

# Medicare Expenditure in New Brunswick

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## **I. Introduction**

The Canadian health care system has been considered as one of the most efficient systems in the world, and the public-financed Medicare service has viewed as a symbol of the equity in the sense that everyone has the same access to Medicare services. In order to assure that money is well spent on Medicare services, it is necessary to know the factors that determine the Medicare expenditure. The objective of this paper is to investigate the trend, age-gender distribution, and region distribution of the Medicare service in New Brunswick by using the New Brunswick Medicare Data Base from 1998 to 2002. The Medicare database contains information of individual claims with basic demographic and regional information regarding to the patient and physician. We divide the database into 2 subsets: one for general physicians and one for specialists. For each subset, the total expenditures and the number of patients and claims are further broken down into years, age-sex, and health regions groups. We present trends and age-sex distributions of health care expenditure as well as its regional variation from 1998 to 2002. In addition to the analysis of these trends, several regression models are used to identify factors that determine Medicare expenditure in New Brunswick. Results show that age, gender, and the accessibility to the Medicare services all are factors that affect the Medicare expenditure.

The paper is organized as follows: Section 2 contains some descriptive analysis of the total and average Medicare expenditure in New Brunswick over the sample period. Section 3 presents the regression results and Section 4 concludes.

## **II. Descriptive Analysis**

We first focus on analyzing the Medicare expenditure by general physicians (GP). Figure 1 shows the trend of the monthly total expenditure by GP (TEGP) over the 48-months period.

