

**SHORT THESIS FOR THE DEGREE OF DOCTOR OF
PHILOSOPHY (PHD)**

Title

**ANALYSES OF THE HEALTH IMPACT OF THE
PREVENTIVE ACTIVITIES OF THE HUNGARIAN CARE
MANAGING ORGANIZATION**

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**UNIVERSITY OF DEBRECEN DOCTORAL SCHOOL OF
HEALTH SCIENCES**

DEBRECEN, 2020.

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The PhD Defense takes place at the Lecture Hall of Bldg. A,
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1. INTRODUCTION

After the change of regime in Hungary every government has tried to transform and rationalize the health care system.

One of the most comprehensive experimental forms of this attempt was the implementation of the managed care system called Hungarian Care Managing Organization (Hungarian abbreviation: IBR) between 1999 and 2008.

The effects of IBR on the health of the cared population are unquestionable, but the analysis of the health impact of the program has not been completed so far.

Meditres Ltd., the care organizer in Kecskemét was a member of the IBR right from its inception. The area covered by Meditres Ltd. extended to the northern and central regions of Bács-Kiskun County during the extensions of the application. During its operation the care manager in Kecskemét aimed at designing preventive programs in a way that the data generated during the work could be analysed and processed by scientific means. This gave us the opportunity to get a picture of the health effects of the program in the Central Hungarian region.

In the dissertation we processed the results of two complex prevention programs focused on cardiovascular prevention. The first program made it possible to assess the cardiovascular risk status of the population in the area covered by the care organizer.

Using the same study, in order to analyse a more cost-effective cardiovascular screening strategy, a high-risk population was selected by pre-screening the general practitioners' database, and the selected patients' cardiovascular risk status was compared with the risk status of a randomly selected population.

During the implementation of the complex prevention program the assessment of the cardiovascular risk status of the population was followed by health education, diagnostic and care activities in accordance with current professional guidelines. We would like to explain the long-term effects of the program through mortality data, which is one of the most important characteristics of the health status of a population.

In our other study we focused on the screening and complex treatment of obesity. The treatment of obesity requires a lot of effort from both the care system and the patient. The basis of an effective management of the disease is complex treatment, which includes regular health checks, the detection and treatment of the associated risk factors, complications and co-morbidity, and complete lifestyle changes. In our work we describe the effectiveness of the complex lifestyle change program implemented by the care organizer in this population.

In our later work participating in an international co-operation, we analysed the correlation between weight gain – during life and in women during pregnancy and menopause – and high blood pressure

and/or diabetes mellitus. We were curious to find out what the critical periods for the development of metabolic syndrome in adulthood are, in which the weight loss treatment should be started. This issue is particularly important because a process takes place almost before the general practitioner's eyes, in which the patient becomes overweight or may become obese, and then the associated diseases develop in later years.

2. LITERATURE REVIEW

2.1 A general overview of the managed care system, the international antecedents of the Hungarian experimental model

In pure managed care systems, the service provider receives a fee calculated by the insurer based on the capitation fee and the number of the contracted population. The care providers work with their own and contracted doctors, and purchase services. The key to the operation of the managed care system is the cost factor. The principle of the managed care system is that money follows the member, whether they are patients or not.

The managed care system was developed in the United States, where the so-called HMO (Health Maintenance Organization Act 1973) was a major change, which promoted the development of the managed care system. Another international antecedent of the Hungarian IBR is the

British GP (general practitioner) fundholding system, in which the general practitioners are in the focus. They receive the money by which they provide the basic care and conclude a contract with the hospitals for outpatient care and diagnostic tests, and manage the pharmaceutical support amount. They are allowed to spend their savings on developing their own practice under strict rules. This can make it possible to provide as definite care as possible in their own practices, which is an additional cost-reducing factor, while the role of GPs is also strengthened.

Managed care systems use a well-defined set of tools that allow them to deliver extra performance compared to traditional forms of supply. The elements of this are rigorous patient management, patient path tracking, creating and strictly following protocols, and information technology, which is essential to achieve the functions detailed above.

2.2 An introduction to the Hungarian Care Managing Organization

In 1999 the Hungarian Care Managing Organization was launched in Hungary as an experimental model, and was later expanded into the Hungarian Care Managing Organization System (Hungarian abbrev. IBR), which was essentially an adaptation of a managed care healthcare system to Hungarian conditions.

