SUMMARY

Aim. Bulgaria joined the European Union in 2007. This study aims to analyse Bulgarian scientific health output over a five year period before enlargement, highlighting both its interests and concordance with European health recommendations.

Methods. A bibliometric analysis was undertaken in MEDLINE between 2000 and 2004 according to a year-by-year bibliographic search. The articles were classified by fourteen fields according to the main European Union health report recommendations.

Results. 2,176 articles were found, distributed as follows: 15.63% in 2000, 20.50% in 2001, 20.63% in 2002, 19.9% in 2003 and 23.25% in 2004. 89.48% of the articles were written in English, 78.81% of the total scientific output was published abroad. Most of the articles were signed by Bulgarian authors and were carried out in Bulgarian research centers.

Conclusion. Increased number of articles was noted mainly in the basic research field and global clinical medicine. Bulgarian research priorities generally were aligned with the European Union health recommendations. More sources are recommended to be consulted and more analysis conducted of the Bulgarian research.

Key words: bibliometrics, health, research, scientific output, Bulgaria, European Union

INTRODUCTION

Significant interest in scientific research has been observed in recent decades in Europe, including health research (1). Several European countries increased their scientific output (SO) year by year and sometimes the scientists show their support for research through public demonstration (2–5). European union support for research has been demonstrated by financial investment, such as the 73 billion euro fund, of which 8.37 billions of euro were allotted for health research (6). The European Parliament (EP) has also proposed greater solidarity and increased international co-operation between countries in health issues (7). This could have a positive effect on research, since one of the factors which must be taken into account when discussing medical research in Europe are countries’ levels of SO, particularly when considering the specific characteristics of specific Member States. Since scientific research in Europe places great importance on the field of health and the European Union (EU) moved its boundaries to East, Eastern Europe is an ideal area in which to study this sector. The Balkan region requires greater attention, taking into account the lack of reforms, documented dysfunction in the field of health and the decrease in life expectancy after the 1990s in comparison with the ‘old’ Member States (8, 9). Bulgaria, where until recently the financial resources in the medical field used to be provided totally from central public funds under a national insurance scheme (10), is a country which economy changed post-1989, following the change of political regime. In spite of some difficulties experienced while seeking to meet the conditions for entry set by the European Council, which was closely monitoring the country’s progress, in 2007 Bulgaria became a new Member State of the EU (11). This did not exempt Bulgaria from continuing in its efforts to solve its health problems, such as modest conditions in mental health institutions or child welfare provisions (12), the declining Bulgarian population, infant and total mortality figures, tuberculosis, and ischaemic heart disease and stroke (13). The principal post-1997 health reform law was the Bulgarian Health Act 2004 (14).

The bibliometric analysis may allow the study of SO and/or its evolution, in national or international context, in specific or general field in accordance with specific period of time. The aim of this work was to study Bulgarian scientific health output retrieved from the database MEDLINE (accessed through PubMed) and to analyze its characteristics over a five year period, documenting both its tendency and its agreement with the EP’s health strategy by means of a bibliographic review.

MATERIAL AND METHODS

A bibliographical search of scientific articles about Bulgaria between 2000 and 2004 was carried out in MEDLINE (accessed through PubMed) as world’s largest medical library (15), leading online database of biomedical literature records and essential tool used by scientists and physicians to monitor research developments (16). The search was carried out by year using a basic search equation (BSE): ‘Bulgaria’. All abstracts of the articles added to MEDLINE between 2000 and 2004 were reviewed. Inclusion and exclusion criteria: Articles on Bulgaria in any field of research,
Table 1. EU Parliament main health objectives as per the 23 September, 2002 report targeting the period 2003–2008