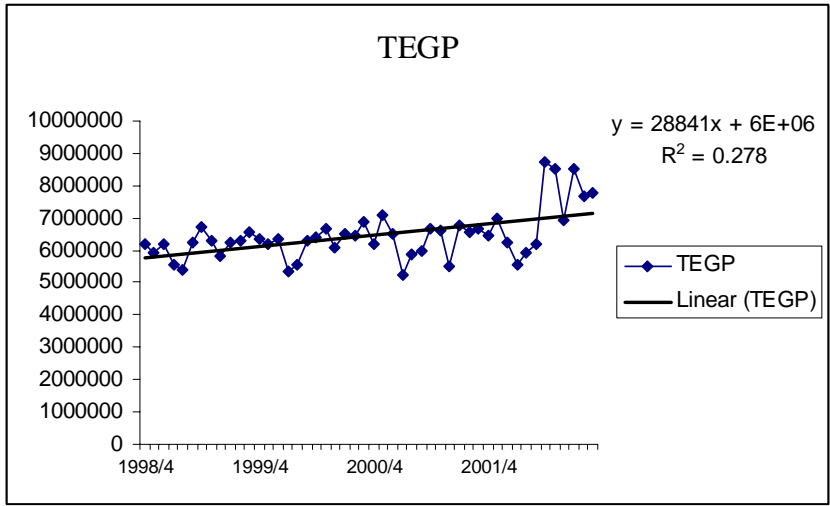


Figure 1: Monthly Total Expenditure by GP (TEGP) from 1998 to 2002

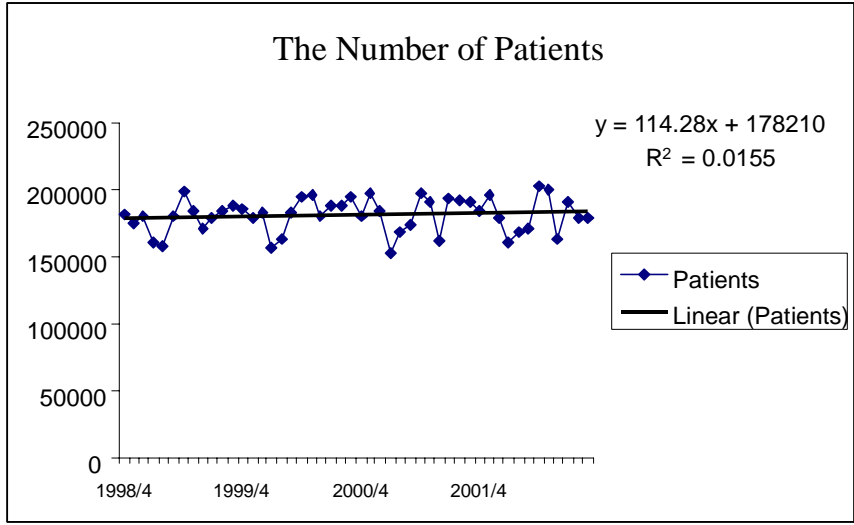


Figure 2: Monthly Total Number of Patients by GP from 1998 to 2002

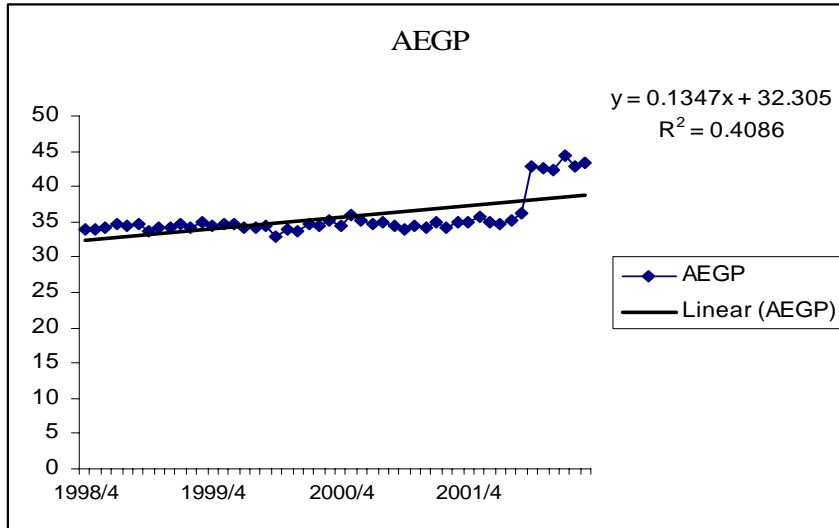


Figure 3: Monthly Average Expenditure by GP from 1998 to 2002

Figure 1 shows an increasing trend of the monthly total expenditure on Medicare in New Brunswick with some fluctuations around the trend. July and August are the two months that usually have the lowest Medicare expenditure during the year. It is interesting to notice that there is a jump between September 2001 and October 2001, and this could have been caused by a dramatic increase of either the number of patients and claims or the fee schedule change of the Medicare services.

To find out what causes the increasing trend and the fluctuations in the TEGP, we looked at the total number of patients (Figure 2) and the average expenditure by general physicians (Figure 3) during the sample time period. We define the average expenditure as the total expenditure divided by the total number of patients, so it is reasonable to assume that the trend and fluctuations we observed in the TEGP (total expenditure by general physicians) can be either from AEGP (average expenditure by general physicians) or from the patient numbers.

