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# DOCTORAL DISSERTATION

# SUMMARY

# ASSOCIATIONS AND DISPARITIES BETWEEN INDIVIDUAL, POPULATION, HEALTH SYSTEM FACTORS AND COLORECTAL CANCER IN THE CONTEXT OF THE DEMOGRAPHIC TRANSITION


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## SUMMARY

Cancer is a major public health problem because it is a substantial cause of mortality and morbidity globally. Colorectal cancer is one of the main forms of cancer, especially in industrialized countries. Colorectal cancer is one of the most common forms of cancer, and is also a leading cause of death from cancer worldwide. There was a 9.5% increase in incident cases and a 13.5% increase in mortality between 1990 and 2017. One of the biggest concerns is that the incidence of colorectal cancer increases in proportion to the age of people, and this will increase in the future with the ageing population and the increase in global life expectancy at a much faster rate than in the past. Although the incidence is already very high, substantial growth above the current level expected in multiple regions will have a major impact on public health globally.

On the basis of these arguments, this thesis indicates the need to understand the different dimensions and relationships between individual indicators and those of the demographic, economic transition and indicators of the health system and the burden of colorectal cancer.

**Chapter 1.** *The introduction* chapter lays the foundations for the other chapters of the current thesis. Its structure discusses the global burden of colorectal cancer and the effect of demographic transition (ageing population and increased life expectancy) on this type of cancer, the tendency being to increase this burden. Multiple disparities in patients with colorectal cancer contributing to this burden globally and individually and which must be addressed through scientific-based public health interventions and policies and focused on specific population subgroups at risk have also been discussed.

The average lifespan at birth of humans increased dramatically from 50-60 years at the beginning of the last century, to about 80 years in most developed countries. During the same period, we see in recent years an increase in the burden of malignant diseases, especially in the elderly. Because cancer is a disease of ageing population, increased incidence and mortality rates of colorectal cancer are specifically attributable to the population over 50 years of age. About 90% of incident cases and deaths globally occurred above this age.

The disparities of patients with colorectal cancer, from risk factors to treatment and survival rate, are the cumulative result of inequalities throughout the healthcare of these patients. This duration includes the existence of risk behaviours, preventive early detection interventions and screening programmes, diagnosis, treatment and monitoring. People with low socio-economic status are more likely to have structural and economic barriers to access

health services and even have a health care or health insurance provider. That's why accessibility to health care contributes a high proportion to the disparities encountered in the burden of colorectal cancer.

In order to reduce disparities in the incidence and mortality of colorectal cancer, strategies are needed to reduce risk and improve early detection and treatment programmes. The majority of reported interventions focused on improving accessibility to pre-existing health services, but not enough attention was paid to improving community healthcare, which includes promoting healthy lifestyles, increasing literacy, screening, diagnosis and curative measures as scientific evidence-based interventions.

**Chapter 2.** "Retrospective*comparative analysis at European and national level of the demographic and economic transition of the health system"* provides new information on the national context of the demographic transition and the health system compared to the context of the European Union and what has been the evolution of the multiple demographic and health indicators. From the results described in this chapter we can infer that the sustainability of the national health system is at risk by the evolution of the demographic transition and the trend of decreasing the resources of the current health system (human, financial and structural).

**Introduction.** Romania's health system faces massive underfunding compared to other EU member countries. Health spending accounts for only 5.2% of GDP in 2017, compared to the rest of the Member States with an average of 9.8% of GDP, and the total annual budget is 6 times lower than the EU average. Population projections for the next 30-40 years predict a continuous increase in life expectancy, and with this an increase in the impact of health spending on the total budget, as well as an increase in the dependency ratio in old age.

The objective of this study is the comparative, descriptive and time-series analysis of the most recent data of the Statistical Office of the European Union "Eurostat" and the National Statistical Institute on the demographic evolution of the population and the current state of the health system in order to identify the main socio-economic and health differences between the data of the Member States of the European Union and Romania. This study provides an interesting opportunity to promote our knowledge of Romania's current external context (comparatively at European level) and to highlight the main needs of the Romanian population according to the relations between health system and demographic indicators.