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<td>1. Public health development (health promotion, improvement of health and life expectancy, public protection, fast reaction against the threat of disease, medical information, education, international solidarity and technological development)</td>
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<td>2. Global clinical medicine (clinical medicine topics)</td>
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<tr>
<td>3. Participation of Central and Eastern European countries in health programmes</td>
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<td>4. Basic research studies</td>
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<tr>
<td>5. Injury prevention and unintentional injuries</td>
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<td>6. Control and prevention of communicable diseases and AIDS</td>
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<tr>
<td>7. Prevention of drug consumption and dependence</td>
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<td>8. Studies into rare diseases</td>
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<td>9. Studies into the fight against tobacco consumption</td>
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<td>10. Studies into the fight against oncological disease</td>
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<td>11. Studies into mental health diseases</td>
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<td>12. Studies into cardiovascular disease</td>
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<td>13. Studies into the respiratory disease</td>
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<td>14. Studies into the effects of environment and pollution on human health</td>
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</table>

written by any author, carried out by any national/international research center and added to MEDLINE between 2000 and 2004 were included. Articles excluded were those which only listed the country along with others, or mentioned it only in insignificant examples (rather than specifically carrying out research on Bulgaria) and articles written by foreign authors in foreign research centers and simply published in Bulgarian journals. By using the search tag [pl] added to the term ‘Bulgaria’, a categorization by year according to the journal of publication was done classifying the articles into published in ‘national’ or ‘foreign’ journals. By using the language search option permitted by the database, the articles were also classified by year according to the language of publication as ‘Bulgarian’, ‘English’ or ‘other language’. After the application of the inclusion and exclusion criteria and for information purpose only owing to the difficulty to determine exactly this parameter, a classification by ‘Bulgarian’, ‘foreign’, and ‘Bulgarian and foreign’ authors was carried out to determine Bulgarian authors’ SO, foreign authors’ output about Bulgaria and collaboration between Bulgarian and foreign researchers.

The classification was carried out using by way of guidance the name(s) of the author(s), the language used, the research center and the journal in which it was published. The articles not signed by any author were classified into the ‘no author listed’ category. The institutions in which the studies were undertaken were also classified by ‘national’ center, ‘foreign’ center, bi/multi center (articles revealing more than one center in the affiliation section). When no center was mentioned in the affiliation, the references were classified as ‘no center listed’.

A synthesis of the most recent EP health report was carried out and summarised into fourteen objectives as per the 23 September, 2002 report, (17) targeting the period 2003–2008 (Table 1). To observe points of correspondence between Bulgarian health interests and to relate them to European health objectives, an agreement equation was drawn up, linking the European objective with the corresponding article. In the EP’s objective ‘Global Clinical Medicine’ were included those articles relating pathology or illness in any medical/health branch but not related to the unintentional injuries or injury prevention, or belonging to the field of communicable diseases and AIDS, rare/uncommon diseases, oncology, cardiovascular, respiratory and mental health (psychiatric and/or psychological) diseases, which were classified individually. The ‘Basic Research Studies’ category included all references referring to studies in the field of basic sciences (e.g. anatomy, physiology, histology, molecular biology, bio/physics, bio/chemistry, genetics, animal/laboratory studies etc.) but not in the field of the topics encompassed by the others EP’s objectives. All the articles were classified and the statistical analysis was carried out using the SPSS 14 program. Frequencies and percentages were determined and 95% confidence intervals (95% CI) were calculated. A classification reproducibility measurement was performed by using an agreement analysis obtained from two reviewers, measuring the kappa index. A kappa index of 0.79 (95% CI: 0.62–0.94) was obtained.

RESULTS

2,176 articles written mainly in English and Bulgarian were found between 2000 and 2004 according to the BSE, distributed as follows: 340 (15.63%; 95% CI: 14.10–17.15) in 2000, 446

Fig. 1. Scientific output (n) in Bulgaria by year between 2000 and 2004.
Table 2. Annual distribution of articles by SO, language and journal of publication in numerical (and percentage terms) according to the BSE

