E-Muser (Enhanced Multiple Sclerosis Expected Rate): A Technical Improvement

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Abstract

Multiple sclerosis (MS) is an idiopathic chronic inflammatory disease that strikes the Central Nervous System (CNS). Moreover, it is the most diffused disabling neurologic disease, in fact about 12 * 103 new diagnoses/year arise in the United States alone. It is clear that the development of a MS predictive system is necessary, in order to have a reliable biostatistics tool to forecast the incidence value with a significant degree of accuracy in both time and space. Since the reached prevision time was equal to 1 year (namely 2019), the model was ameliorated by unpacking the considered and refined time period. The theoretical MS incidence for 2023 in Italy was calculated to be 12.17% (± 2.04), with a theoretical accuracy of 99.35% (± 1.02). It can be stated E-MuSER (Enhanced Multiple Sclerosis Expected Rate) could reach a higher dependability degree, as well as theoretical accuracy, with the respect to the previous model. Its efficiency will be assessed at the end of year 2023.

Introduction

Multiple sclerosis (MS) is an idiopathic chronic inflammatory disease that strikes the Central Nervous System (CNS). Moreover, it is the most diffused disabling neurologic disease, in fact about 12 * 103 new diagnoses/year arise in the United States alone [1]. Interestingly, MS incidence was found to be directly proportional to the the distance from the equator [2-4] and it was also assessed that such a value is approximately twofold in women, if compared to men [5]. Some studies suggest that the above cited latitude distribution may be decreasing [6-8] and it was found that the sexual ratio (female vs male) could even be augmented over time [9-11]. Observing such a scenario, it becomes clear that the development of a MS predictive system is necessary, in order to have a reliable biostatistics tool to forecast the incidence value with a significant degree of accuracy in both time and space.

Rationale behind E-MuSER (Enhanced Multiple Sclerosis Expected Rate) Model

The model's concept is based on a previous paper [12] in which a bran dew approach was proposed. It is the evolution of MuSER (Multiple Sclerosis Expected Rate) system [13], developed by analysing the Italian Multiple Sclerosis (MS) incidence within a 42-years long time period. Considering that Italy, as well as other Europeans countries, was proven to be ethnically homogeneous [14], it was taken as a starting area.

Methods & Results

Italian MS annual incidence data, among 1965 and 2007 [15], were used in order to build three dispersion graphs, subdivided by geographic area (Northern, Central and Southern Italy). After setting tendency lines and calculating both equations and R2 coefficients. Since R2 accuracies were too low, outlier data were cancelled and R2 factors higher than 0.90 were obtained, conserving a minimum n=5. Since the reached prevision time was equal to 1 year (namely 2019), the model was ameliorated by unpacking the considered and refined time period (Figure 1) for each area (Northern, Central and Southern Italy). Since MuSER reached a theoretical accuracy of 93.76% (± 2.43), with a reliability range of 1 year in the future (namely 2019), and the unpacked set mean value is equal to 96.56% (± 5.73), it was decided to employ this kind of approach to reach 5 years in the future, up to 2023 (Figure 2). The theoretical MS incidence for 2023 (Table 1) in Italy was calculated to be 12.17% (± 2.04), with a theoretical accuracy of 99.35% (± 1.02).
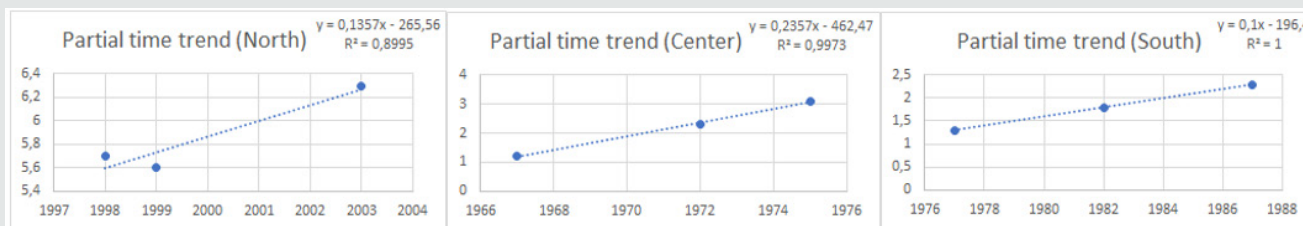
Figure 1: Unpacked dispersion graphs up to 1988 (mean year value), equations and R² coefficients.
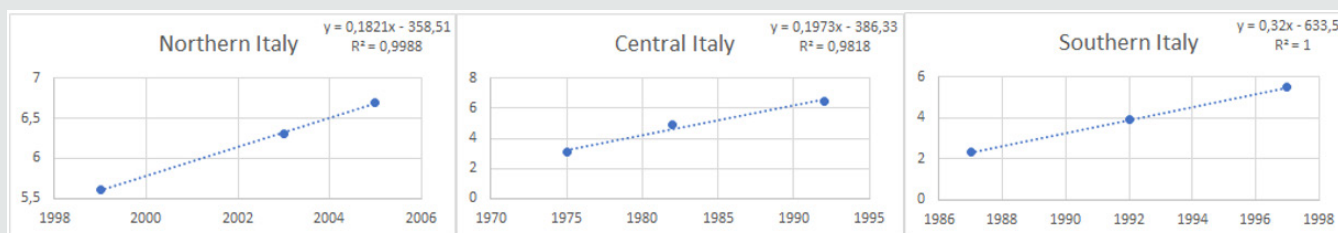

Figure 2: Unpacked dispersion graphs up to 1998 (mean year value), equations and R² coefficients.

Table 1: Expected Multiple Sclerosis incidence on 100 000 individuals, calculated for 2019.

Area	Incidence on 100 000	Expected accuracy	SD
Northern Italy	9,8783	99,88	-
Central Italy	12,8079	98,18	-
Southern Italy	13,82	100	-
Whole country	12,16873333	99,35333333	2,047108

Conclusion

It can be stated E-MuSER (Enhanced Multiple Sclerosis Expected Rate) could reach a higher dependability degree, as well as theoretical accuracy, with the respect to the previous model. Its efficiency will be assessed at the end of year 2023.

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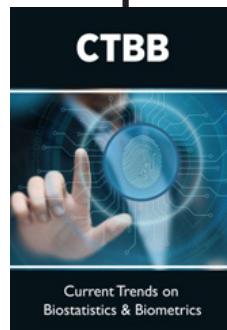
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84