NTNU – Trondheim
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Socio-metabolic analysis of the specialist health care sector infrastructural stock in Norway

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Master in Industrial Ecology
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MASTER THESIS

for

Maren Cathrine Lundhaug

Spring 2015

Socio-metabolic analysis of the specialist health care sector in Norway
En sosio-metabolsk analyse av spesialisthestejeneste sektoren i Norge

Understanding the socio-economic metabolism - *which is defined as the study of the magnitude, patterns and drivers of the society-nature interactions that determine the satisfaction of human needs* - can prove to be an important approach to decoupling social and economic growth from materials, greenhouse gasses (GHGs) emissions, and other environmental impacts.

The satisfaction of human needs and the socio-economic metabolism has a strong link to the demand and supply of services offered and covered by the population as well as to the development, maintenance, and use of the built environment. Therefore, there is a need for increasing the number of studies that address both areas with the population as a driver.

Currently, there are abundant data and models on demographic development and specific age-related needs over time, but these have not been integrated into MFA and stock dynamics studies and models. And, although there are increasing studies of the residential/household sector and the building stocks of housing, other sectors and associated building stocks have remained unexplored. Hence, the proposed study will address this gap by using a type-cohort approach to population and its link to the built environment using one specific diagnosis that is treated in the specialist healthcare sector in Norway as a case study.

The need for specialist healthcare is very much connected to the demographics of the population, with age and gender as the main determinants. The service of specialist healthcare is provided by the Norwegian state, which has been structured in four health districts that must provide the service for the inhabitants within the geographical region.

Statistics Norway has estimated that in 2050 1/5 of the Norwegian population will be over 67 years. This could trigger a higher employment and infrastructural demand in the health sector since the tree main reasons for spending more time than 24 hours at a hospital, when excluding childbirths, are all diagnoses that have a higher probability of occurring as you get older. These diagnoses are circulatory diseases, cancer, and muscles and skeleton diseases

The following tasks are to be considered:

1. General description of the structure of the Norwegian specialist healthcare sector.
2. Literature review of indicators and statistics of the Norwegian specialist health care sector.
3. Literature review of studies on specialist healthcare services from a socio-economic perspective, and on specialist healthcare infrastructure stocks.
4. Selection of a specific diagnosis/disease for the case study development based on data availability and finding of the literature review processes.
5. Development of a quasi-stationary MFA model for the specialist health care sector in Norway - emphasizing on the selected diagnose - using, if possible, a type-cohort-time approach. Standard MFA methodology must be followed, and a clear system definition and mathematical model are the main expected outcomes of the thesis. The focus of the model will be on population stocks and flows within and across the different diagnose-related processes differentiating users and suppliers. The following subtask should be carried out during the model development:
    a. Characterization of population demographics in Norway with emphasis on the selected diagnosis from a type-cohort approach for one recent year or, if possible, several years.
    b. Characterisation of the demand of labour force (suppliers) types associated to the selected diagnosis for one recent year or several years. Include cohort differentiation if possible.
    c. Quantification of the mathematical model for at least one recent year, and eventual validation of the model. If possible, health-district differentiated quantification is to be carried out.
    d. If possible, quantification of the mathematical model for one user/patient's cohort or more, and eventual validation of the model. Historical diagnosis-dependent population information is required for this task.
6. If possible, development and further quantification of a mathematical expression that describes the demand for infrastructure connected to the diagnose and treatment of the selected. A preliminary characterization of the diagnosis-related building stock (infrastructure) for one recent year or several years would be required.
7. Analysis and interpretation of the results, considering among others the following questions:
    a. Which parameters tend to remain constant and which ones are growing or shrinking over time?
    b. Where could the nation face challenges or opportunities in the future if the current trends continue?
8. Write a thesis report.

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Within 14 days of receiving the written text on the master thesis, the candidate shall submit a research plan for his project to the department.

When the thesis is evaluated, emphasis is put on processing of the results, and that they are presented in tabular and/or graphic form in a clear manner, and that they are analyzed carefully.

The thesis should be formulated as a research report with summary both in English and Norwegian, conclusion, literature references, table of contents etc. During the preparation of the text, the candidate should make an effort to produce a well-structured and easily readable report. In order to ease the evaluation of the thesis, it is important that the cross-references are correct. In the making of the report, strong emphasis should be placed on both a thorough discussion of the results and an orderly presentation.

The candidate is requested to initiate and keep close contact with his/her academic supervisor(s) throughout the working period. The candidate must follow the rules and regulations of NTNU as well as passive directions given by the Department of Energy and Process Engineering.

Risk assessment of the candidate's work shall be carried out according to the department's procedures. The risk assessment must be documented and included as part of the final report. Events related to the candidate's work adversely affecting the health, safety or security, must be documented and included as part of the final report. If the documentation on risk assessment represents a large number of pages, the full version is to be submitted electronically to the supervisor and an excerpt is included in the report.

Pursuant to "Regulations concerning the supplementary provisions to the technology study program/Master of Science" at NTNU §20, the Department reserves the permission to utilize all the results and data for teaching and research purposes as well as in future publications.

The final report is to be submitted digitally in DAIM. An executive summary of the thesis including title, student's name, supervisor's name, year, department name, and NTNU's logo and name, shall be submitted to the department as a separate pdf file. Based on an agreement with the supervisor, the final report and other material and documents may be given to the supervisor in digital format.

☐ Work to be done in lab (Water power lab, Fluids engineering lab, Thermal engineering lab)
☐ Field work

Department of Energy and Process Engineering, 11. February 2015

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Abstract

We often do not mentally connect the provision of services like healthcare and education to the emissions of greenhouse gasses. Because we often do not regard the service of healthcare as a physical product, disregarding the materials involved. In addition, there is a knowledge gap of understanding how demographics and the populations demand for services affects the throughput of materials and energy in the social metabolism, which further relates to greenhouse gas emissions.

The service economy we currently have in Norway calls for new methods for understanding how we affect and interact with our environment.

In an attempt to assess part of this gap, we have built two models for the service of treating and investigating colorectal cancer in Norway. A sector that is expected to account for 174,2 billion NOK in 2015 and are under an enormous pressure of delivering a high level of service to the population, with a low cost and within a limited timeframe.

To do this we have looked at the overall treatment capacity in Norway for 2013 and built scenarios for 2040, in an attempt to understand how the aging of the population will affect the demand for treatment. Our second model looks at waiting times for colorectal cancer treatment, due to data availability this is built as a conceptual model exemplifying how we can model waiting times. Both models are only conducted for the patient flow, due to data availability.

Essential in both is the understanding of where the emissions occur; we therefor have three layers in our model (1) the patient layer, (2) the employment layer and (3) the infrastructure. And it is in the third layer in which we interact with our environment.

Although we have not gotten as far as assessing the two other layers we have used this as a basis for how to move forward with this research. However, our results for the patient layer clearly shows that there is a need for long-term management in the healthcare sector. In addition, that by 2040, as the age distribution differs from 2013, we will need more healthcare personnel and more infrastructure if we aim to provide the same level of service as we currently do.

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1.0 Introduction

The environmental challenges we face today are a direct consequence of industrialization and our increased level of affluence [1]. The economy, a building block in our society, enables us extract materials form the biosphere, hydrosphere and lithosphere and utilize them for diverse human needs. This allows us to maintain and further develop the society and our standard of living [1–4]. This throughput of materials along with their transformation in our society are defined as the socio-economic metabolism, or our social metabolism [5–7]. The first to apply a concept of a societal metabolism was Marx and Engels in Das Kapital, where they used the term to describe the process of labor, which by them, are the core driver for the exchange of materials between man and nature [3,8].

Highly developed countries are characterized by having a so-called service economy [9]. In such economy we demand more of services like transportation, communication, education, retail distribution and healthcare among others [9]. This also has a high significance for employment and in highly industrial countries like Norway for instance it is estimated that approximately 70% of the population is employed in service related professions [9].

Currently there is a knowledge gap in the understanding of how demographics and the population demand for services affect the throughput of materials and energy in the social metabolism, which further relates to greenhouse gas emissions and other environmental impacts.

We often do not mentally connect the provision of services, like healthcare and education, to the emissions of greenhouse gasses. Because we often do not regard the service of for instance healthcare as a physical product, disregarding the materials involved. Demanding the service itself does not yield any emissions. It is in the supply of the service where the emissions occur, very often through the infrastructure and equipment – and their associated materials and energy – required for the provision of the service.