Figure 3 shows that similar to TEGP, AEGP also presents an increasing trend and a sudden jump between the September 2001 and October 2001. However, it is much less volatile than TEGP. On the other hand, we do see the fluctuations over time in the patient numbers, but the increasing trend in the patient numbers is not as clear as in TEGP and AEGP. These results suggest that the jump occurred in 2001 was likely caused by an increase in the fee schedule of Medicare service, and the fluctuations in the TEGP is caused mostly by the number of patients.

Following the analysis of the monthly Medicare data at the provincial level, we break down the data by gender, age group, and the health region. We first break down the TEGP by gender, and it is shown in Figure 4. Over the 4-year period, female patients account for 61% of TEGP while male patients account for 39% of TEGP. The average expenditure by female patients (\$481.5) is 45.1% higher than that by male patients (\$331.8).

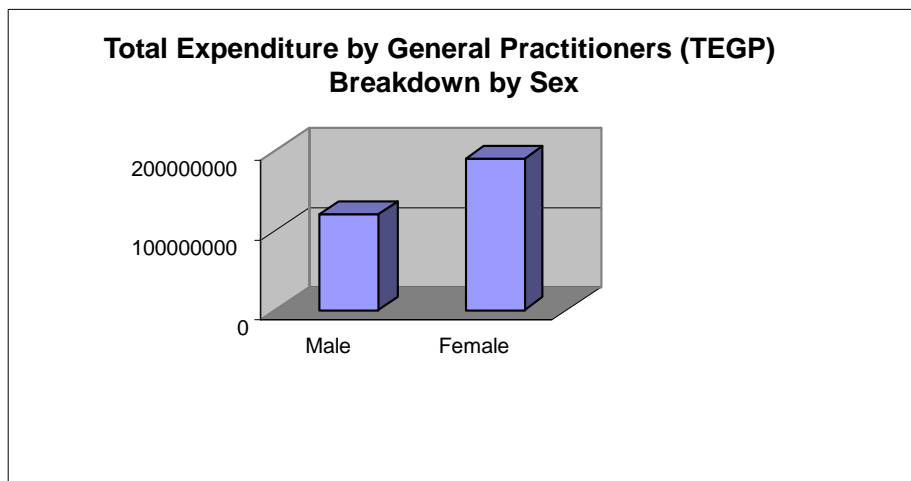


Figure 4: Total Expenditure by GP Breakdown by Sex

Next, we grouped the patients together according to 12 age groups: 0-1, 1-9, 10-19, 20-29, 30-39, 40-49, 50-59, 60-69, 70-79, 80-89, 90-99, and over 99. Figure 5 shows that the age distribution of TEGP has an increasing trend at the younger age groups, reaches the peak point at the age group 40-49, and starts to decrease at older age. According to how we define the AEGP, the age distribution of TEGP is affected by both age distribution of patient numbers (Figure 6) and the age distribution of AEGP (Figure 7). Since the AEGP of a certain age group indicates the average expenditure caused by one patient from that age group, it makes better sense to use the AEGP to see how age influences their Medicare expenditure, rather than using TEGP.