**Research methodology.** This study uses ecologic methodology, using secondary published data at national level by the National Statistical Institute, compared to the data published by the Eurostat Statistical Office in other Member States of the European Union. This

study carried out the comparative descriptive analysis by time series of population statistical data in Romania and EU averages. The indicators included in the analysis are grouped into two main categories: demographic transition indicators and resources (human, structural and financial) of the health system.

**Results.** As regards to the natural growth, it became negative in Romania between 1990-1995 and shows a downward trend that began in the 1970s. Compared to the EU, during the period 1970-1990 Romania showed a higher natural growth, but after the change of the political system, although the European and national trend is decreasing, its slope is more pronounced for Romania, and the natural increase in the EU only turned negative in 2015. A similar trend is present for the birth rate, which is decreasing at both national and European level, and in 2015 its values become roughly equal. In terms of mortality, unlike in the EU where this rate is constant, in Romania its trend shows a worryingly steady increase over the period. It turns out that the average dependency ratio at European and national level has an increasing trend. The ratio of healthy years of life as a percentage of life expectancy is 78.9% in Romania, and in the European Union 78.5%. It was observed that the difference is nevertheless increased between the EU average and Romania for both indicators. The difference is relatively equal between the EU and Romania averages for both indicators, being 5.7 years for life expectancy in 2018, and 4.2 years for the number of healthy years at birth.

The European and national trend is to decrease the number of hospital beds. Compared to the EU, the number of hospitals reported to 100,000 citizens in Romania is lower, but the trend is growing. Although the national capacity of hospital beds per 100,000 inhabitants is higher than the European one, the number of hospitals is much lower. Looking at the number of hospitals by form of ownership, we see that the number of public hospitals decreased from 1990 to 2017. Romania has a number of doctors per 100,000 inhabitants musch lower than the average of this indicator in the 28 Member States of the European Union. Although the number of doctors per 100,000 inhabitants has increased since 1990 from 168 doctors per 100,000 inhabitants to 298 doctors in 2017, we still do not approach the average EU values of around 350 doctors per 100,000 inhabitants.

The expenses of the Romanian and European public health care system are analysed below. Spending in the Romanian healthcare system has the highest increase in 2012-2017 compared to other countries in the European Union, although Romania also reports the lowest current expenditure per capita during this period. The increase in the budget allocated to health per capita increases in Romania by 57.7%, from 313 EUR in 2012 to 494 EUR in 2017, and

during this period the average increase at European level was 14.85%. While this increase is encouraging, the per capita budget is reduced compared to the 2017 European Union average of 2887 EUR.

**Discussions and conclusions.** In the current health system, we see a major underfunding and a consistently lower trend over time compared to the European Union than the EU average of the resources of this system (human, financial and structural). In the future, Romania's economy will face a problem, it will have a high share of the third-age people and an insufficient workforce to fuel the economic growth needed to finance the health and social system. In the future, the pressure on the health system will be even greater, given the ageing population and the retirement of part of the workforce. In view of the results of this study, we can see that there are multiple trends that endanger the long-term sustainability of the health system in Romania, among which the most relevant indicators is the ageing of the population with the consequent increase in demand for health services and the increase in the ratio of economic dependence.

**Chapter 3.** "The*comparative analysis at the level of romania's development regions of the influence of macroeconomic indicators and the Romanian health system on the life expectancy at birth of Romanian citizens" complements* the previous chapter and identifies, compares and synthesizes indicators of demographic transition and health system at the level of Romania's macro-regions of development. The results identified in this chapter demonstrated the socio-economic and health system inequalities within Romania, which should be addressed in order to increase the performance of the health system in socio-economically disadvantaged and weak areas from the point of view of the health system. At the same time, life expectancy at birth differs between different macro-regions and we have shown that it is associated with certain socio-economic indicators and health infrastructure. This requires multiple interventions and political involvement due to the potential implications for Romanian citizens.

