

The Secondary Sex Ratio at Birth Was Depressed in Quebec by the Sovereignty Referendums

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Abstract

Introduction: Globally, male live births exceed female live births by approximately 3%. The secondary sex ratio is conventionally expressed as male births divided by total live births (M/T). Many factors have been implicated as influencing this ratio, such as stress (including non-violent political events) and toxins, both of which reduce it. The Quebec government twice proposed referendums to its populace advising sovereignty. This study was carried out in order to ascertain whether the referendums had any effect on the M/T ratio in Quebec and in Canada as a whole.

Methods: Annual births in Quebec and Canada were compared for the index (referendum) years 1980 and 1995 versus the sum of the preceding and following five year periods, for each event. The monthly M/T ratio for Quebec before and after the 1995 referendum was also calculated.

Results: This review covered 8 099 600 live births. In Quebec, the M/T ratio was lower in the two referendum years than in the preceding and following five year periods, and was significantly lower after the 1995 referendum ($P = 0.04$). No significant changes were noted for Canada as a whole. Monthly calculations for Quebec showed a decline in the M/T ratio three months after the 1995 referendum ($P = 0.035$), followed by a rapid recovery ($P = 0.001$).

Conclusion: The second Quebec referendum on sovereignty in 1995 had a higher voter turnout than the 1980 referendum and was more closely run. Reductions in the M/T ratio have been noted in association with stressful population events, including non-violent political activities. This may have been the case in Quebec, where the M/T ratio declined in association with two referendums that proposed sovereignty, possibly due to the stress engendered by these events and the potential outcomes.

Key Words: Canada, Quebec, birth rate, birth trends, infant, newborn, sex ratio, politics

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Résumé

Introduction : À l'échelle mondiale, le nombre de naissances vivantes de garçons dépasse le nombre de naissances vivantes de filles dans une proportion d'environ 3 %. Le taux de masculinité des naissances est classiquement obtenu en divisant le nombre de naissances de garçons par le nombre total des naissances vivantes (taux M/T). De nombreux facteurs exerçant un effet sur ce taux ont été identifiés, comme le stress (y compris celui qui est associé aux événements politiques non violents) et les toxines (ces deux facteurs entraînant une baisse du taux en question). À deux reprises, le gouvernement du Québec a proposé un référendum sur la souveraineté à sa population. Cette étude avait pour but de déterminer si ces référendums avaient exercé quelque effet que ce soit sur le taux M/T au Québec et dans l'ensemble du Canada.

Méthodes : Les naissances annuelles au Québec et au Canada au cours des années probantes (référendums de 1980 et de 1995) ont été comparées, dans chaque cas, à la somme des naissances annuelles des cinq années précédentes et des cinq années suivantes. Le taux M/T mensuel pour le Québec avant et après le référendum de 1995 a également été calculé.

Résultats : Cette analyse a couvert 8 099 600 naissances vivantes. Au Québec, le taux M/T a été plus faible au cours des deux années référendaires qu'au cours des quinquennats précédents et suivants; il a été considérablement amoindri à la suite du référendum de 1995 ($P = 0,04$). Aucune modification significative n'a été constatée dans l'ensemble du Canada. Pour ce qui est du Québec, les calculs mensuels ont indiqué un déclin du taux M/T trois mois à la suite du référendum de 1995 ($P = 0,035$), le tout ayant été suivi d'une récupération rapide ($P = 0,001$).

Conclusion : Un plus grand taux de participation a été constaté dans le cadre du référendum québécois sur la souveraineté de 1995, par comparaison avec le référendum de 1980; les résultats ont également été plus serrés en 1995 qu'en 1980. Des baisses du taux M/T ont été constatées en association avec des événements populationnels stressants, y compris des activités politiques non violentes. C'est ce qui a pu se produire au Québec, où les taux M/T ont connu un déclin en association avec les deux référendums sur la souveraineté, et ce, peut-être en raison du stress engendré par ces événements et leurs conséquences potentielles.