<table>
<thead>
<tr>
<th>Year</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>Total</th>
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<tbody>
<tr>
<td>Scientific output</td>
<td>340 (15.63)</td>
<td>446 (20.50)</td>
<td>449 (20.63)</td>
<td>435 (19.99)</td>
<td>506 (23.25)</td>
<td>2,176 (100)</td>
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<tr>
<td>Language</td>
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<tr>
<td>Bulgarian</td>
<td>20 (10.36)</td>
<td>100 (51.81)</td>
<td>41 (21.24)</td>
<td>10 (5.18)</td>
<td>22 (11.40)</td>
<td>193 (100)</td>
</tr>
<tr>
<td>English</td>
<td>315 (16.18)</td>
<td>338 (17.36)</td>
<td>397 (20.39)</td>
<td>420 (21.57)</td>
<td>477 (24.50)</td>
<td>1,947 (100)</td>
</tr>
<tr>
<td>other</td>
<td>5 (13.89)</td>
<td>8 (22.22)</td>
<td>11 (30.56)</td>
<td>5 (13.89)</td>
<td>7 (19.44)</td>
<td>36 (100)</td>
</tr>
<tr>
<td>Journal</td>
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<tr>
<td>Bulgarian</td>
<td>81 (17.57)</td>
<td>142 (30.80)</td>
<td>85 (18.44)</td>
<td>53 (11.50)</td>
<td>100 (21.69)</td>
<td>461 (100)</td>
</tr>
<tr>
<td>Foreigner</td>
<td>259 (15.10)</td>
<td>304 (17.73)</td>
<td>364 (21.22)</td>
<td>382 (22.27)</td>
<td>406 (23.67)</td>
<td>1,715 (100)</td>
</tr>
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</table>

DISCUSSION AND CONCLUSIONS

In the current study, approximately steady increase of SO was observed during the years studied (Figure 1). For every year studied, the majority of authors were Bulgarian; their numbers increased during the period studied. Collaboration between Bulgarian and foreign authors improved, almost doubling in 2002 and growing almost threefold in 2004 suggesting rising presence of the Bulgarian scientists in foreign research centres as a result of increased mobility among health care professionals in Europe (18, 19), increasing foreign interest in studying Bulgaria, or both. A growing number of Bulgarian research centers was noted, while the number of foreign research centers originating articles remained approximately constant. Likewise, despite a peak production in 2001 of articles published in Bulgarian, the use of this language decreased after this year meanwhile an increase of the articles written in English was observed. The increased use of English as language of publication even in a national context was noted in some other countries as well; Kevelaitis and Grabauskas (20) pointed out in a study carried out between 2001–2006 an increase of English as language of publication in Lithuania.

When related to EU health recommendations for 2003–2008, the basic research field was best covered, followed by global clinical medicine. Satisfactorily, the SO focusing Public Health is the third classified, considering Bulgaria’s difficulties in this area as revealed in some studies (11, 21, 22, 23). Given the prior data relating to the past development of and future predictions for HIV/AIDS and sexually transmitted diseases in Eastern Europe...
and in some specific ethnic groups in Bulgaria (24, 25), a good interest on the Bulgarian research in this area was noted. Given the worrying development of oncological disease in Bulgaria that have been observed last years (26, 27), local research was found to have paid satisfactory attention to this field. Clinical medicine focuses its interest on the cardiovascular sector as this represents another problem which Bulgaria had to face during its transition period, bearing in mind the high levels of problems such as stroke, which incidence is particularly high in certain regions of Bulgaria (28). Further some research interest on the mental health was also noted. Some data mention that this country has enacted legislation to develop health services rendered to people with mental problems in agreement with the European Commission’s requirement for ‘increased efforts’ to improve environment in mental health institutions (12). Despite of the concerning data on tobacco consumption in Bulgaria and their negative consequences for people’s health (29, 30), there was a low level of interest in research in this area. Taking into account that the Eastern European countries experienced similar post-1990s transition difficulties it is considered positive and constructive to promote the interest in research and collaboration among Central and Eastern European health programs. Like other former post-socialist countries in the region, Bulgaria had a healthcare system chronically short of funds; its medical sector having been entirely financed by the government (10). The SO of any country may be related to the countries’ economic status, the poverty in countries undergoing post-socialist transition being widespread limiting human development (31). The source of funding of the health field is an important aspect; in 2004 the total health budget in Bulgaria represented only 8% of the Gross Domestic Product (GDP) (32) while the average of the same parameter was 9.2 and 15.4 in the EU 15 countries and USA respectively (33).

Given the fact that the methodology used in this work might leave out data published in journals not visible in the database chosen for this study, more sources are recommended to be consulted and more research to be conducted by using bibliometric studies. Analysis of the Bulgarian SO (post EU enlargement) focusing on research interest and trends, collaboration and/or other parameters are also recommended. Studies using similar methodology have assessed SO in basic sciences such as molecular biology, and total SO over a set period of time in relation to health policies (34, 35). Similar Iberian studies were carried out to assess research in specific medical areas or in fields such as communication and health in both national and international contexts (36, 37).

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REFERENCES


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