To partially bridge this gap, we aim to apply the method of Material Flow Analysis (MFA) to the Norwegian healthcare service sector – a sector that is expected to account for 174,2 billion NOK in 2015, corresponding third largest post on the Norwegian stage budget [10] – by the development of a case study on “the service of treatment and investigation of colorectal cancer patients in Norway”. The case study builds on the postulate that to connect services to the throughput in the social metabolism it is necessary to understand the interconnectivity

between patients, employment and infrastructure, as shown in figure 1. To in the end reduce the greenhouse gas emissions, the efficiency of the current and future throughput in the social metabolism is vital. This implies efficiency in the throughput of patients, efficient usage of employment, and efficient usage of materials in health related infrastructure. Due to data limitations in the material provided to us by the Norwegian Cancer Registry (CR) and the available statistics through the Norwegian Statistical Office (SSB), we will only assess the patients' layer. Nevertheless, this thesis will set the basis for further work on the topic.

We in this thesis define that a service contains 3 components, or layers shown in figure 1.

(1) Population demanding the service, in this case patients needing colorectal cancer treatment.
(2) Supply of the service, the population required to provide the service, employment of healthcare related personnel in this case.
(3) Infrastructure requirements, here in the form of hospitals and other health related infrastructure and equipment.

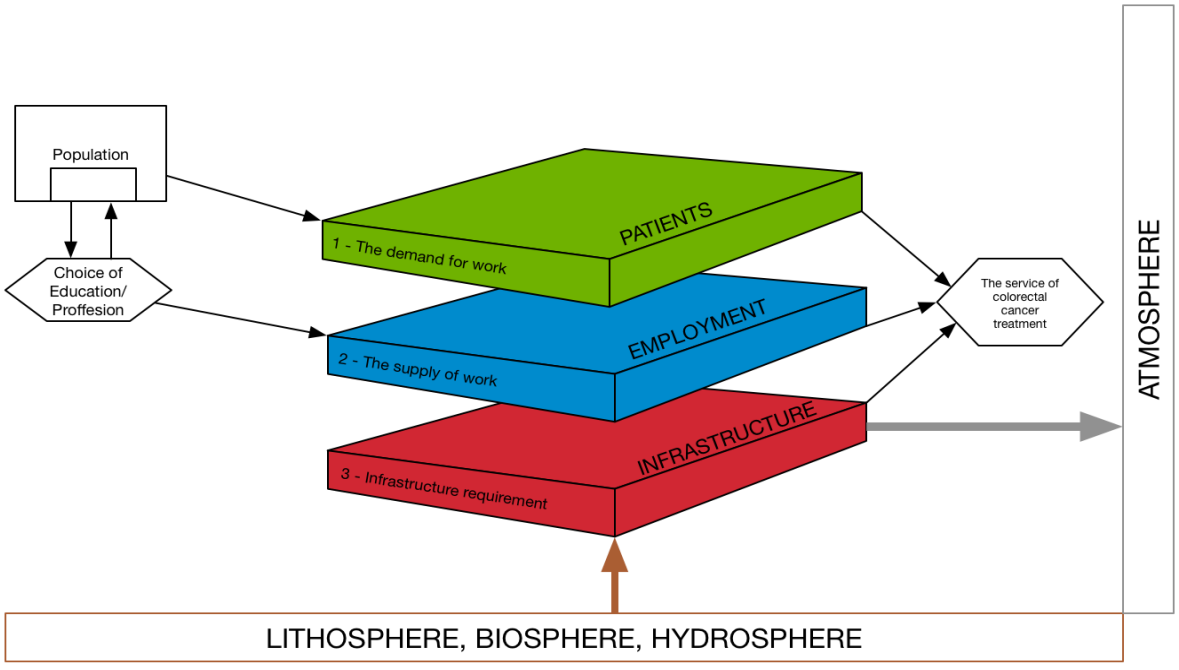

Figure 3: Layers required to provide the service of colorectal cancer treatment.

The healthcare sector is under an enormous pressure of delivering a high level of service to the population, with a low cost and within a limited timeframe [11]. The sector itself is divided between different governmental levels, which can implicate the efficiency of delivering healthcare services and adds on to the complexity of such a system [12].

For this reason, we will approach the healthcare sector and the efficiency of colorectal cancer treatment from two perspectives:

(1) Top-down, which we define as a long-term management perspective. Making it possible for a hospital or regional/national health management assessing the overall sector capacity for colorectal cancer. We will in this thesis develop a quasi-stationary model for the year 2013, with data material provided by the Norwegian Cancer registry (CR). Further we develop two scenarios for the year 2040, based on the forecasted population from the Norwegian Statistical Office (SSB) [13].
(2) Bottom up, which we define as a short-term management perspective which is more from a patient point of view. How a hospital can follow governmental guidelines related to treatment times and patient waiting times. We in this thesis have developed a qualitative conceptual system for this purpose.

The concept of modelling patients as flows within a system, *patient flow modelling*, is not new. Prior to this thesis, two main types of approaches have been applied: Discrete Event Simulation (DES) and System Dynamics (SD) [14].

System Dynamics is normally used to increase the understanding of complex systems by modelling, either qualitatively usually by causal loop diagrams or qualitatively by using Stock and Flow diagrams in a software such Vensim [14,15]. It was intentionally meant as a tool for understanding industrial processes, and in the later years it has been applied as a tool for policy development and analysis [15]. SD modelling has been applied for health care in the UK and in Canada as a tool for policy making, strategic planning, capacity assessment and epidemiology [14,16–19].

Discrete event simulation (DES) has been the most applied method on patient flow modelling during the last 30-40 years. It has its origin in operations research, and it is based on the Monte Carlo method [20]. DES focuses mainly on queuing systems and how queues progress through time. The world within a DES model is represented by entities that flow through a network of activities and queues, and at the same system the resources - mainly employment - are shared between the activities. It has been directly applied amongst others by the United States' and the United Kingdom's administrators as a way to plan better, with the aim of reducing the cost of healthcare services and as a method for a better organization of emergency systems [20–23].

Neither SD nor DES address the third layer in figure 1, the infrastructure required to do the work. It is here where we believe MFA can prove to be a significant contribution to the field by providing a comprehensive understanding of the interactions between man and nature in relation to the provision of services.

In the field of Industrial Ecology, assessing the healthcare sector or elements of it is very new and few studies have been conducted but never with an MFA methodology. Only very few studies are found, all either with an LCA perspective or Carbon Footprinting [24–26].

To our knowledge, there is no model that quantitatively and systematically assess all the three layers in figure 1 integrally. The infrastructural requirements is what MFA does best, connecting the use of materials and resources to the satisfaction of human needs [6,27–29]. By applying a much-used method on infrastructure onto the healthcare system, we are able to quantitatively estimate the interaction between man and nature in the present, and to establish the requirements for providing the same level of service in the future. An analysis that is not only valid for the healthcare system, but most service sectors in our society.

At the core of all this lies the question of how the healthcare sector can efficiently utilize the resources they have available, both in terms of employment and infrastructure to meet the current and future demand for healthcare services, while reducing the throughput of materials and energy in the social metabolism. We approach this from two perspectives, top-down and bottom-up, as described earlier. In addition, this thesis aims to assessing if MFA can prove to be a useful tool for this type of analysis.

2.0 Methodology

The scope of both systems is the treatment and investigation of colorectal cancer patients in Norway. The flows of patients between the processes and stocks that are involved in treating and investigating colorectal cancer are inside our system boundary. The cancer free population is also defined to be inside the boundary because the cancer incidents rates affect them and drive the demand for treatment. Both systems are also defined by a single year, for system 1 this applies to 2013 and 2040, figure 3, whilst system 2 is only for 2013, figure 4. We model our first system as a quasi-stationary inflow-driven model according to standard Material Flow Analysis methods [30]. System two is based on the same methods, and it is here only explained on a conceptual level, due to limitations in publicly available data. We aim to model system two in our future work by the use of a dynamic inflow and stock-driven model.

Our two systems are designed with two different time-management-perspectives in mind, long-term for system 1 and short-term for system 2. This difference in temporal scale is why we believe that the two models should be modelled differently. Whilst modelling on a yearly basis is better for the long-term treatment capacity. System 2 that will focus on the short-term capacity and patient waiting times will need to be modelled on a week-to-week or month-to-month basis within a year to best assess the issue in question - waiting times as a representation of efficiency. Since system two only represents a conceptual model, we will here also focus on the policies regarding cancer treatment in Norway that lead up to the Colorectal cancer proceeding, which aims to streamline the investigation and treatment of colorectal cancer from January 1st 2015 [31].