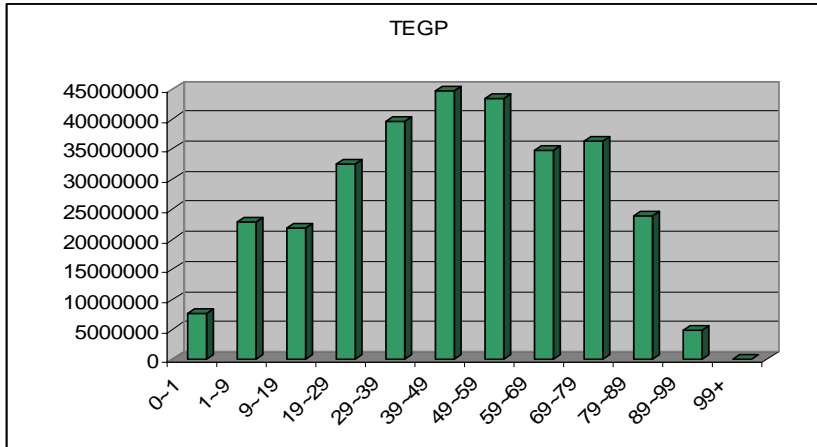


Figure 5: Total Expenditure by General Physicians Breakdown by Age

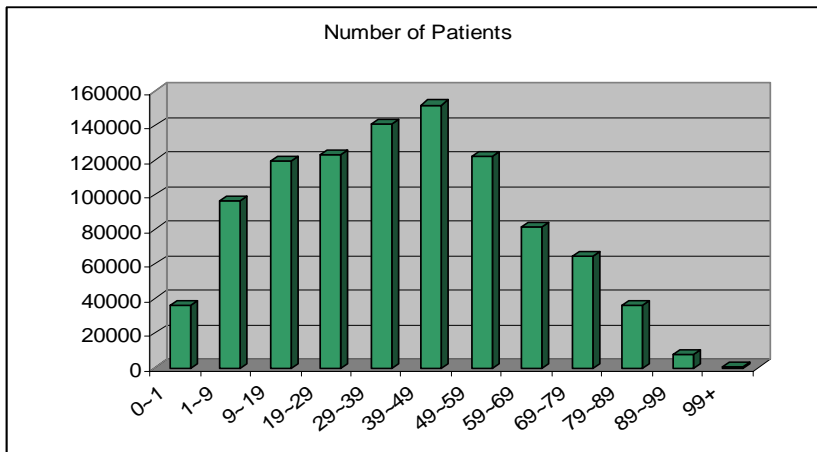


Figure 6: Total Number of Patients Breakdown by Age

The age distribution of the number of patients is very similar to that of TEGP, but the age distribution of AEGP is quite different. As shown in Figure 7, AEGP reaches the highest point at the age group 80-89. The age group 10-19 has the lowest AEGP among all age groups because the teenagers usually are in low demand of Medicare service. The AEGP level is relatively stable, but still slowly increasing, among all the younger age groups up till the age group 40-49. From the age 50-59 on, the AEGP increases substantially until it reaches the highest point.

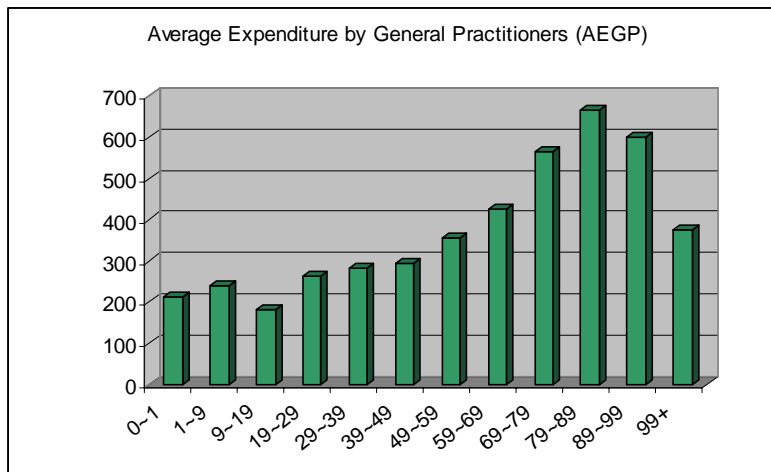


Figure 7: Average Expenditure by General Physicians Breakdown by Age

With respect to health regions, there are 7 health regions in New Brunswick, and the three biggest health regions, which are region 1, region 2 and region 3, account for 70.4% of the total number of patients and 69.8% of the total expenditure, but in terms of the average expenditure AEGP, the three biggest health regions do not have the biggest AEGP. The health region 5 has the highest AEGP. How the health region is related to the Medicare expenditure will be further discussed later in this paper.