**Introdation.** Life expectancy at birth in Romania is one of the lowest in the EU, although the slope is upward, we still cannot compare ourselves to the other industrialised countries in this political and economic union. Life expectancy at birth is an indicator of the performance of health systems, economic and social development. A recent published study on life expectancy in development regions in Romania confirms that there are significant correlations between economic and social development and life expectancy at birth at territorial level.

The objective of this study is to understand the different dimensions and relationships between demographic transition indicators and health system indicators by comparing Romania's development regions and identifying significant statistical correlations between life

expectancy at birth, health, macroeconomic and demographic system indicators and synthesizing information into main dimensions to observe disparities and similarities between development regions.

**Research methodology.** This study uses an ecologic methodology, using secondary and aggregated data collected at national level by the National Statistical Institute. The analysis of the data includes the statistical correlation using Pearson bivariate correlation methods between life expectancy at birth and health system indicators, such as costs, infrastructure and health care personnel in each development region, as well as macroeconomic indicators such as education, social assistance and average salary at the level of the development regions NUTS 2 in Romania: North-West, North-East, Central, Bucharest-Ilfov, South-East, South-West, South-West, South and West. In the next stage, an analysis was used by applying the principal component analysis to study the discrepancies and similarities between the development regions in terms of the factors influencing life expectancy in Romania and to obtain an overview of the direction and intensity of the relations between these variables.

**Results.** There are important differences between the variables analysed between the regions of Romania, there are areas with high performance and others with very low performance for most population and macroeconomic variables. The biggest difference can be seen in the unemployment rate which can be five times higher between regions. Although with less obvious variation the life expectancy, the level of education, the average monthly net earnings and the social assistance pension have differences from 1.3 to 1.5 times higher between development regions. Another great variation in variables can be seen in the annual health budget per capita between regions, which may be 3.6 times higher than the minimum. It can be seen how it ranges from 1432.73 RON in the North-East region to 5188.16 RON in the Bucharest-Ilfov region, and the average of the regions, excluding Bucharest is 1919.60 RON, being well below the national average. The same is true of the number of doctors per 100,000 inhabitants with a difference of 3.7 times greater then the minimum. Bucharest-Ilfov region is the best performing in terms of indicators of the health system (number of hospitals, number of outpatients number of family medicine offices, number of beds in hospitals, medical staff).

The budget allocated for health services per capita, the average monthly net salary, the budget allocated to social assistance pensions, the number of people who have completed secondary or tertiary education, the infant mortality rate are statistically correlated with life expectancy at birth. It can be inferred that in regions with a higher budget for health services, which spend more on average monthly wages and pensions for social assistance, and where the

population is more educated, citizens' life expectancy is higher compared to the situation of development regions where a smaller budget is allocated.

In order to identify the differences and similarities between the development regions of Romania from the perspective of macroeconomic indicators and those describing the health system, the principal component analysis was used in order to reduce the complexity of the data. Factor 1 is very negatively associated with infant mortality and population proportion with primary or secondary secondary education and shows a positive association with the number of family doctors, nurses and midwives and family medicine physicians reported per 100,000 inhabitants. Factor 1 also presents a positive relationship with economic indicators: earnings, the amount of average per capita expenditure for health and social assistance pensions. Factor 2 has an extremely positive relationship with natural growth, and an extremely negative relationship with the mortality rate per 1000 inhabitants. Also, the number of hospital discharges and the number of hospitals and outpatients per 100,000 inhabitants were positively correlated with factor 2, and the unemployment rate negative.