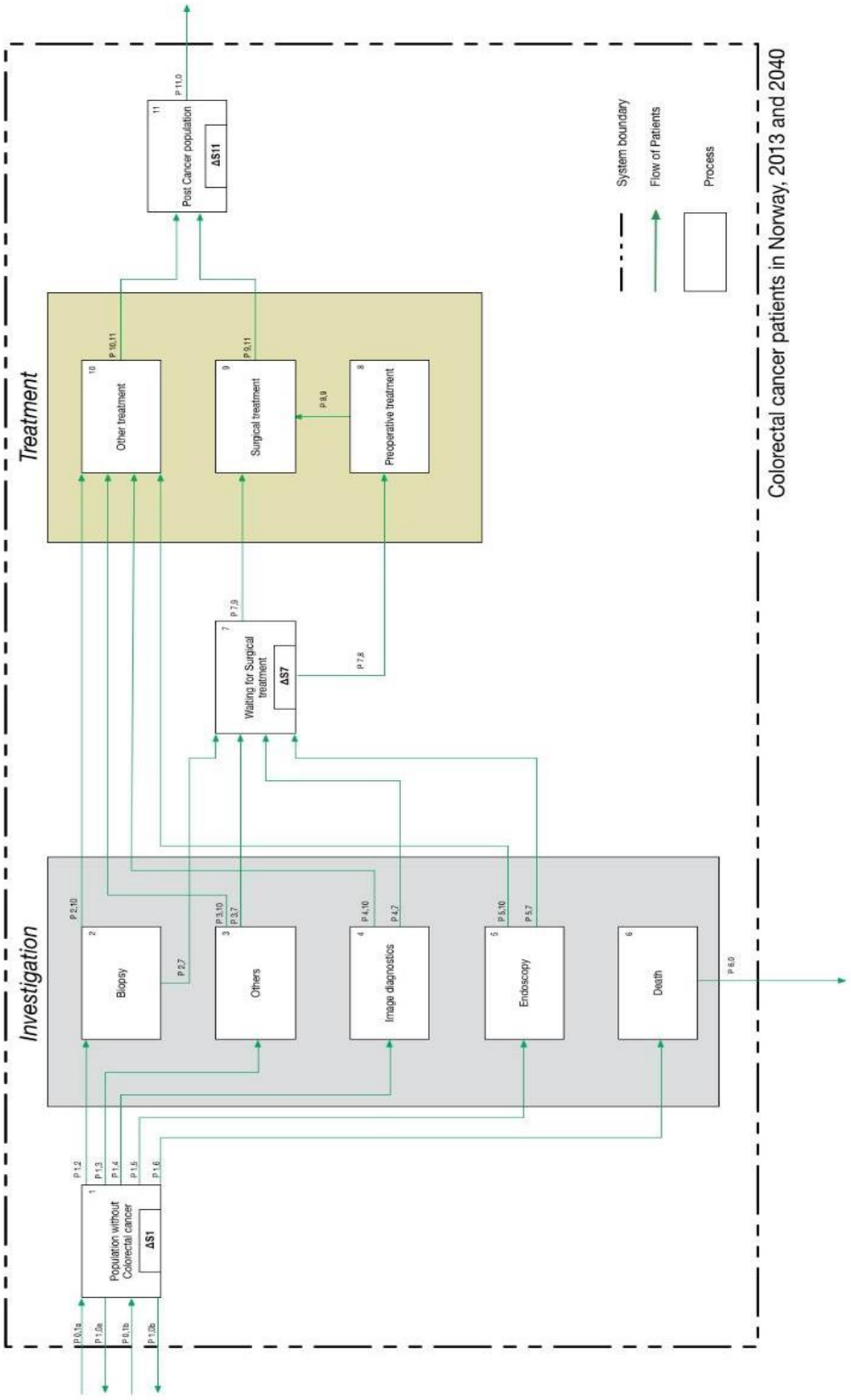

Figure 4: System 1 - Top-down approach for treatment capacity.

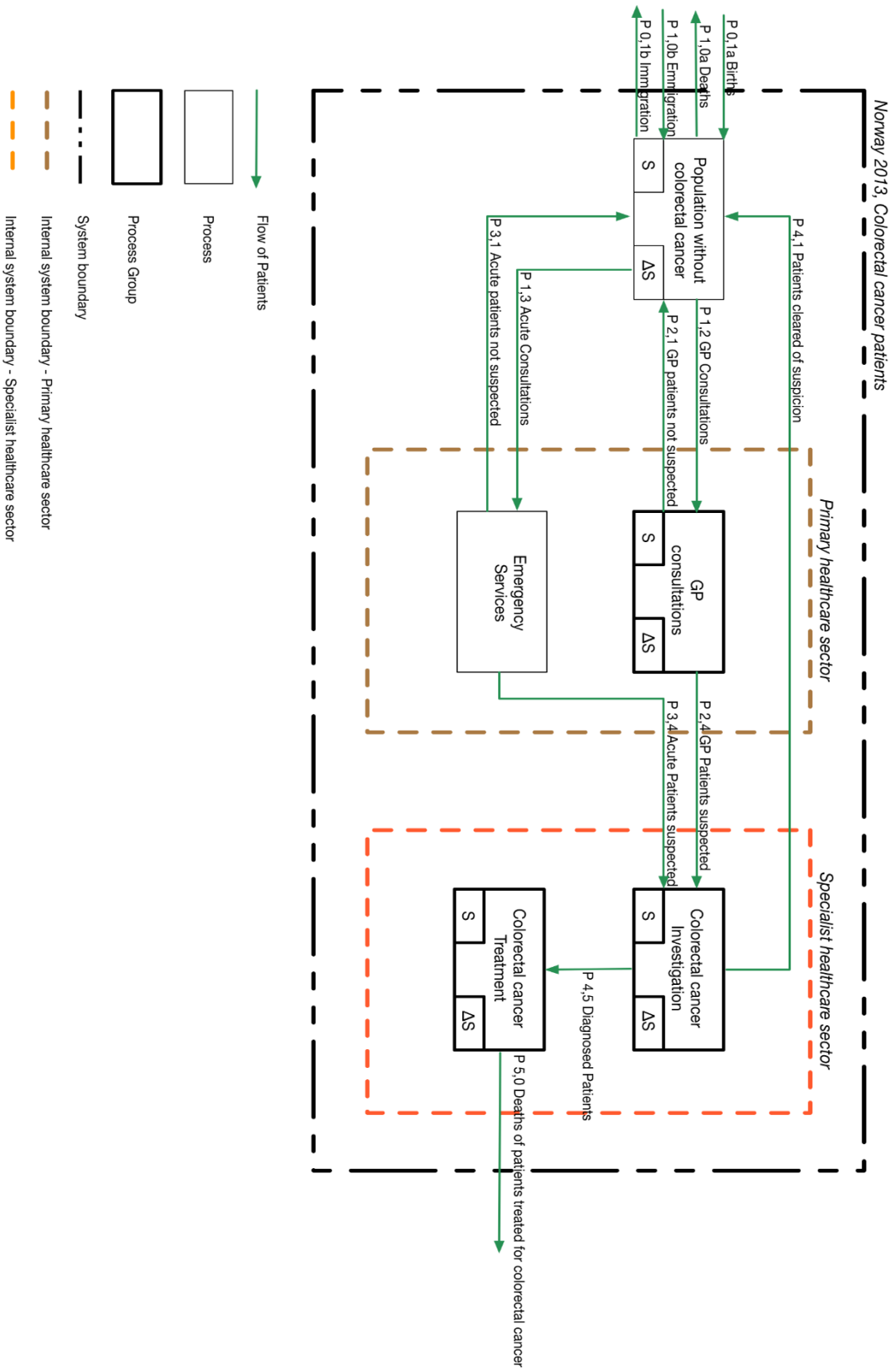

Figure 3: System 2 - Bottom-up approach, short-term management of patient waiting times.

2.1 Description of System 1 – Top-down - Long-term capacity

The system consists of 11 processes, 3 of them containing stocks (process 1 population, process 7 waiting for surgery and process 11, post cancer population). The system in total contains 24 flows. Overall we need 27 (stocks + flows and stock changes) equations to be able to solve the system analytically, a trademark for MFA modelling and not compatible with DES or System dynamic models.

To be able to provide an analytical solution we have relied on the data from the Norwegian cancer registry (CR) and The Statistical Office in Norway (SSB) for the estimation of the following parameters. Our constants and all values for parameters are shown in the appendix.