Health Region	TEGP	Patients	AEGP
1	71695441	185705	386.0717
2	72355728	176999	408.7917
3	71958735	167464	429.6967
4	19875623	52428	379.1032
5	14998761	30973	484.2528
6	36303455	88342	410.9422
7	22115894	50791	435.4294

Table 1: Total Expenditure by General Physicians Breakdown by Health Region

Similar analysis is applied to the Medicare expenditure by specialists (TESP). The trend of monthly total expenditure by the specialist (TESP) does not present an increasing trend as steep as the TEGP does, but the fluctuations and the seasonal affect do exist (Figure 8). Like the TEGP, the TESP always reaches the lowest point at July and August, and there is a jump between September

2001 and October 2001. An interesting point to notice here is that the number of patients that received the Medicare service by specialists showed a decreasing trend over the 4 years (Figure 9). The AESP presents an increasing trend, and this trend is more obvious than the trend of TESP.

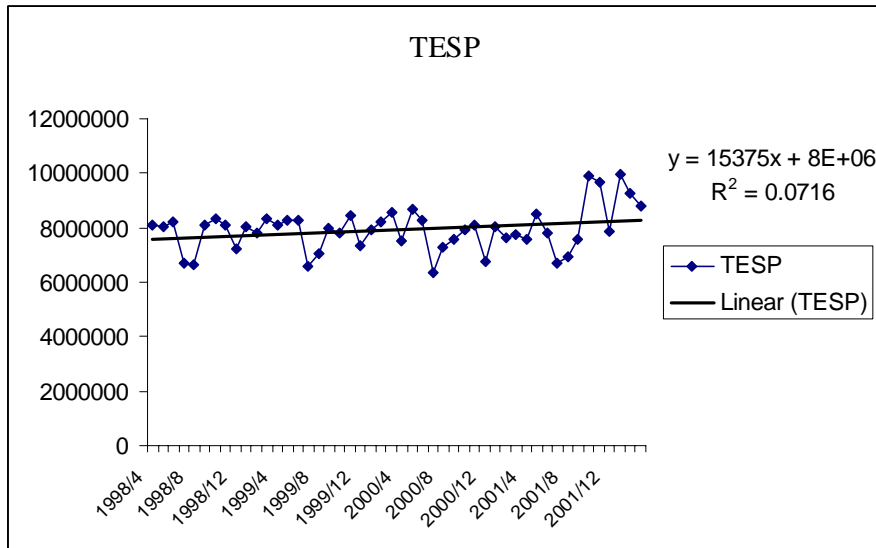


Figure 8: Monthly Total Expenditure by Specialist from 1998 to 2002

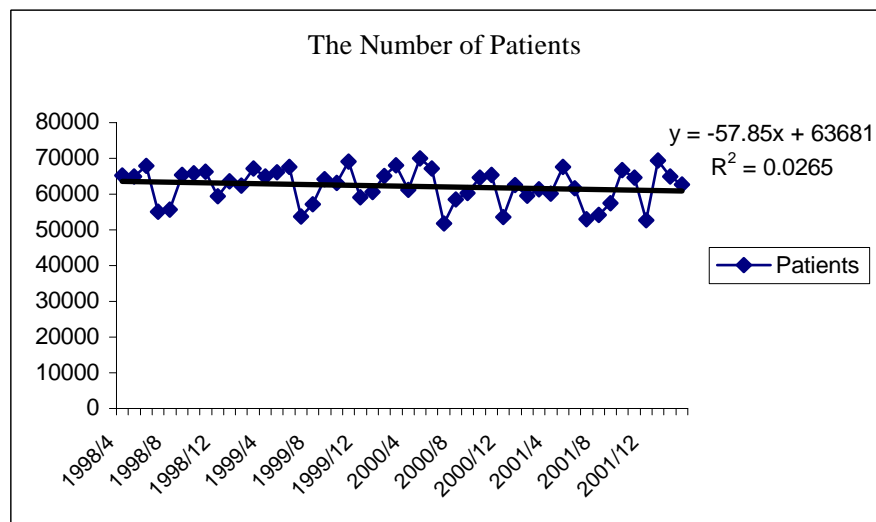


Figure 9: Monthly Total Number of Patients by Specialists from 1998 to 2002



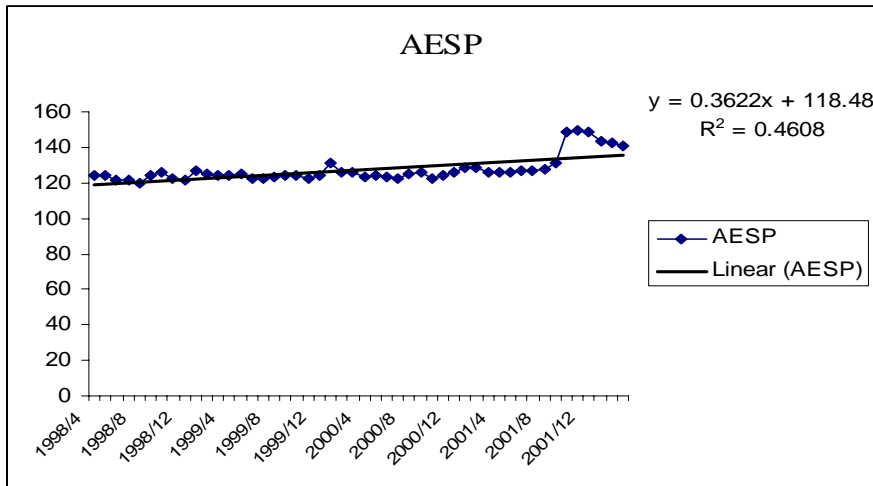


Figure 10: Monthly Average Expenditure by Specialists from 1998 to 2002

When the TESP is broken down by sex (Figure 11), female patients account for 56% of TESP while male patients account for 44% of TESP. The gender distribution of the numbers of patients is similar to the gender distribution of TESP, so as a result, the average expenditure by specialists does not have much difference between female patients and male patients.

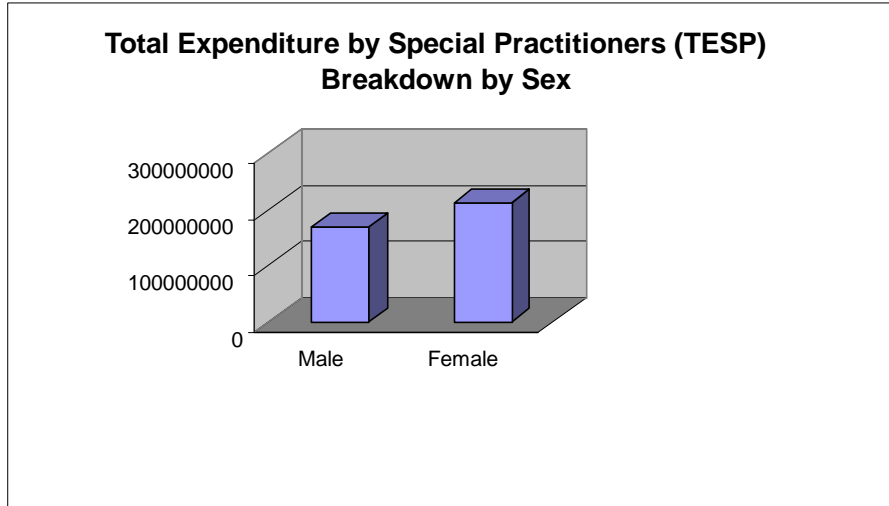


Figure 11: Total Expenditure by Specialists Breakdown by sex

Similar to what has been done for TEGP, the TESP is also broken down by age groups. Figure 12 shows that the age distribution of TESP presents an increasing trend, a peak point at the 70-79 group, and then a decreasing trend. Comparing with the one for AEGP, AESP reaches the highest point at the age group 70-79, earlier than the AEGP does. This is logical because when people get older, more conservative treatment is used for them, so the special Medicare services will not be

used as often as for the younger age groups.