The declared objective of the IBR was to create an efficient system of care and funding for justified health-based needs, emphasizing primary and secondary prevention of diseases and the remediation of diseases near the place of residence.

The basic concept of the experiment model was closer to the British fundholding system, with regard to its organizational structure and operational logic, but also integrated the American managed care toolkit.

At that time, the National Health Insurance Fund (Hungarian abbrev.: OEP) concluded a financing contract with service providers for a managed care experimental model, and for this purpose a tender was issued.

With the winning care providers, who were referred to as ‘care managers’ in the model, they opened a virtual invoice at the time the financing contract was signed, which was called a ‘theoretical current account’ in the system. The income of the account was calculated on the basis of the adjusted capitation fee calculated for that population. On the expenses side of the theoretical current account was the amount of the real expenses of the actual health care used by the population involved, irrespective of where the insured person used the service. The care organizers received direct funding to cover the costs of running the program and to implement the required prevention programs. It should be emphasized that the rules of care for the population involved did not

change, which affected the right of free choice of doctors and the rules for the actual financing of service providers.

In order to calculate the sources and expenses sides of the theoretical current account, it was important to get the most accurate data from the general practitioner system to the financier. For this reason, IBR's care managers had to make significant improvements in both the software and hardware side of their IT system; and the record of the B300 item report used today was gradually developed. The IT development also made tracking and analysing patient paths an important element of managed care. Other elements of managed care also appeared in IBR: protocols covering all levels of care had to be developed and presented to general practitioners, and a quality assurance system was put in place.

2.3 Prevention in IBR

It was the responsibility of the care organizers involved in the organization of IBR to undertake the preventive activity, by which they joined the 'Johan Bela National Program of Decades of Health'. In accordance with the priorities of the Public Health Program, in case of children obesity, healthy bodily and mental development, and respiratory allergies were in the focus. In the case of adults, cardiovascular diseases, including obesity and metabolic diseases, and smoking, and the prevention of cancer were the priorities.

2.3.1. Secondary prevention-screenings

For the participating general practitioners, the care organizers encouraged the screening required by law. The family physicians did not only document these activities but reported monthly and quarterly to the OEP through the care manager.

2.3.2. An overview of the results of the prevention activity carried out by IBR participants

The results of the preventive work can only be read in the reports on IBR's work, and there is little literature available. The most significant source is the reports of screening activities. Valuable and comparable screening data were only available to the National Health Insurance Fund and the managed patient care system organizers from September 2000.

2.3.3. An analysis of the screening not performed by GPs according to the law

There are three types of screening of major public health-related diseases: breast screening, cervical screening and colorectal screening. The data of patients going through screening were sorted out from the outpatient care data received by the National Health Insurance Fund. In my work I present the results of three priority screening, mammography, cervical and colon screening.

2.4. OBJECTIVES OF THE DISSERTATION

The main objective of the dissertation is to analyse the health impact of the activity of the Hungarian Care Managing Organization on the basis of the following two cardiovascular prevention programs organized by the care organizer of Kecskemét:

1. 2006-2009 – A program for assessing the cardiovascular risk status of the supplied population. Analysing this we were looking for answers to the following questions:

- A characterization of the cardiovascular risk of the population participating in the programs based on relevant anthropometric and laboratory data.
- Analysing a more cost-effective cardiovascular screening strategy. A high-risk population was selected by pre-screening the general practitioners' database, and the selected patients' cardiovascular risk status was compared with the risk status of the randomly selected population based on the SCORE cardiovascular risk assessment system.
- A prospective comparison of the participating practices and regional and national mortality data. In addition to the crude mortality rates of the population, we also analysed the standardized mortality indicators.

2. 2003-2006 – A program for the screening of overweight and obese patients and for a specific protocol lifestyle therapy.

- The effects of the treatment focused on lifestyle changes based on defined professional guidelines on the cardiovascular risk status of overweight or obese patients.

3. Another objective was to examine

- the relationship between the pace of growth from young age and the development of diabetes mellitus or hypertension,
- in addition, the relationship between weight growth in women during pregnancy, delivery and menopause, and the development of diabetes mellitus and hypertension.

