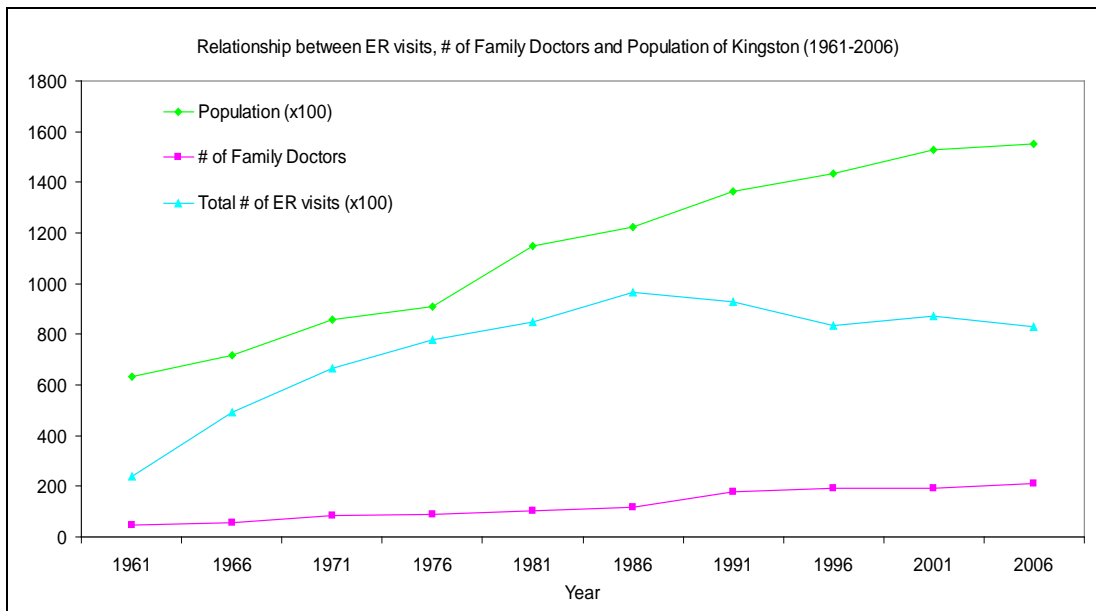


Figure 1: Plot of the Number of Total ER visits, GPs and Population from 1960 to 2006.

## Regression Analysis

In order to analyze the research question, regression analysis was used. Regression analysis is a statistical method attempts to determine the relationship between one variable (dependant variable) and another (independent variable) to see if changes in the independent variable can be used to predict/explain changes in the dependent variable. First regressing population against the number of GPs and the total ER visits shows that there is a 95% and 65% correlation respectively. This means that 95% of the changes in the number GPs can be explained by changes in the population and that 65% of the changes in the number of ER visits can be related to changes in population. This was to be expected: If the population increases the number of GPs would increase as would the number of ER visits.

As we have seen, the population has a large effect on our variables. Therefore, to take this into account the number of GPs per capita needs to be regressed against the number of ER visits per capita. Regressing these two variables produces a correlation of 13%. At this point one would be tempted to say that there is little to no correlation between the number of GPs per capita and the number of ER visits per capita. However, when our two values are plotted against each other we see that one substantial outlier, from 1961, appears to be throwing off the analysis, Figure 2.

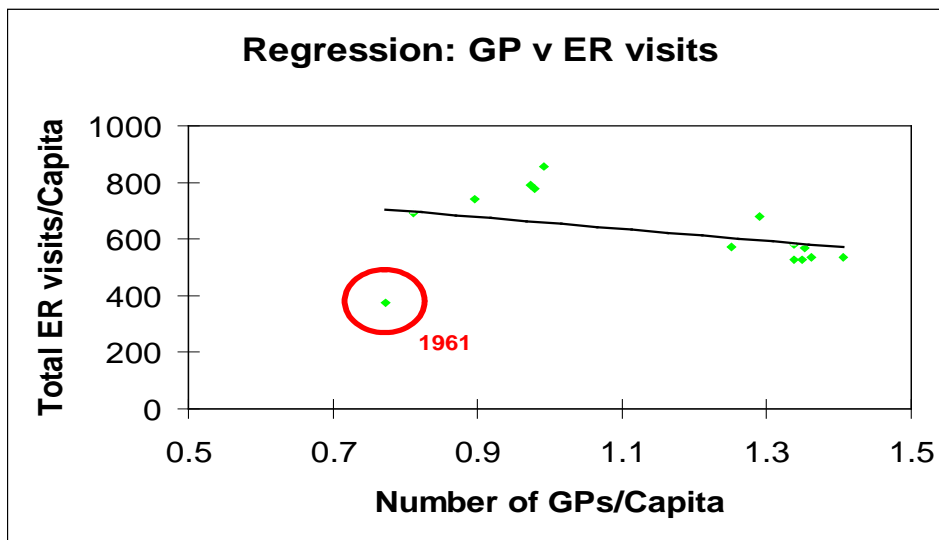


Figure 2: Regression analysis: GPs per capita and Total ER visits per capita. Circled value indicates the outlier from 1961.