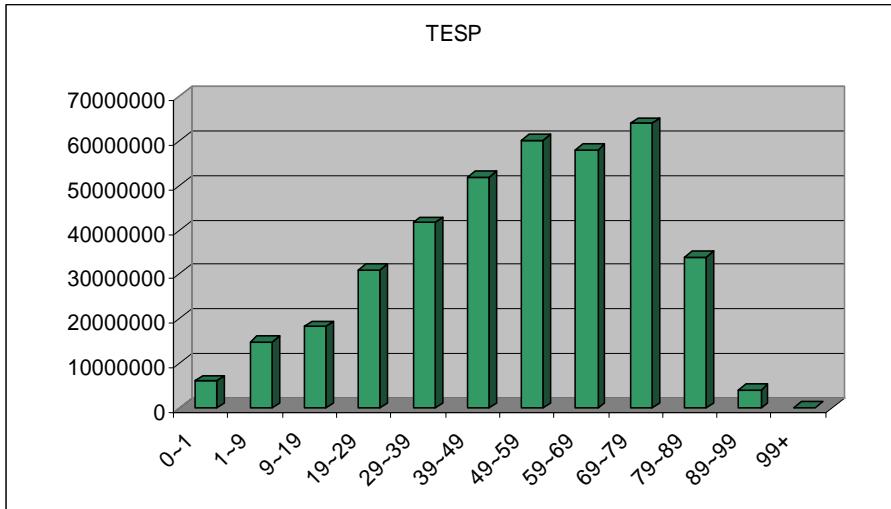


Figure 12: Total Expenditure by Specialists Breakdown by Age Groups

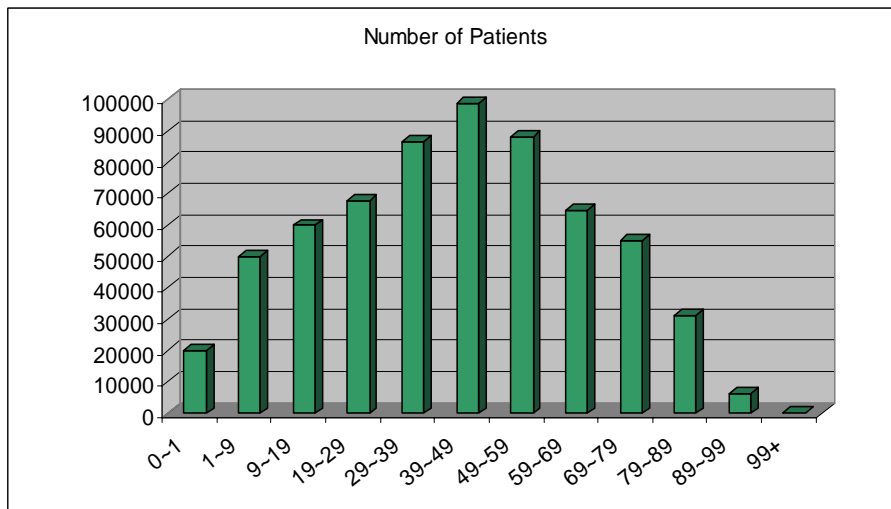


Figure 13: Total Number of Patients by Specialists Breakdown by Age Groups

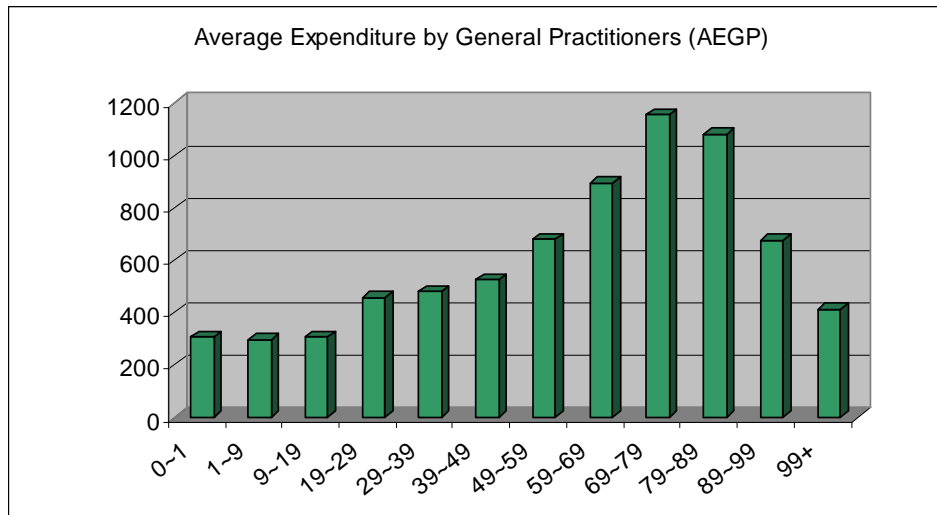


Figure 14: Average Expenditure by Specialists Breakdown by Age Groups

Finally, Table 2 shows the regional distribution of TESP, patient numbers and AESP. Again, the 3 biggest health regions accounts for the three biggest numbers of patients and expenditure. However, the highest AESP is not from any of these 3 regions, but rather from region 5.