Parameters			
Name	Abbreviation	Unit	Source
Percentage share of people under the age of 50 diagnosed with colorectal cancer	U50_DCR	p/year	CR
Percentage share of people from 50-66 diagnosed withe colorectal cancer	50-66_DCR	p/year	CR
Percentage share of people from 67-79 diagnosed withe colorectal cancer	67-79_DCR	p/year	CR
Percentage share of people from 80-89 diagnosed withe colorectal cancer	80-89_DCR	p/year	CR
Precentage share of people over the age of 90 diagnosed with colorectal cancer	O90_DCR	p/year	CR
Share of Biopsy as mean basis for diagnosis	DB	p/year	CR
Share of Others as mean basis for diagnosis	DO	p/year	CR
Share of Image Diagnostics as mean basis for diagnosis	DID	p/year	CR
Share of Endoscopy as mean basis for diagnosis	DE	p/year	CR
Share of Death as mean basis for diagnosis	DD	p/year	CR
Surgically treated colorectal patients	ST_CR	p/year	CR
Other treatment colorectal cancer patients	OT_CR	p/year	CR
Maximum treatment capacity	MAXT_CR	p/year	CR
Colorectal cancer patients with pre operative treatment	PRE_ST	p/year	CR
Colorectal cancer patients without pre operative treatment	NOPRE_ST	p/year	CR
Relative Survival 1 year	SURV	p/year	CR

Table 7: List of parameters.

2.1.1 Population and incidence

We run our model in total seven times, 5 times for 2013 and 2 times for our scenarios for 2040. For 2013 we apply different methods for calculating incidence rates in the first 3 runs and we separate the two cancers to rectal cancer in run 4 and colon cancer in run 5. The number of patients diagnosed in 2013 is calculated based on the incident rates for colorectal cancer. The age distribution of the population is the most important factor for the total number of people with the diagnosis as shown in figure 4, which numbers are calculated by using the averages of the years 2009-2012. Figure 6 shows the age distribution for 2013 and 2040 for both genders as reported by SSB [13,32]. Whilst figure 5 shows the cumulative risk of getting colorectal cancer through a lifetime differentiated by gender on the basis of figure 4.

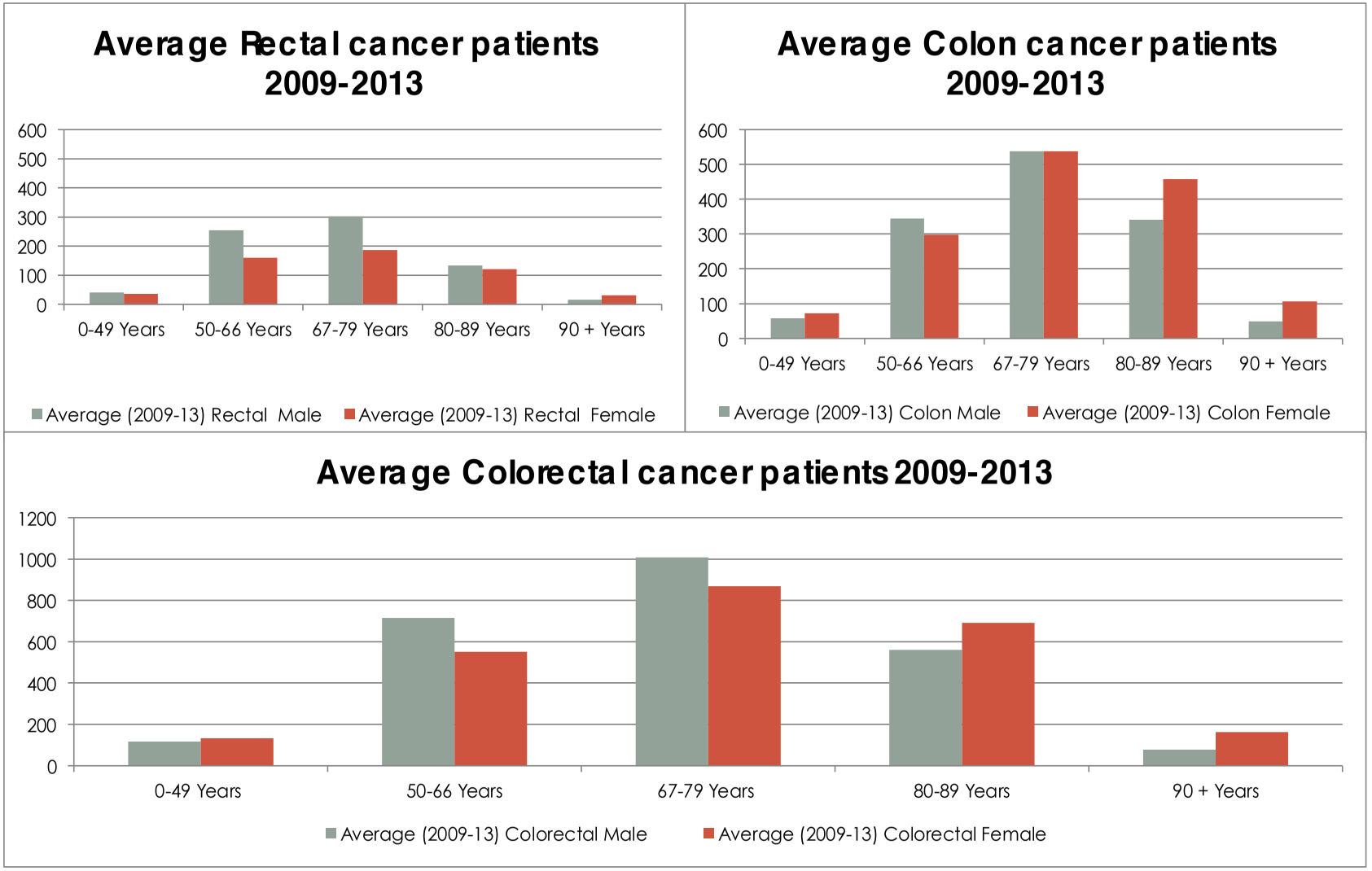

Figure 4: Average cancer incidence for rectal cancer, colon cancer and colorectal cancer, differentiated by age cohorts and gender.

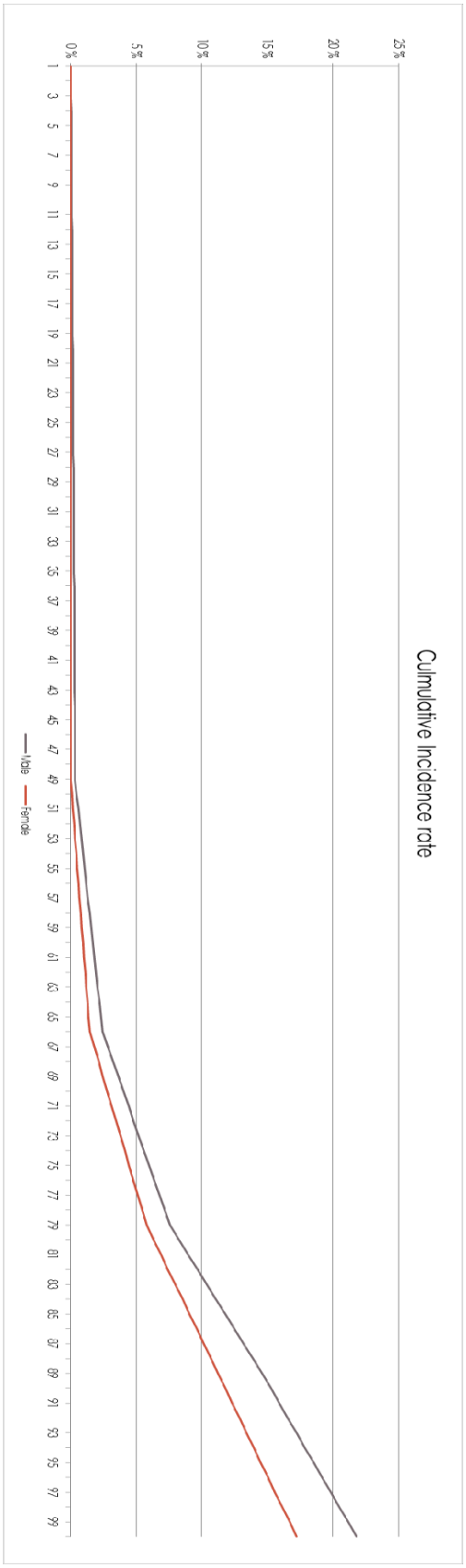

Figure 5: Cumulative cancer incidence through a lifetime for both genders.