There are several reasons for excluding this outlier. At KGH, 1960 was the first year that data on the number of ER visits was recorded. Looking at the raw data, Table 1, we see that there was approximately nine thousand visits to KGH in 1960, ten thousand in 1961 and the twenty three thousand in 1962. While the number of ER visits at HDH remains relatively stable during this same time period and the number of visits to KGH after this time period also remains relatively stable. This variability can perhaps be attributed to imperfect/changing methodologies in recording the number of ER visits. Thus, by excluding this data point we are allowing the data set to achieve a relatively steady state before performing our analysis.

After excluding 1961, regressing the number of GPs per capita against the number of ER visits per capita returns a correlation of 69%, see Figure 3. Therefore, there is a historical correlation between the number of GP visits per capita and the number of ER visits per capita. In other words, 69% of the changes in the number of ER visits from 1965 to 2006 can be explained by changes in the number of family doctors from 1965 to 2006. What's more as the number of GPs increases the number of ER visits decreases.

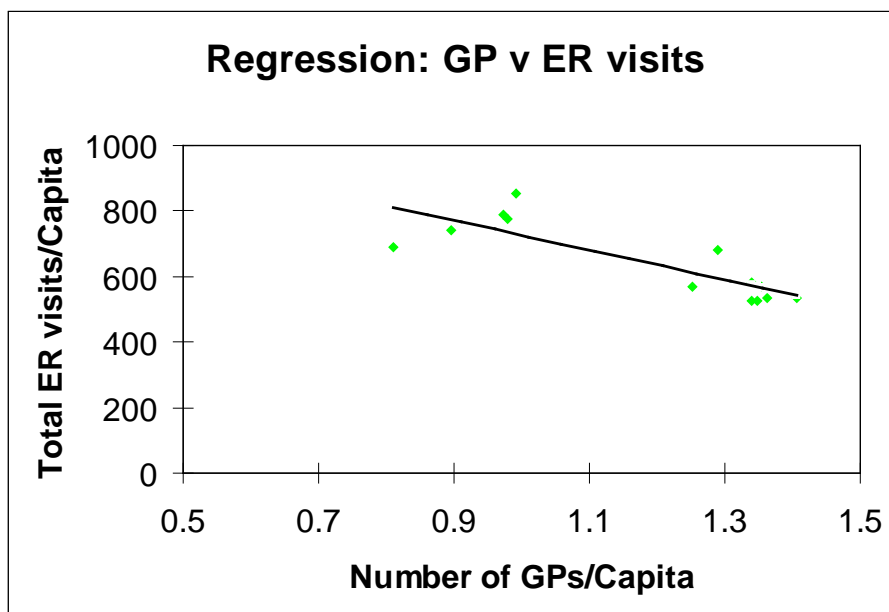


Figure 3: Regression analysis: GPs per capita and Total ER visits per capita after removal of outlier.

## Conclusion

However, there are several points to consider: First, errors may have been made in data collection. As was mentioned earlier, the number of GPs in Kingston during 1960 to 1992 was obtained by counting the number of listed family doctors and GPs in the phone books for those years. This method does not take into account any GPs who may have been unlisted and it is possible mistakes may have been made during the actual counting. Second, there may be errors in the data itself. The methodologies with which the ERs counted the number of patients seen year to year were in all probability not standardized which may have led to differences year to year (as was seen from 1960 to 1962). In 1997, HDH's ER changed from being open 24 hrs to being open from 8 am to 10 pm. This accounts for the sudden drop in the number of ER visits after 1997. Data on the number of GPs obtained from the OPHRD included the number of family doctors for all of Frontenac County and so the number of GPs for these years may have been slightly higher than expected. Though when compared to the number of GPs listed in the phone books for those years (1992-2006) the numbers are comparable. Finally, not all variables were taken into account. To make this analysis as accurate as possible it would have been ideal to have had the number of hours worked by each family doctor, as there has been in recent times a trend for family doctors to work fewer hours. However, obtaining this data would have been impossible. The final point to consider is that correlation does not imply causation. It is possible that there is as of yet an unidentified third variable that is responsible for this strong correlation.

This study shows that there is a correlation between the number of GPs in a city and the number of ER visits in that city and that when the number of GPs increases the number of ER visits decreases. Therefore, increasing the number of GPs may help to alleviate ER overcrowding.

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