Health Region	TESP	Patients	AESP
1	71695441	185705	386.0717
2	72355728	176999	408.7917
3	71958735	167464	429.6967
4	19875623	52428	379.1032
5	14998761	30973	484.2528
6	36303455	88342	410.9422
7	22115894	50791	435.4294

Table 2: Total Expenditures by Specialists Breakdown by Health Region

In summary, the descriptive analysis shows that there are increasing trends and fluctuations in the monthly total expenditures over the sample time period by both general physicians and specialists. Gender and age of patients are the factors that affect the expenditures on Medicare services. Regional variations exist in both total expenditures and average expenditures, but the regions with higher total expenditure do not necessarily have higher average expenditure on Medicare services. In order to further understand the factors that influence Medicare expenditure in New Brunswick, we proceed to the regression analysis in the next section.

## . Regression Analysis

We run a few regressions with Medicare expenditure against a set of demographic variables including: patients' gender, health region, age group, and fiscal year. Most of the explanatory variables are categorical. For example, there are 7 health regions in New Brunswick, and we used the region 3 as the base group. The same is done for gender (female as the base group), fiscal year (1998/99 as the base group), and age group (50-59 chosen as the base group).

According to the information contained in the database, we grouped all the patients into the subgroups by patient's age, gender, the health region where the patient is from, and the fiscal year. As the result, 672 subgroups are generated. We set up the models with the total expenditure and the average expenditure of these subgroups as dependent variables and the age, sex, region, and fiscal year as the independent variables. Because it is believed that the accessibility to the Medicare service would affect the total expenditure on Medicare service, we need to bring in some variables to control the effect. Full time equivalence (FTE) is a measure of physician supply, which attempts to standardize physician practice volume to a common base and quantifies each physician's practice relative to what is considered a full-time workload. Based on the definition of FTE, the FTE and population ratio is used as a measure of the accessibility people have to utilize the Medicare service. We used the FTE calculated by Xu and Yu (2004) for this variable. The relation between the physicians FTE/population ratios and the total Medicare expenditure might be non-linear, so we have the quadratic term involved in the model. Table 3 presents the regression results for TEGP and AEGP.

The results for the general physicians show that the year dummy variable for 2001/2002 has significant positive influence on both of the total expenditure and average expenditure by general physicians confirming the sudden jump for that year as we observed before. Male patients cost less on Medicare services by general physicians at the aggregate level as well as per patient level. Most of the age control variables are significant, which means age is closely related to the cost on Medicare services. The estimates show that comparing with the base group (50-59), the younger groups spend less on Medicare services at the aggregate level. For the older age groups, the 90 to 99 and the 99+ age groups have lower total expenditures on general physicians' services.

Table 3: Regress Results for the General Physicians

Inde. Variables	TEGP		AEGP	
	Coef.	t	Coef.	t
Patients	115.0161	40.99		
Year 99/00	-5932.997	-0.48	-3.862309	-0.89
Year 00/01	-3754.204	-0.29	2.199377	0.48
Year 01/02	65058.89	5.05	27.81298	6.09
Region 1	-67345.08	-3.91	-15.00417	-2.48
Region 2	-2525.661	-0.13	2.702122	0.38
Region 4	-88222.27	-4.12	-6.54767	-1.03
Region 5	-53422.34	-2.03	8.716483	1.07
Region 6	-34254.1	-1.68	12.0758	1.80
Region 7	-49338.41	-2.47	7.494272	1.29
Male	-110099.9	-12.63	-14.13085	-4.76
Age (0-1)	-53163.73	-2.13	3.47135	0.48
Age (2-9)	-172883.7	-8.22	-38.80888	-5.35
Age (10-19)	-279187.2	-13.51	-54.54875	-7.52
Age (20-29)	-112199.1	-5.45	-28.11565	-3.88
Age (30-39)	-109110.9	-5.32	-23.18223	-3.20
Age (40-49)	-104629.6	-5.05	-18.02035	-2.48
Age (60-69)	69828.52	3.29	23.48202	3.24
Age (70-79)	192332.4	8.78	72.38777	9.98
Age (80-89)	148359.9	6.23	124.1596	17.12
Age (90-99)	-28911.74	-1.11	139.2192	19.19
Age (99+)	-75893.74	-2.85	76.13666	10.40
(FTE/,000)	3279948	3.13	787.5648	2.12
(FTE/,000)^2	-2202191	-3.05	-535.9018	-2.09
Cons	-1036547	-2.71	-154.7641	-1.14
Adj. R-squared	0.9381		0.7352	

In terms of the regional variations that have been shown in the results, comparing with the base group (region 3), all the regions have lower total Medicare expenditure; however, regions 5, 6, and 7 have higher average expenditure. With regard to accessibility to Medicare service (i.e., the FTE variable), results show that both of the TEGP and AEGP increase with the FTE/Population ratio initially and start to decrease after FTE/Population ratio reaches a certain point.