**Discussions and conclusions.** This study identified the current state of territorial disparities in Romania, and for these disparities we predict that disparities will increase between regions with urban centers where medical infrastructure is developed compared to other regions, where life expectancy does not show the same trend of ascent. In view of the increased impact on the health system system, it is recommended that the future investments of the Romanian Government need to focus on the decrease of differences between development regions and be focused on the system's resources, but also on the population through increased income and social protection. The current thesis identified the main differences between the development regions in Romania in terms of the life expectancy of citizens and the socio-economic indicators and the health system, exemplified how certain socio-economic and health system indicators are correlated with and influence life expectancy in the 8 regions of Romania. Current results confirm that socio-economic inequalities between regions translate into disparities in the health status of the population.

**Chapter 4.** "The *incidence and mortality of colorectal cancer and their relationship with health determinants, health service-associated factors and the Human Development Index in the Member States of the European Union"* reports the burden of colorectal cancer in the European Union, but at the same time explores multiple factors that could be associated with it. In previous chapters, the demographic transition, the resources of the health system and the level of socio-economic development have been treated in comparison at national and European

level, but also by time series, and this chapter fills the gap between the relationship of some indicators of these aspects with the burden of colorectal cancer. The current trend in the burden of colorectal cancer is unevenly changing between the various Member States of the European Union, and this is strongly associated with the Human Development Index and its components and the resources of health systems. In some population subgroups, we have demonstrated the correlation between mortality and certain health determinants. We have also shown that life expectancy at birth and the number of MRI machines per 100,000 inhabitants are independent predictors for colorectal cancer mortality.

**Introduction.** Colorectal cancer is one of the main forms of cancer especially in industrialized countries. This type of cancer is one of the largest indicators of the transition of cancer, for which we can see in countries undergoing demographic and socio-economic changes the replacement of cancers associated with infection with cancers that are predominantly associated with Western lifestyles. This type of cancer is already common in countries with an increased standard of living.

Geographically, the burden of colorectal cancer is highest in developing countries and is growing in developing countries. The survival rate differs drastically between nations with different socio-economic levels, as it depends in the foreground on the stage of neoplasia at the time of diagnosis, and the lack of effective screening programs or underfunding of health systems can cause the diagnosis to delay. International comparisons show that there are wide differences between the Member States of the European Union, the environmental factors associated with health services, but also in socio-economic development. It is also known that the incidence and mortality of cancer is decreasing in developed, upward countries and mortality has a developing trend in developing countries.

The research objectives are: (1) tonalize data on the burden of colorectal cancer in the EU and the possible indicators associated with it (health determinants, health service-related factors, and those associated with human development), with the ultimate result of identifying the main differences between Member States; (2) analysis of the data using Pearson bivariate correlation methods to identify the main statistically significant correlations in the incidence and mortality of colorectal cancer and the possible indicators associated with them in the European Union and (3) the description of indicators that are significantly correlated with colorectal cancer mortality in the European Union and a linear multiple regression model is used to identify the main factors that single-way influence the dependent variable.

**Research methodology.** This chapter presents an ecologic study examining the burden of colorectal cancer in the Member States of the European Union to assess the objectives listed in the previous sub-chapter. This cross-country benchmarking uses aggregated country-level reported data, which different organisations have published regularly for multiple countries. In the current investigation, the effects of health determinants, health service-related factors and the Human Development Index on the mortality and incidence of colorectal cancer in European Union countries are assessed.

**Results.** According to current results, a strong correlation exists between the standardised death rate of colorectal cancer with the Human Development Index (HDI) and its components in the European Union in 2018, but these results do not apply to the standardised incidence rate. Among the dimensions of the HDI, life expectancy at birth, the expected number of years of schooling and GDP per capita have a significant negative correlation with standardised colorectal cancer mortality in the EU. The current thesis identified that the countries of the European Union with the highest incidence rate are Hungary, Slovakia and Poland. According to linear regression, in European Union countries, for every increase in the number of magnetic resonance devices per 100,000 inhabitants, the mortality rate decreases by 2,088 deaths per 100,000 inhabitants. Another significant predictor is life expectancy at birth, where the mortality rate is observed to drop by about 0.5 deaths per 100,000 inhabitants for each additional year of life expectancy at birth.