3. METHODS

3.1. AN ANALYSIS OF CARDIO-VASCULAR SCREENING IN THE GPs' PRACTICE

In the course of our work, we analysed the screening activity of the participating GPs by processing the data of the cardiovascular prevention program organized by the care manager in Kecskemét. The main aspects of the analysis were:

- assessing the cardiovascular risk status of the population involved in screening,

- a comparison of cardiovascular risk status of pre-screened and randomly screened patients
- an analysis of mortality in the settlements involved in the prevention program.

Inclusion criteria:

It was a *general criterion* that only patients who did not suffer from known cardiovascular disease and diabetes mellitus were allowed to participate in the program.

The pre-screening criteria of the pre-screened group were that the patient had not been to the GP for more than two years, and they were over the age of 55 with males and 65 with females, or there was a family history of cardiovascular events (acute myocardial infarction, stroke), or they were smokers, or they had a BMI > 25 kg/m².

The *control group* included random screened individuals who met the general inclusion criteria.

Screening activity:

Patients were asked to fill in a form containing the following information: personal medical history, cardiovascular diseases and diabetes mellitus in the patient's family history, patient lifestyle issues: smoking, alcohol consumption, physical activity. We recorded the results of anthropometric measurements such as height, body weight, BMI (body mass index), waist circumference and relevant laboratory

results (blood sugar, cholesterol, triglyceride, HDL, LDL cholesterol, hsCRP). The patient's SCORE was automatically calculated by the GP in possession of data recorded or downloaded into the computer.

Intervention:

The intervention was dependent on the patient's cardiovascular risk status. The cardiovascular risk status was determined based on the recommendations of the current 5th Hungarian Cardiovascular Consensus Conference and the SCORE system included therein. The following ways of intervention were applied:

- The patient is healthy, has a low cardiovascular risk, and their lifestyle is healthy. We discussed the elements of a healthy lifestyle with them, there was no intervention.
- The patient is healthy, has a low cardiovascular risk, but their lifestyle is unhealthy. For patients, we formulated an individual lifestyle recommendation that was discussed with their GP.
- With patients with high cardiovascular risk, the therapeutic target values were determined according to the consensus conference recommendations, and the family doctor initiated the necessary lifestyle changes and, if necessary, medication.
- Cardiovascular diseases or diabetes mellitus discovered during the screening were treated by the patient's general practitioner in accordance with the current Hungarian recommendations, if necessary, with the help of outpatient care.

Mortality data

Following the completion of the program, general and cardiovascular mortality data for the screened population were surveyed between 2006 and 2012. Data were compared with national and regional data on basis of the data of the 2011 census.

3.2. THE EFFECTS OF THE INTERVENTION ON DIET AND LIFE CHANGE ON THE CARDIOVASCULAR RISKS STATUS OF OVERWEIGHT AND OBESE PATIENTS

Inclusion criteria

Patients with BMI above 25 kg/m² appearing in the surgery time of own GP were entitled to enter the program.

Patient involvement and evaluation of exclusion criteria (secondary causes of weight gain) were performed based on a surgery examination and available patient documentation.

Following the inclusion, a data sheet was filled out containing patient's personal information, lifestyle issues (regular exercise, smoking habits, alcohol consumption), nutritional characteristics, known diseases, and medication.

From the patients' cardboard BMI, waist circumference, blood pressure and pulse (resting and post-squat load) were recorded, as well as the results of laboratory tests: fasting serum cholesterol, HDL, LDL cholesterol, triglyceride, blood sugar.

Intervention

Patients received personalized advice from a dietician, physiotherapist, and internist during the program.

Control

At the end of the 3rd month, BMI, waist circumference, resting and exercise blood pressure and pulse were measured. At the end of the 6th and 24th months, besides the measurement of BMI, waist circumference and resting and exercise blood pressure and pulse, the development of fasting blood glucose, cholesterol, triglyceride and HDL cholesterol was also examined.

3.3. EARLY AND MENOPAUSAL WEIGHT GAIN AND ITS RELATIONSHIP TO THE DEVELOPMENT OF DIABETES AND HYPERTENSION

The target group was patients aged 60-70 who, for any reason, visited their GP, and who then were asked to fill out a questionnaire marking their body weight by decades from the age of 20, and also marking

separately when their weight was the greatest. In addition, we asked for their height at 20 and at the time of selection. In addition to the above, female patients were asked to write their first pre-pregnancy weight, their last child-birth weight and their pre- and postmenopausal weight. Body weight data were refined based on the GPs' cardboard records, if there were any data.