Table4: Regression Results for Specialists

Inde. Variables	TESP		AESP	
	Coef.	t	Coef.	t
Patients	325.8816	50.00		
Year 99/00	4630.779	0.32	-0.6746094	-0.09
Year 00/01	4296.851	0.29	0.4962577	0.07
Year 01/02	53675.32	3.32	28.65529	3.58
Region 1	43797.1	0.68	-27.5752	-0.86
Region 2	-7709.819	-0.15	-41.86542	-1.63
Region 4	502.725	0.02	-22.70549	-2.48
Region 5	33603.95	1.43	-11.1518	-1.14
Region 6	15421.99	0.64	-0.8308646	-0.07
Region 7	52421.48	1.82	9.057681	0.69
Male	43273.82	4.15	33.17849	6.79
Age (0-1)	-18327.64	-0.60	-79.02521	-6.63
Age (2-9)	-244424.3	-9.19	-161.4062	-13.54
Age (10-19)	-252699.4	-9.70	-146.4276	-12.28
Age (20-29)	-113238.6	-4.45	-77.3366	-6.49
Age (30-39)	-161085.5	-6.61	-72.20799	-6.06
Age (40-49)	-168220.7	-6.97	-52.93125	-4.44
Age (60-69)	196158.8	7.98	74.03038	6.21
Age (70-79)	374285.5	15.04	157.5438	13.21
Age (80-89)	195828.8	7.11	149.1388	12.51
Age (90-99)	19681.99	0.62	46.85527	3.93
Age (99+)	13141.02	0.41	-67.5173	-5.52
(FTE/,000)	558194.6	0.34	-1571.006	-1.94
(FTE/,000)^2	-449791.1	-0.24	1879.788	2.01
Cons	-229346	-0.64	620.0911	3.52
Adj. R-squared	0.9540		0.7408	

As shown in Table 4, similar results were obtained for the Medicare expenditure by the specialists. The year 2001/2002 again shows the significant influence on both the TESP and AESP, which is consistent with the time when the spike in the expenditure trend happened. Different from the results of the general physicians, the male tend to have higher total expenditure and average expenditure on specialist services. For age variables, the results show that comparing with the base group, the people from older age groups spend more on Medicare services by specialists and people from younger groups spent less. In term of regional variations, except for region 2, all other health regions have higher total expenditures than region 3, but only region 7 has higher average

expenditure than region3. The result also says that the accessibility to the Medicare services by specialists significantly influence the expenditure on specialists at per patient level, but not the aggregate level.

#### IV. Conclusion and Discussion

From both the descriptive analysis and the regression results, we see both the total Medicare expenditure and the Average Medicare expenditure present an increasing trend over time, and age, gender, health region, and the accessibility of the Medicare system have been identified to affect Medicare expenditure in New Brunswick.

In spite of the intuitive results obtained from this study, there are a number of limitations that should be mentioned. First, the independent variables used were mostly categorical and can not be directly used as predictors; second, the analysis would be enriched with expanded sample period and more recent data; and finally, there is lack of quantitative variables such as social economic status and health status in the database for our analysis.

For future work, we plan to use the information on service types to explore Medicare expenditure by service types. By doing this, we can rank the expenditure by the type of services and further investigate the age, gender and regional distributions for a certain type of services.

As our regression results have shown, as well as a commonly known fact, the utilization of the Medicare service changes with age. New Brunswick has one of the oldest populations among all the provinces in Canada. According to the Atlantic Institute of Market Studies, during the next three decades, the proportion of the population aged 65 and over in New Brunswick will increase from 13.6% in 2001 to 18% in 2015, and 25% in 2025. This projected the dramatic change in the age structure in New Brunswick population will lead to higher expenditure on Medicare service. It is true that New Brunswick has severe aging problem, and although there have been some policies employed to deal with this social phenomenon; it is not a problem that can be easily solved in near future. If the aging population problem, which affects the Medicare expenditure, cannot be easily solved or relieved, how much the total Medicare expenditure are affected by the aging

population need to be projected in order to assure the system stay sustainable, and this would be helpful for managing the Medicare demand effectively. Supply side of the Medicare system has received a lot of attention in order to make the system run efficiently and smoothly. However, little attention is given to the demand side. The change of the population's health status and the change of the populations' demographic characteristics affect the Medicare expenditures, so well-managed the Medicare demand side is also important for the system to remain functional.

Of course, predicting and managing Medicare expenditure is a complicated but very important task to accomplish. But detailed analysis of the features of the Medicare expenditure in New Brunswick can help policy makers make more informed and cost-effective decisions.



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