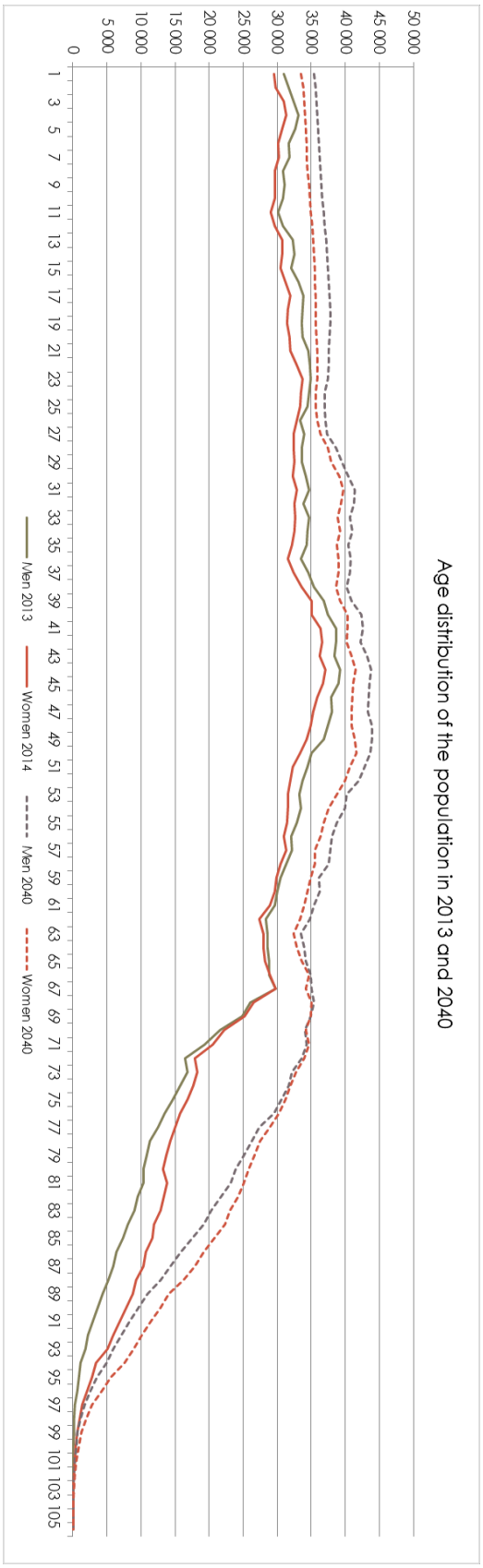

Figure 6: Age distribution of the population in 2013 and 2040.

A logarithmic trend function was used to forecast the incidents rates in 2013, based on the values from 2009 until 2012 found in the appendix, which were used in the second run of the model. For the third run of the model we applied the actual cancer incidence for 2013 calculated by analyzing the data material we had. For the fourth and fifth run we segregated the cancers using the average incidence rates for each cancer shown in figure 7. We apply the parameters for diagnostics at the same time, leaving us with the following equations.

Equation 1

$$P1{,}2 = \left(\sum S\,1_{t-1} * U50\_DCR * 50 - 66\_DCR * 67 - 79\_DCR * 80 - 89\_DCR * 090\_DCR\right) * DB$$

Equation 2

$$P1{,}3 = \left(\sum S\,1_{t-1} * U50\_DCR * 50 - 66\_DCR * 67 - 79\_DCR * 80 - 89\_DCR * 090\_DCR\right) * DO$$

Equation 3

$$P1{,}4 = \left(\sum S\,1_{t-1} * U50\_DCR * 50 - 66\_DCR * 67 - 79\_DCR * 80 - 89\_DCR * 090\_DCR\right) * DID$$

Equation 4

$$P1{,}5 = \left(\sum S\,1_{t-1} * U50\_DCR * 50 - 66\_DCR * 67 - 79\_DCR * 80 - 89\_DCR * 090\_DCR\right) * DE$$

Equation 5

$$P1{,}6 = \left(\sum S\,1_{t-1} * U50\_DCR * 50 - 66\_DCR * 67 - 79\_DCR * 80 - 89\_DCR * 090\_DCR\right) * DD$$

2.1.2 Diagnostics

Due to the limited quality of data we are only able to model the process that confirms the diagnosis. Most often patients go through several of the procedures to confirm the diagnosis and in many cases they go through some of the same processes as a preoperative measure to help the surgeons by investigating the morphology of the tumour [33,34]. In our model this is simplified and the patient goes directly from the population to the investigation and further straight to treatment.

The majority of colorectal cancer patients get their diagnosis confirmed by a biopsy of the tumour, approximately 95%, see figure 7. All parameters are calculated by their percentage share of the basis for diagnosis for each year and then divided for the total of the 4 years (2009-2012). The remaining diagnostic procedures have the following percentage shares: Others 0,5%, Image diagnostics 1,4%, Endoscopy 0,8% and patients who are diagnosed post mortem 1,8%. We also applied the same methods individually for rectal cancer and colon cancer, and the respective values are found in the parameter overview in the appendix.

2.1.3 Treatment

Colorectal cancer together with other form of cancers, if curative treatable, has three main treatment possibilities, which can be done separately, or in combination depending on the cancer stage and the complexity [33,35]. In our model, we can only model two options, other or surgical treatment, which is the most common and preferred treatment. In the period of 2009-2012 on average almost 80% of colorectal cancer patients received surgery. Leaving only less than 20% to have chemotherapy, radiation or palliative care, as shown in figure 8. Most rectal cancer patients receive pre-operative treatment in the form of radiation therapy to shrink the tumour before the surgery, figure is shown in the appendix [33,34]. By doing so, the time from diagnosis to surgery increases. For colon cancer, pre-operative treatment is not as common as for rectal cancer [33,34].