In addition to the above, we recorded the history of diabetes mellitus, hypertension disease and the time of diagnosis from the patient's medical history.

The validity of the self-reported data was verified by measuring the patient's weight by the general practitioner and, in case of a 3-kg or greater deviation, the patient's data were removed from the analysis.

The study protocol was translated into English for every foreign research site, and they translated it into their mother tongue.

4. RESULTS

4.1. AN ANALYSIS OF CARDIOVASCULAR SCREENING IN THE GPs' PRACTICE

4.1.1. Characteristics of the screened population

A total of 4,462 individuals were screened in the program, 1,977 men and 2,485 women. The average age of the screened population was 47.4 years (median: 49 years), 47.9 years for men and 47.1 years for women.

There were interestingly low rates of cardiovascular disease in the family history data of the screened population. The proportion of overweightness in the population was 39.6%, and the proportion of obesity was 23.7%. The proportion of overweightness and obesity was similar to the Hungarian average. By examining the genders separately, we found that overweightness and obesity among men are close to the national average, while the proportion of obesity among women was lower. In women, the average of the waist circumference was over 88 cm. Among the lifestyle characteristics, a high proportion of men who consume alcohol regularly should be highlighted.

4.1.2. The distribution of the screened population according to the SCORE cardiovascular risk assessment system, and the distribution of high-risk patients for cardiovascular diseases

According to the SCORE system, 266 patients with high cardiovascular risk were screened during the program. (Based on SCORE, cardiovascular risk is 5% or greater).

According to the recommendations of the 5th Hungarian Cardiovascular Consensus Conference, we also reviewed the data of patients with cardiovascular risk below 5% based on SCORE classification, and found that further 78 patients could be classified as having a high cardiovascular risk due to a serious cardiovascular risk factor.

4.1.3. Results obtained by comparing the two screening models (pre-filtered and randomly screened patients)

3,420 patients (1,508 men and 1,902 women) were in the pre-screened group, and 1,042 (465 men and 577 women) in the randomly screened group. The mean SCORE in the pre-screened group was 1.82, while it was 0.55 in the randomly screened group (mean difference 1.27, $p < 0.001$).

4.1.4. Mortality data

Aggregated mortality data were collected from participating practices after the program was completed. The average tracking time was 7.15 years. Mortalities for any reason and cardiovascular mortality data were collected separately. We collected data from 4,182 patients. A total of 158 patients died in the screened population during this time, total mortality was 5.7 per thousand (national 12 per thousand), 46 patients in the screened population died from a cardiovascular disease, resulting in a 1.3 per thousand death rates (national 6.4 per thousand).

We also calculated the mortality rates of the partaking settlements during and after the program in cases of death for each possible reason. We found that after the end of the program, mortality increased in both sexes, more significantly in women.

4.2. THE EFFECTS OF THE INTERVENTION IN DIET AND LIFE CHANGE ON THE CARDIOVASCULAR RISKS STATUS OF OVERWEIGHT AND OBESE PATIENTS

We included 2,489 people, 1,623 women and 866 men. Their average age was 49 years.

437 (18.6%) patients with a metabolic syndrome participated in the program. Of the patients enrolled, 1,793 (72%) reached their 12-month visit and 901 (36.2%) completed the program.

Changes in physical test results

1. BMI:

In the first year, a significant decrease of 0.56 BMI ($p < 0.001$) was observed, while in the second year a smaller decrease of 0.0088 BMI (n.s.) was observed.

2. Waist circumference:

In the first year of follow-up, the waist circumference did not change significantly or decreased slightly in most subjects. In the second year a non-significant decrease occurred on an average of -0.04cm/year.

3. Rest and Exercise Blood Pressure and Pulse:

In the first year of follow-up, the mean decrease in resting systolic blood pressure was 5.9 mmHg/year. ($p < 0.001$). In the second year there was a further decrease with a negligible, non-significant excess: an average of 0.11 mmHg/year.

At the beginning of the follow-up, systolic blood pressure increases were normal distribution with good approximation. During the first year there was a small but significant increase (mean = + 1.9 mmHg/year, $p < 0.001$); during the second year we saw a slight, not significant decrease (mean = -0.1 mmHg/year).