**Discussions andconclusions.** This study makes an important contribution to the research of colorectal cancer in the European Union, one of the world's regions with the highest standard of living, but also of industrialisation, resulting in an increased burden of colorectal cancer. Thus, we can promote knowledge about the current context of colorectal cancer in the European Union and raise awareness of unmet needs at European level according to the relationship between the burden of colorectal cancer in each country and the resources of the health system, the determinants of health and the level of human development.

The incidence and mortality rate of colorectal cancer varies significantly worldwide, with specific gradients based on the human desolation index. This is why colorectal cancer is considered a clear marker of cancer transition in countries that are in an economic transition zone. There is a tendency of increased burden especially in low and middle income countries and a trend of stabilisation or decrease in highly developed countries where however rates remain some of the highest globally.

**Chapter 5.** "*Analysis of the administrative data of a regional hospital in Cluj County on the health of patients with colorectal cancer"* tries to identify the characteristics and disparities faced by patients with colorectal cancer according to their age category in a hospital in Cluj County, and finally proposes a predictive model to solve the differences in discharge results in the health status of patients diagnosed with this form of cancer, by knowing the predictors of the state on discharge. These predictors could then be used to plan the discharge of a colorectal cancer patient, increase efficiency, improve resource allocation and reduce the negative outcomes of these patients. In this chapter we have revealed contextual gaps in the health outcomes of some age groups and the services offered to them.

**Introduction.** Based on GLOBOCAN's 2018 estimates of the incidence and mortality of colorectal cancer produced by the International Agency for Cancer Research (IARC), colorectal cancer ranked second in Europe in incidence and mortality, with over 500,000 new cases diagnosed in Europe alone and 243,000 deaths. A significant problem identified is the high average age of hospitalized colorectal cancer patients in Romania. A study in Romania reported that the majority of patients with colorectal cancer are over 60 years of age, and the median age at diagnosis is 72 years for women and 68 years for men.

People born from 1955 will start retiring from 2020 and will increasingly need health care due to a longer life expectancy. Fertility rates are below the replacement level, life expectancy and the share of the population over 65 are increasing. There will be a growing demand for healthcare, pensions, while economic growth could fall.

In the reports of the National Statistical Institute entitled "Predicting the elderly population of Romania in territorial aspect, by 2060", it is specified that Romania's 65-year-old and elderly population will increase from 3,467,500 in 2016 to 3,730,700 people in 2060 if the values of life expectancy, fertility and migration in 2015 are maintained. But the most plausible option on the demographic transition is an increase of up to 4,090,600 people, an increase of about 18 percent compared to 2016.

Elderly patients often have chronic comorbidities and negative health outcomes associated with post-curative morbidity and mortality. Elderly patients with colorectal cancer who are discharged do not frequently receive adequate care, including assistance for functional deficits, social and emotional assistance and economic resources to manage their post-curative medical recovery. In addition, when post-discharge healthcare plans do not adequately address deterioration of physical function, there is an increased risk of re-internment, leading to increased expenditure on patients and healthcare systems. On the basis of these arguments, it is

suggested to identify the characteristics at the individual and system level in order to achieve better results in the healthcare of patients with colorectal cancer in Romania.

This study proposes the following objectives: (1) Exploring socio-demographic, administrative and clinical characteristics and related to the surgical treatment of patients with colorectal cancer in order to identify disparities in the age of patients in relation to these characteristics; (2) Investigation of possible associated factors and predictors for the condition of patients at the exernation of hospitalized patients for the diagnosis of colorectal cancer.

Knowing this information would enable the identification and creation of a series of strategies that could help to improve the quality and effectiveness of the ways of diagnosing, treating, rehabilitating and planning the discharges of patients with colorectal cancer, especially the elderly.