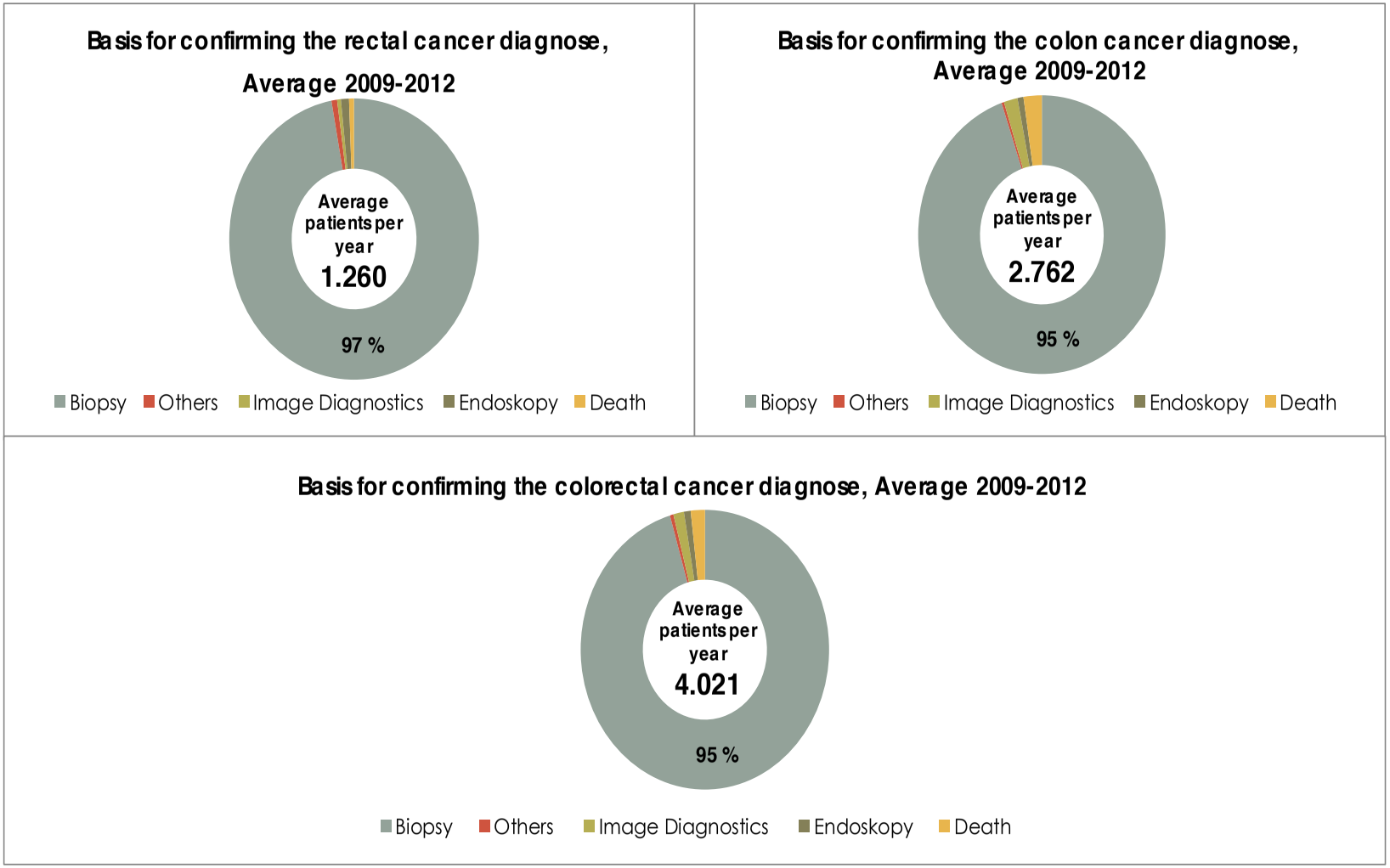

Figure 7: procedure used as Basis for confirming the diagnosis for colorectal, rectal and colon cancer.

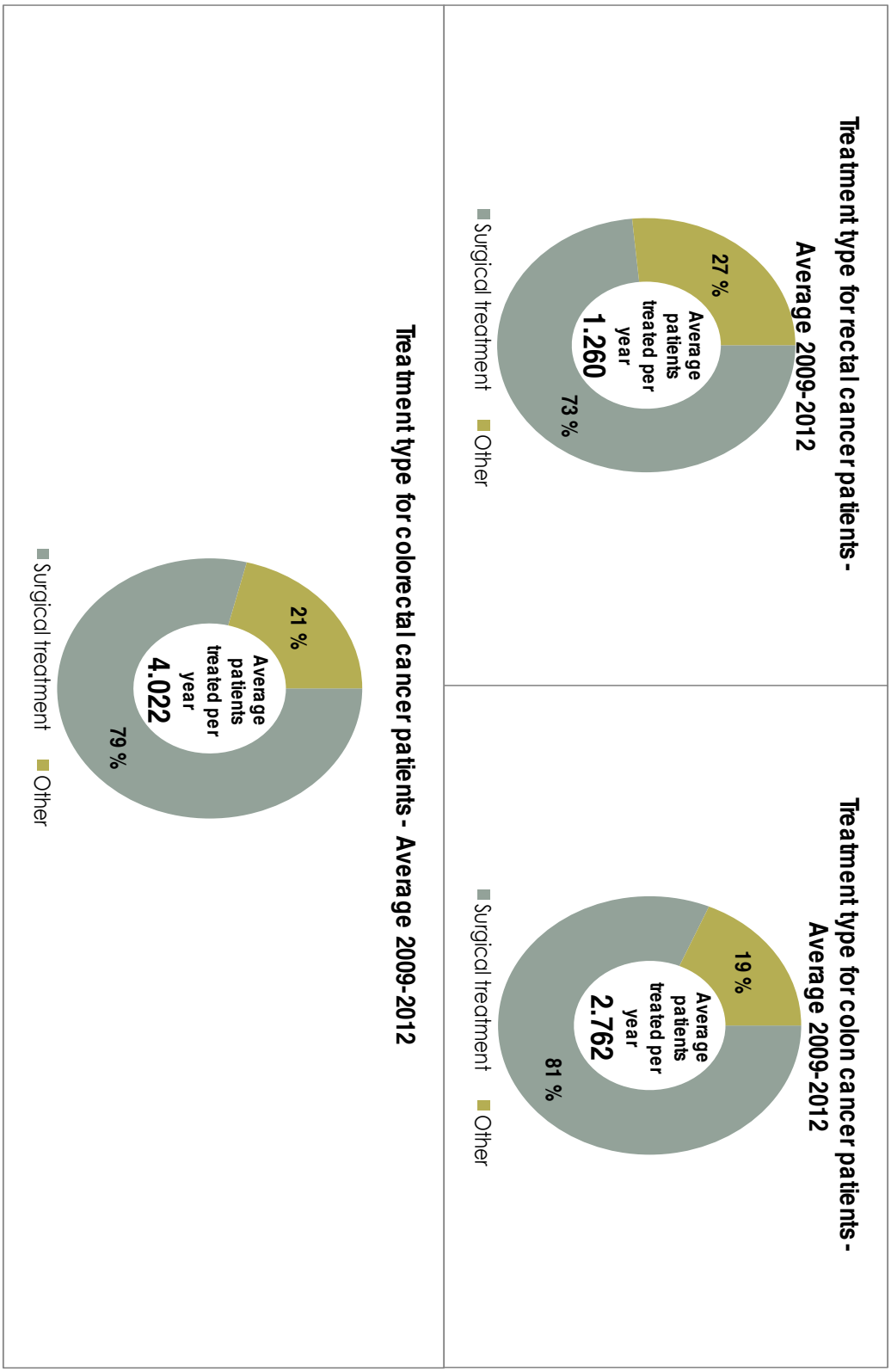

Figure 8: Treatment types for colorectal, rectal and colon cancer.

2.1.4 Treatment capacity

The treatment capacity is vital for our study with a long-term perspective; this parameter determines how many of the patients the healthcare sector has the capability to treat during a year. Several approaches were discussed to establish this parameter. The basis for the discussions was the fact that it will never be possible for all patients to be treated every year, due to the time of diagnosis and whether the patients receive preoperative treatment or not. If the patient receives preoperative treatment this will delay the time of surgery potentially by several weeks [33–36].

In our model we operate with two concepts, we calculated a treatment capacity in percentage based on the number of patients diagnosed and scheduled for treatment in a year divided by the number of patients diagnosed and treated within the same year, shown in table 2. This way we end up with a treatment capacity for colorectal cancer at 90% for 2012 which we also apply for 2013, table 3. We also assume that the treatment capacity will not decrease, and that it will be able to respond to the increase in the number of people.

In 2040 we apply two different treatment capacities, one where we apply the parameter for 2013 (90%), and one where we apply the maximum number of treated patients per year 3242. By applying a constant number, we will be able to estimate how much more resources will have to be added to provide the same level of service when we consider the stock of patients waiting to be treated. We applied this for our scenarios for 2040.

One also has to consider the fact that the colorectal cancer or even cancer only accounts for a small part of somatic needs that the specialist healthcare sector is responsible for. Tumours in the digestive system only accounted for 0,4% of the hospital visitation in 2013, figure 10.

Equation 6

$$P7{,}9 = \left(\left(\sum I_7 + S7_{t-1} * ST\_CR\right) * MAX\_CR\right) * NOPRE\_ST - P7{,}8$$

Equation 7

$$P10{,}11 = \sum I_{10} * OT\_CR$$

Equation 8

$$P7{,}8 = \left(\left(\sum I_7 + S7_{t-1} * ST\_CR\right) * MAX\_CR\right) * PRE\_ST - P7{,}9$$

Colorectal	Treated in the year	Diagnosed in the previous year but treated in this year	Diagnosed and treated within the same year	Diagnosed and scehdueld for treatment
2009	3045	274	2770	3117
2010	3132	300	2826	3183
2011	3145	329	2815	3193
2012	3242	339	2924	3246
2013		-343		

Table 8: Basis for calculating the treatment capacity.

	Rectal cancer	Colon cancer	Colorectal Cancer
2009	78 %	94 %	89 %
2010	77 %	94 %	89 %
2011	75 %	94 %	88 %
2012	82 %	93 %	90 %

Table 9: Treatment capacity for rectal, colon and colorectal cancer.