The pulse rate values given to the load showed a significant increase during the first year (mean = 2.3/min/year, $p < 0.001$), no significant decrease was observed during the second year (mean = -1.0/min/year).

Changes in metabolic parameters

1. Blood Sugar:

In the first year, the mean blood glucose levels decreased significantly (mean change = -0.15 mmol/l/year, $p < 0.001$), and decreased further in the second year (mean change = -0.19 mmol/l/year, $p = 0, 03$).

2. Cholesterol:

In both years, the cholesterol levels decreased in the majority of subjects. The changes are significant. In the first year the change is:

average = -0.23mmol/l/year , $p < 0.001$; in the second year: average = -0.07 mmol/l/year , $p = 0.02$.

3. Triglycerides:

Triglyceride levels decreased on average by 0.18 mmol/l in the first year ($p < 0.001$), and in the second year a further but not significant decrease (mean = -0.08 mmol/l (n.s.)) was observed.

4. HDL Cholesterol:

HDL cholesterol levels were minimal but showed a significant decrease due to the high number of cases (mean = $-0.0118\text{ mmol/l/year}$, $p < 0.001$).

4.3. EARLY AND MENOPAUSAL WEIGHT GAIN AND ITS RELATIONSHIP TO THE DEVELOPMENT OF DIABETES AND HYPERTENSION

Of the 815 patients (319 male and 496 female), 733 (286 male and 447 female) patients' data were complete and ready to be processed. Almost 80% of the participants were overweight or obese, especially in groups with diabetes mellitus. Men with diabetes mellitus usually showed the highest weight gain early in their 20s and 30s, both in kilograms and compared to themselves at 20 years of age. The weight of patients with hypertension was higher at all ages than that of the control group, but there was not always a significant difference.

Increasing body weight in the first decades (20-40 years) is a significant risk factor for the development of diabetes mellitus. (OR = 1.49; p = 0.017; 95% CI: 1.07-2.08)

Even more significant weight gain occurs in the patient groups when compared to the healthy control group. The highest body weight gain among non-diabetic men was between 30 and 40 years of age, while in diabetic patients it was between 20-30 years of age and in the last decade before the diagnosis of diabetes. Similar, but less characteristic changes were observed in women.

In women, changes in body weight around giving birth and menopause influence the development of metabolic diseases. The mean weight at the last childbirth and at menopause is significantly correlated with the risk of developing diabetes mellitus and hypertension. There is no significant relationship between the number of children and weight changes.

5. DISCUSSION

5.1. AN ANALYSIS OF CARDIOVASCULAR SCREENING IN THE GPS' PRACTICE

5.1.1. An analysis of the cardiovascular risk status of the examined population

In order to plan the primary preventive intervention, the cardiovascular risk status of the population living in the area and the distribution of lifestyle and measured parameters should be known.

Looking at the cardiovascular risk status of the population we investigated, based on the SCORE estimate, it can be said that two thirds of the population are at low cardiovascular risk. However, differences can be detected by examining the individual risk factors.

The mean blood pressure values and mean laboratory values were in the normal range. Within the category of character of lifestyle, the proportion of male smokers was 20%, and that of women was 10.7%, both below the Hungarian average of 26%. The same applies to the average rate of alcohol consumption in women, while we found a higher than average proportion in men. Overall, the cardiovascular risk status of the examined population is characterized by low risk status, but obesity is higher among men.

5.1.2. A comparison of the two screening models

Cardiovascular risk estimation methods help to detect high-risk patients, but we need to do a lot of negative tests to screen high-risk patients. Obviously, the costs are high, which raises the question of whether there is a method for filtering out high-risk patients with less effort but with the same efficiency.

In our work we compared two screening approaches: using the GPs' database to address pre-screened and endangered patients based on certain criteria (pre-screening). Based on the average SCORE value we found significantly more patients with high cardiovascular risk than in the randomly filtered group. In practice, this means that about ten times as many patients need to be screened by random as the pre-screening method to find a high-risk patient.

5.1.3. An analysis of mortality data

Another aim of our work was to analyse the impact of the program on the mortality of the affected population. During the processing of the aggregated mortality data, a significant reduction in mortality was found in all causes as well as in cardiovascular mortality.

Investigating the settlement distribution of mortality data, we found that mortality rates in the area covered by the participating practices were, in most cases, significantly below the data of individual settlements.