**Research methodology.** This secondary analysis is carried out retrospectively using data from the medical register of the Regional Institute of Gastroenterology-Hepoatology Prof. "Octavian Fodor", Cluj-Napoca. The hospital database contains clinical, demographic and administrative data from 2009 to 2018 for all patients of the institute. Cases of colorectal cancer over the age of 18 years, which have been admitted to a total of 9009 patients. These patients are those who have been medically assisted in one of the following clinical sections of the Institute: gastroenterology, internal medicine and general surgery, during their hospitalization. The data collection period shall run from January 2009 to December 2018. This database includes 23 variables divided into 3 main categories, including: socio-demographic data, administrative data on admission and discharge and clinical data.

Descriptive statistics were developed for all socio-demographic variables as well as for the administrative and clinical data of the 9009 subjects included in the analysis. As regards the inferential analysis between socio-demographic, clinical and administrative data, the Chi-Square test was used to calculate the size of the effect. A binary logistic regression model was developed to identify the predictors and their impact on the general health of patients diagnosed with colorectal cancer when they were discharged from the hospital. It was used between the various independent variables and the dependent variable, encoded as subjects with aggravated, stationary or deceased discharge status (1) and improved discharge or cured patients (0).

**Results.** Of all patients with colorectal cancer, 4405 subjects (48.9%) were under 65 years of age, 4074 (45.2%) between 65 and 79 years of age, and 530 (5.9%) are over 80 years of year. The age of patients with colorectal cancer is between 18 and 97 years, and the average age of the sample is 64.08 years (DS = 10.89). The following aspects can be observed: the

share of colorectal cancer is higher in the male population (57.9%) than in the female group (42.15%), but there are no differences between the gender ratios between the different age groups (X2 = 0.306, p = 0.858). Most patients (51%) were in the 55-69 age group, while only a minority of 17.2% were between 18 and 54 years old. In 2009, a total of 560 patients were discharged (6.2%). A maximum of 1213 discharged patients (13.5%) are reached in 2017, with a further 1085 cases (12%) to be discharged in 2018. There are significant differences between the share of women and men each year between 2009 and 2018. Although the ratio of women to men is about 4:6 each year, the share of women increases progressively from 38.6% in 2009 to 44.4% in 2017, and the share of men decreases from a value of 61.4% in 2009 to 55.6% in 2017 (X2 = 21.12, p = 0.012), which denotes a possible equalization of the gender share in the following years.

From the administrative data on the hospitalisation of the patients presented in the following table, a semnicative difference by age group of the admission criteria is observed. The share of those who are admitted for medical-surgical emergencies and life-threatening situations increases with age, and those who are admitted for diagnosis, treatment and monitoring decreases in the older age groups. Also, the majority of patients (49.2%) were admitted to hospital on the basis of a referral note from the family doctor, followed by those who were sent by a specialist doctor (28.3%). The majority of cases were admitted to the general surgery wards (62.2%), while 19.3% and 18.5% were admitted to the gastroenterology unit and the internal medicine unit respectively. The proportion of patients who have been admitted to the various clinical and surgical wards of the hospital can be observed, whether or not they have undergone surgery and their transfer to the ward from which they were discharged. The length of hospitalization increases with the age of patients from an average of 5.31 days (DS =5.16) for people between 18 and 24 years of age to an average of 9.21 for people over the age of 80. The average length of hospitalization shows a steady downward trend between 2009 and 2018 from an average of 10.16 days (DS = 7.55) in 2009 to 6.36 days (DS = 6.536) in 2018. The share of patients discharged under 7 days increases from 27.9% of all patients discharged in 2009 to 64.3% in 2018.