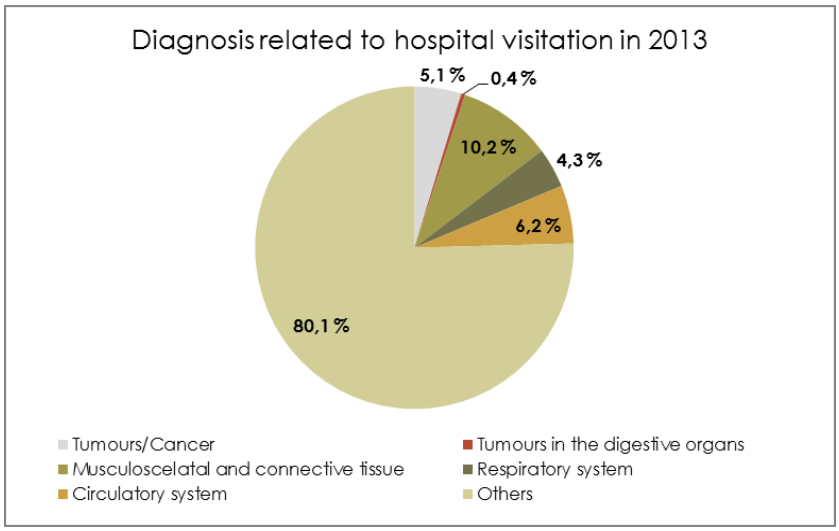

Figure 9: Share of diagnostics groups in relation to usage of the specialist healthcare sector for somatic needs.

2.1.5 Post Cancer population

After the patient is treated for colorectal cancer, we intentionally allocate it in a new process/stock instead of taking it back to the population without colorectal cancer. This is based on the fact that the relative survival of the treated patients is lower than for the rest of the population. The survival rates have increased over the years, but the majority of the colorectal cancer patients are relatively old, and the cancer makes them even more fragile. The relative survival is taken from the Norwegian cancer registry, and we applied the relative one year survival [33]. Relative one year survival is defined as the probability of being alive one year after the diagnosis.

In addition, monitoring of the patients after the treatment is in large parts done by the specialist healthcare sector, with some involvement of the primary healthcare system. This also adds on to the usage of resources by colorectal cancer patients.

Equation 9

$$P11{,}0 = \sum I_{11} * SURV$$

2.2 Description of system 2 – Short-term patient waiting times

System 2 consists of 5 processes, 3 of which are defined as process groups because they represent subsystems. The subsystems for process 4 and 5 are shown in the appendix. Due to data availability, we are not able to quantify the system, but we present here a modelling concept based on the 3-layer system presented earlier in figure 1. The three layers have somewhat different dynamics. Layer 1 is inflow driven, the same as for system 1 where the flow of patients is driven by the incidence rate and the age distribution. The two other layers are stock driven, driven by the stocks and flows of patients in the first layer, in a way that demand should equal supply. For us to be able to model waiting times, this should be modeled in a dynamic way, either in a week-to-week or month-to-month basis for a year. So that both the flows and the stocks are subjected to change under time shift [30].

2.2.1 Process 2: GP Visitation

The majority of colorectal cancer patients first-encounter with the health care system happens in the primary health care system, which includes both GP and the emergency services regulated by the Norwegian municipalities. To be able to model the complete picture we also need to consider that others are also utilizing this service, which may cause restrictions on the GP service as well in the form of waiting times. In 2012, there was approximately 13,5 million consultations with GPs in Norway, and of this around 180 000 consultations were related to cancer [37]. When the suspicion of cancer arises the patient then transfers from the

primary healthcare sector to the specialist sector. Before the general practitioner further refers the patient to the specialist health care system with a suspicion of colorectal cancer, he, as a rule, needs to exclude other possibilities. Which also may cause delays on the procedures in the investigation phase due to the fact that some of the same investigation procedures are required, but for different diagnostic purposes. In terms of colorectal cancer, this is when the patient from January 1st 2015 is referred to "pakkeforløp for tykk- og endetarms kreft" the colorectal cancer proceeding [31].

Although it is possible to find statistics on GP visitations, we cannot differentiate them on a smaller time scale than a year and in pre-defined age groups and only from 2012 and 2013 when we require referral by diagnostic groups, in which colorectal cancer is not found [38,39]. This will cause a limitation on further modelling of this system.

2.2.2 Process 3: Emergency services

In some cases, colorectal cancer presents itself with acute bleeding and/or abdominal pain, and forces the patient to seek emergency help. Usage of the emergency services are only reported in statistics differentiated by age groups that utilize the service, and not by the purposes of the emergency [40]. Here we would have to look at the individual patient record to be able to see how the patient entered the specialist healthcare sector. Another possibility is to look at the current data set and see the number of days from diagnosis to surgical treatment for the surgical treated patients, and if the number of days was less than 7 days, we could assume that this is an emergency, although with this method we would be subjected to an uncertainty in our results.

2.2.3 Process group 4: Investigation phase

The investigation phase involves all the processes where diagnostics are taking place. It has 5 main procedures in which the diagnosis can be confirmed. There are two processes that are common for most of patients, endoscopy and pathology (biopsy of the tumour). Depending on which type of cancer the patient is diagnosed with, either colon or rectal, the recommended diagnostic procedure differs slightly.

All inflows start at the point of waiting (stock) for one of the procedures, and come from either process 2 GP consultations or 3 Emergency services. At this point the two flows A 2,4 and A 3,4 from the primary healthcare sector can be summed and treated as equal since the procedure from here on out does not differ.

There is 4 different ways of entering the system either to waiting for endoscopy, waiting for ultrasound, waiting for CT, or waiting for MRI.

By having this sequence of waiting for the procedure, then the procedure, followed by waiting for the interpretation and then finally the interpretation of the results from the investigation we can clearly see the connection between the layers. When connecting the two other layers we would be able to more accurately see where the bottlenecks in the system are. Variables from the two other layers would work as parameters in the patient layer: we could see for instance the effects of adding another pathologist, see figure 10. Where as in the layers of employment and infrastructure, we would have stocks of employees and the infrastructure connected to the procedures that the patient would go through, affecting the number of people who can be subjected to the procedure at the same time.

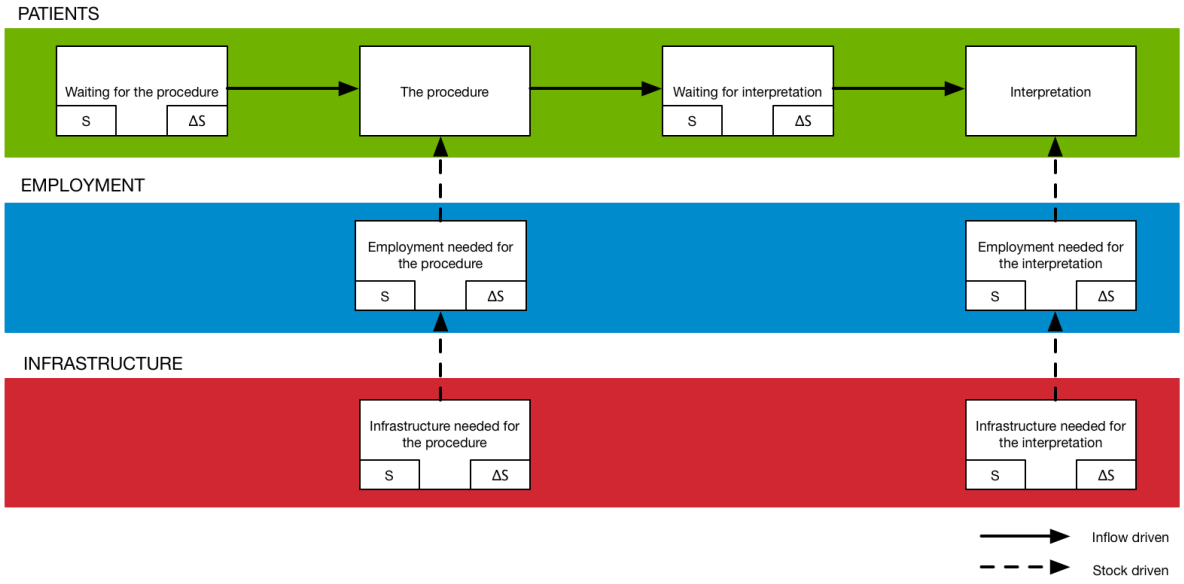

Figure 10: The interconnectivity between the layers of the model, an example for a process in the investigation phase.

2.2.4 Process group 5: Treatment phase

The treatment phase involves the processes needed to treat the patient and in addition to monitoring the patient after completed treatment. It has three main treatment processes: surgery, chemotherapy and radiation therapy. The treatment phase also consists of a process with a stock called palliative care, where patients who are in the latest and not curable stage of cancer will reside. The patients in this stock will also in some cases be subjected to other

types of treatment, but then very often just as a pain-relief measure in the latest stages of life and the disease.

The patient can be subjected to more treatments than one, for instance in the form of preoperative treatment and postoperative treatment that involves chemotherapy and/or radiation. Also in this system, we will have a stock of post cancer population that are subjected to monitoring and a differentiated life expectancy from what we define for the cancer free population. The treatment processes will share the same interconnections with the two additional layers as shown in figure 10.