INTRODUCTION

Male live births narrowly exceed female live births globally by approximately 3%.¹ The secondary sex ratio is conventionally expressed as the number of male births divided by the number of total births, and is referred to as the M/T ratio. The reasons for the discrepancy in the sex distribution at birth are uncertain, but a large number of factors have been implicated as influencing this ratio.^{1,2}

Factors that reduce the M/T ratio (i.e., lead to relatively fewer male births) include toxins,^{1,2} privation and famine,³ natural calamities,⁴ short wars,⁵ and elements that induce stress in populations. Examples of the latter include political events such as terrorist attacks, as evidenced in New York after the attacks of September 11, 2001.⁶ The mechanism appears to be the spontaneous induction of intrauterine fetal death, which affects male fetuses more than female fetuses.⁷

These effects are noted even in extrauterine pregnancies; when such events lead to delivery of a live baby, there is a reduction in the proportion of males (to 37.5%).⁸ This may be due to the excessive loss of male fetuses, which are physiologically more vulnerable in the unusual and presumably more hostile extrauterine environment. The effects of stress on the M/T ratio may be quite powerful even in populations that are not directly threatened, as witnessed in California after the September 11 attacks (where the M/T ratio also fell).⁹

Non-violent political events have also occasionally been shown to lower the M/T ratio. For example, the M/T ratio in Cuba dipped sharply in three different years in response to legislation enacted in the United States.¹⁰ Democratic Maltese parliamentary elections have also been shown to lower the M/T ratio in that country.¹¹

Debates in Quebec advocating independence have loomed large in the province's politics. Indeed, the Quebec sovereignty movement comprises not only political aspects, but also an ideology of values, concepts, and ideas that champions sovereignty.¹²

Parti Québécois governments held referendums on the issue of secession from Canada in 1980 and 1995. Both had close outcomes and resulted in defeat of the proposal by a small margin, especially the second referendum on October 30, 1995.¹² This study was carried out in order to ascertain whether the referendums had any effect on the M/T ratio in Quebec and in Canada as a whole.

METHODS

Data for annual births in Quebec and annual births in Canada were obtained from the website of Statistics

Canada (StatsCan) for the period 1971–72 to 2013–14. Annual data were available for one-year periods ranging from July 1 to June 30 of the following year.¹³ Data for annual stillbirths in Canada and in Quebec were also obtained from Statistics Canada, and these were available up to 1991. Data were obtained for fetal deaths (20 weeks or more of gestation) and late fetal deaths (28 weeks or more of gestation).

Data analysis and charting was carried out using Microsoft Excel (Microsoft Corp., Redmond WA). The quadratic equations of Fleiss were used for the calculation of 95% confidence intervals.¹⁴ Chi-square tests were applied using the Bio-Med-Stat Excel add-in for contingency tables.¹⁵

Comparisons were made for the index (referendum) years versus the sum of the preceding and following five-year periods. Short periods were chosen because it is known that the M/T ratio demonstrates temporal cyclic changes.¹⁶ Thus, the referendum year 1980–1981 was compared with the totals for 1975–1976 to 1978–1979 and 1981–1982 to 1985–1986, and the referendum year 1995–96 was compared with the totals for 1990–1991 to 1993–1994 and 1996–1997 to 2000–2001.

Monthly births according to sex for Quebec were also obtained directly from the Centre d'information et de documentation of Institut de la Statistique du Québec (personal communication, Ms Brigitte Vaillancourt). These were analyzed for the period January 1994 to December 1996.

The data sources estimated a maximum of 2% error rates for various facets of both stillbirth and live birth data. However, this was not broken down into which variables trend towards this level of error and which have less inbuilt error. A *P* value ≤ 0.05 was taken to represent a statistically significant result.

RESULTS

Annual Analysis, Quebec and Canada, Both Referendums

In Quebec, there were 1 958 767 live births in total for the two study periods: 1975–1986 and 1990–2001. The total male birth count during this time period was 1 007 819 and the total female count was 950 948, giving an M/T ratio of 0.515.

In Canada during this time period, there were 8 099 600 live births in total. The total male birth count was 4 159 248 and the total female count was 3 940 352, giving an M/T ratio of 0.514. Results for the comparisons are shown in Tables 1 and 2 for Quebec and for Canada, respectively.

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