In the case of diagnosis on discharge the total share of malignant tumors of the colon, including those that exceed the colon or have an unspecified localization in the colon) represents 53.7% of the total share of colorectal cancer, and rectal cancer represents 46.3%. Differences in diagnosis are observed on discharge depending on the age category. The share of cancer cases of the proximal colon increases with age, while the diagnosis of tumors of the distal large

intestine is maintained constantly. As regards the decision to perform surgery, the share of discharged patients who have had surgery is 60%. Thereare significant differences between age groups in the decision to intervene surgically, with a share of 66.6% of patients over 80 years of age and 56.3% for patients under 65 years of age ($X2 = 51.375$, $p< 0.000$). The highest rate of surgery was for tumors that exceeded the colon (N = 189, 82.2%), followed by rectal cancer (N = 2527, 60.5%) and approximately equal weight for proximal colon cancer (N = 1231, 59.8%) and distal (N = 1415, 59.7%).

Certain socio-demographic, clinical and administrative data from the medical registry database have been identified and included as predictor variables in a binary logistic regression model. The analysis was carried out to assess the impact of these factors on the likelihood that the colorectal cancer patient would be discharged with an aggravated or stationary state of health upon discharge or to die during the hospital stay (negative or neutral health results) or discharged with improved or cured health status upon discharge (positive health results). The model applied with all preachers was significant, with $\rho 2 = 819.626$ ($df = 9$, $N = 5238$, $p < 0.0001$. The overall accuracy of this model to predict with an estimated probability of 0.5, patients with an aggravated state of health on discharge is 82%, which indicates that this model can distinguish between the health outcomes of patients admitted and diagnosed with colorectal cancer.

Administrative data related to a higher probability of this result were discharge from a surgical ward, submission to a surgical procedure of the patient and a shorter period of hospitalization. The probability increases by more than 6.5 times for the patient who has had a surgical procedure during hospitalization. Also, compared to those who were discharged from the gastroenterological or internal medicine ward, those discharged from a surgical ward were approximately three times more likely to have a stationary/aggravated state of health. Apart from these factors, another important variable is the duration of hospitalization. The logistic regression model showed that patients hospitalized under seven days were more than twice as likely not to improve their health. These results may shed new light on the effect of hospital life on the state of health upon discharge.

**Discussions and conclusions.** Colorectal cancer is largely a disease of aging. In general, old age is the demographic predictor for negative results of patients on discharge. Other authors have also identified that older age is a consistent predictor for re-internment of patients after colorectal surgery. At the same time, the capacity of the Romanian health system is under pressure due to limited financial resources, the demographic transition of the population and

the high rates of cancer, in addition, the results of this study indicate that elderly patients discharged from the hospital are more likely to have inadequate discharge results, thus limiting the well-being of these patients in the long term. Although a prolonged length of hospitalization is often with postoperative complications, advanced age and peroperative complications, our findings on early discharge raise problems with the risk to the health of patients at the time of discharge and therefore on rates of reinternation and postoperative morbidity.

I have identified demographic, and new hospital characteristics with an applicable potential that can predict poor results of colorectal cancer upon discharge to a regional hospital in Romania. More importantly, in this activity, we have identified contextual gaps in the results between certain demographic groups and the health services provided to these patients. Hospitals should take these indicators into account and direct additional interventions and resources to improve morbidity, mortality and other outcomes of patients with colorectal cancer. With the ability to predict during hospitalization the outcome of discharge after a short period of hospitalization for patients with this disease, we can increase the efficiency of patient management in thesefacilities.

**General conclusions.** This thesis comprises five chapters about the ageing population and colorectal cancer as public health problems and increased burdens on society. In this respect, I have chosen to discuss this issue from various perspectives, such as geographical distribution, the association of this pathology with the economic and demographic transition, but also from the perspective of health systems and their ability to influence the burden of this disease and from the perspective of patients diagnosed with this form of cancer. In view of the results of the current thesis, I have contextualized the burden of colorectal cancer at multiple levels (European, national and regional) and in association with various factors (individual and systemic). The trend of increasing life expectancy and ageing of the population will become increasingly common at global, European, national and regional level and is strongly associated with socio-economic development. It needs to be addressed by government authorities to increase financial efforts to combat the cancer epidemic, in particular colorectal cancer, and to reduce the disparities faced by patients with colorectal cancer, the community of which the health system as a whole is a part.

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