At the same time, the monitoring of mortality data showed that mortality data deteriorated after the completion of the IBR, and this change was significant for women.

5.2. THE EFFECTS OF THE INTERVENTION IN DIET AND LIFE CHANGE ON THE CARDIOVASCULAR RISK STATUS OF OVERWEIGHT AND OBESE PATIENTS

Among cardiovascular risk factors it is obesity that the treatment of requires the inclusion of good nutrition and physical activity in the patient's daily lives for a long-term success. During the lifestyle program, changes in the physical status and metabolic parameters of patients were observed. In the first year, mandatory checks were more frequent, while in the second year there were only end-of-the-year checks. BMI declined in both years, but more significantly in the first year. Interestingly, the change in waist circumference followed this trend slower and a significant change was only possible to be shown at the end of the second year. It is questionable when the reduction of waist circumference really started.

In addition to the change in BMI, another important result of our preventive work was that the resting systolic blood pressure values decreased by an average of more than 5 mmHg by the end of the first year, and to a lesser extent, but this trend continued in the second year. We also achieved a favourable change in metabolic parameters.

5.3. EARLY AND MENOPAUSAL WEIGHT GAIN AND ITS RELATIONSHIP TO THE DEVELOPMENT OF DIABETES AND HYPERTENSION

In our work we attempted to show the stages of adult age when significant weight gain may be predictive of diabetes and/or hypertension disease at a later age.

Body weight and BMI increased in the entire study population until their seventies, with a slower pace after their fifties. The rate of weight gain was the highest in diabetic patients both in itself and compared to their body weight at the age of 20. Looking at the decades, the highest increase in non-diabetic individuals was in the fourth decade, whereas in the case of diabetic individuals it was in the third decade. This phenomenon was more pronounced in men. Weight changes in hypertensive patients were also higher than in the healthy group. Patients with diabetes mellitus and hypertension experienced weight gain earlier than those with only one disease.

In women, weight gain during the last childbirth and menopause increases the risk of developing diabetes mellitus and/or hypertension.

6. SUMMARY

The managed care program launched in Hungary was a comprehensive experimental model focused on the entire Hungarian healthcare service.

By 2005, 2.2 million people were enrolled in IBR through their GPs, which was 22.5% of the Hungarian population at that time. The analysis of the health impact of IBR is absent; we can only find general descriptions in the literature, which mention the essence of the programs, the number, the age and gender distribution of participants of the different prevention programs, and the number and the proportion of the screened population. At the same time, the health effects of prevention programs implemented by care managers are unquestionable for the involved population. In my dissertation I analyse the health impact of the prevention programs carried out by the care manager of Kecskemét.

High cardiovascular mortality and obesity are a serious public health problem in Hungary, and the screening of patients and their treatment require significant work.

A further examination of patients with a high-risk profile using different pre-screening methods (medical history, questionnaire) may make a number of tests unnecessary. In our study, we detected a significantly higher average cardiovascular risk status in the pre-screened population, which indicates the cost-effectiveness of the method.

Mortality data were lower in the population of the participating practices compared to national data. The prevention programs primarily focused on cardiovascular diseases, and their mortality data also shows their effectiveness.

The prevention and treatment of obesity was also in the focus of the prevention work of the care organizer. In the dissertation I analyse the results of this work, which show that a strictly controlled therapy based on defined professional guidelines significantly reduces the cardiovascular risk of the participants. In connection with the treatment of obesity, I also present a study with international contribution aimed at analysing the relationship between the degree of the weight gain and diabetes mellitus and/or hypertension. Based on the results of the study, the target group where the treatment of obesity should be started as intensively as possible can be identified.

Based on the analyses presented in the dissertation, it can be stated that a professionally well-organized, financially supported prevention work can significantly improve the cardiovascular risk status of the population.



Registry number:

DEENK/162/2019.PL

Subject:

PhD Publikációs Lista

Candidate: Csaba Móczár

Neptun ID: JRKE70

Doctoral School: Doctoral School of Health Sciences

List of publications related to the dissertation

1. **Móczár, C.**, Rurik, I.: Hungarian Managed Care initiatives between 2000 and 2007: regional health outcomes of the Hungarian Care Organizations.
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Total IF of journals (all publications): 10,736

Total IF of journals (publications related to the dissertation): 3,429



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