2.2.5 Waiting times

Waiting times for surgery is of large concern for both the patients and the hospital management. The biology of colorectal cancer tumors is that it is very time sensitive, and patients would benefit from rapid treatment. Cancer has been on the political agenda since the late 80s, and the policies has developed from being reactive to the increases in incident rates towards a more incidence prevention and patient oriented perspective with the cancer proceedings.

In 1993, the first steps towards a National cancer strategy was initiated by Brundtlands third cabinet [41]. Prior to this in 1989, a Nordic plan of action towards cancer was put in action, with the aim to reduce cancer mortality by 15 per cent by 2000, goals that where in accordance with the World Health Organization and the European Union strategy's [41]. The most recent strategy is aimed at creating a more user-oriented cancer care process to increase the survival rate, the quality of life, the cancer prevention through cancer screenings and by having clear proceedings for cancer [42]. A direct result of this latest strategy is the four first cancer proceedings of a total of 28, that are implemented from January 1st, 2015 based on the Danish model [31,42,43]. The four proceedings being implemented first are for cancers of the lung, breast, prostate and colorectal cancer, the four most common cancers in Norway [31,44]. This is done to further ensure the safety and care of the patients. The proceedings for cancer are an attempt to streamline and coordinate cancer treatment and the investigation phase, so that both the patient and the health care system can monitor the process as a whole, having guided timelines to relate to throughout the process.

For colorectal cancer this implies that, not by law, but by norm a patient suspected to have colorectal cancer should be treated surgically, medically or with radiation within approximately 35-39 calendar days from when the hospital has received the notification

concerning the suspicion [31,36]. The national plan of action for colorectal cancer from 2012 operated with the goal of 20 working days for treatment start. In addition they had a goal of maximum 3 weeks waiting time between the dates of diagnosis until surgical treatment. In 2010 the national average waiting time for colorectal cancer was 23,9 working days. This differs greatly by hospitals where the highest value is found at Kristiansund Sjukehus where you will on average have to wait 55 working days, to Sykehuset Telemark where the average waiting time for treatment is 7 working days [45].

2.3 Scenarios for system 1 – Treatment capacity in 2040

In both scenarios, we only investigate one of our parameters, the treatment capacity. Other scenarios are not feasible due to data limitations. This is an overall constraint in our model in system 1, because we are limited to what is reported to the cancer registry. We therefore run two scenarios, each with a different approach to the surgical treatment capacity for colorectal cancer in the future.

2.3.1 Scenario 1 – Overall capacity growth

20% of the population is now over the age of 60, changing the overall demographics of Norway [13]. No screening programs for colorectal cancer has been put in place, but the colorectal cancer proceedings launched in 2015 has forced the overall sector to grow, both in infrastructure and in employment. Allowing for a continuation of the treatment capacity of 90% in 2013 to the year 2040.

2.3.2 Scenario 2 – Increased pressure in the health sector

Although the changing demographics have been anticipated, the aging also has had its effect on employment due to the same age of retirement in 2013 as for 2040. The cancer proceedings were put in place, but the changing demographics and the overall challenges for the health sector as a whole leave the number of treated patients at the same level as for 2012. Leaving the number of patients possible to treat within a year at 3242 patients the same number as for 2013. Disregarding the timelines of the cancer proceedings.

2.4 Uncertainties and limitations

When discussing the results of the model we have to comprehend that it is in fact just a simplified model of the reality. System 1 yields its limitations when trying to provide an image based on assumptions that the present patterns will appear in the same manner in the future. We calculate averages based on the population, but there is no such thing as an

average person. We are therefore subjected to both systematic and random errors. Our overall understanding of the system due to our lack of medical competence is a large source of uncertainty and limitation for both systems.

We have non-identifiable data for 35 919 colorectal cancer patients, with 35 217 incidents of either colon or rectal cancer provided to us by the Norwegian Cancer registry. This means that some individuals have had either colon of rectal cancer more than once or have had both types of cancer. For rectal cancer we have data from the year 2000 until 2013, for colon cancer we have data from 2007 until 2013. From this data material we primarily used data from 2009-2012.

The information regarding the patients is reported to the Norwegian Cancer registry by the treating physician; the form are enclosed in the appendix. It is reported with medical terminology, leaving the interpretation for both us and other non-medical personnel challenging. In addition, only the usage treatment and the main basis for diagnosis in the specialist healthcare sector are reported. In addition mainly surgical information is reported, the patients interaction with the primary healthcare sector is not included. The investigation phase that usually involves many processes prior to confirming the diagnosis is then not reported to the cancer registry. This makes it challenging to understand and quantify the interactions between the specialist and the primary healthcare sector. An interaction that is of special importance regarding healthcare policies and policy makers, which often involves both sectors.

Due to ethical aspects of dealing with medical data, we are not permitted to distribute the original data material. If others would like to test our analysis and findings, they will have to apply to the Norwegian Cancer Registry to be granted access to the data material used. This aspect then limits transparency in our research, due to ethical concerns of dealing with medical data.

3.0 Results

The overall purpose of both systems is to model the provision of treatment of colorectal cancer to patients. We will first present system 1 for the year 2013 and will further present the results from our two scenarios to 2040. We will here focus on the number of patients diagnosed, the number of patients surgically treated, and the stock of waiting patients at the end of the year. Since it is only in these areas where we can say something about the surgical treatment capacity of colorectal cancer patients in Norway and what may be needed in the future given the available data.

We are not able to quantify system 2 in the same manner as system 1, but we have performed an analysis based on the data material on waiting times. In addition we have differentiated between types of hospital that are treating the patient and the stages of the cancer at the time of diagnosis.

3.1 System 1: top-down approach - Long-term capacity

The model was run for two individual years where the main differences in the results lie in the different age distribution of the population and the treatment capacity in the scenarios for 2040, see table 4. Calibration of the model with different approaches for calculating incident rates has shown to have a large impact for our overall results since our model is inflow driven.

Calculating a trend line or the averages for the incident rates gives us a smaller number of patients than what in fact was the case for 2013. We therefore applied the real incident rates for this year, calculated from our data material. We were not able to utilize most of the other numbers for 2013, due to an incompleteness of the data material. We then get 4307 patients diagnosed with colorectal cancer. Surgery is not the only treatment type but it will be the focus in this report, due to the quality of data. The number of patients that were diagnosed and scheduled for surgery in 2013 is 3318. In addition, we in 2013 have a stock of waiting patients of 343 at the start of the year. These are patients that were diagnosed in 2012, and scheduled for surgical treatment in 2013. When this stock is taken into consideration, 3298 patients are surgically treated in 2013. Leaving 363 patients diagnosed in 2013 to be treated in 2014. Complete results are presented in table 4. The summary results are presented in table 5 and table 6.

FLOWS		2013					2040	
		Colorectal cancer			Rectal cancer	Colon Cancer	Colorectal cancer	
		Average Incidence	Trendline	Actual incidence	Real Incidence average parameters	Real Incidence average parameters	Real 2013 incidence, average parameters	Treatment capacity max 3242 patients
Flow	Flow name							
P 0,1a	Births	58995	58995	58995	58995	58995	68762	68762
P 1,0a	Deaths	41210	41213	41180	41274	41215	56443	56443
P 1,0b	Emigration	35716	35716	35716	35716	35716	37041	37041
P 0,1b	Immigration	75789	75789	75789	75789	75789	56207	56207
P 1,2	From population diagnosed by Biopsy	3718	3577	4079	1241	2652	6978	6978
P 1,3	From population diagnosed by others	18	17	15	9	9	34	34
P 1,4	From population diagnosed by Image diagnostics	54	52	77	6	50	101	101
P 1,5	From population diagnosed by edoscopy	33	32	34	13	22	63	63
P 1,6	From population to death	72	69	102	8	67	134	134
P 2,7	Patients diagnosed by biopsy, treated with suregry	2934	2822	3219	912	2159	5506	5506
P 2,10	Patients diagnosed by biopsy, subjected to other treatment	784	754	860	329	494	1472	1472
P 3,7	Patients diagnosed by other, treated with surgery	14	14	11	7	8	27	27
P 3,10	Patients diagnosed by other, subjected to other treatment	4	4	3	2	2	7	7
P 4,7	Patients diagnosed by Image diagnostics, treated with surgery	43	41	61	5	41	80	80
P 4,10	Patients diagnosed by Image diagnostics, subjected to other treatment	11	11	16	2	9	21	21
P 5,7	Patients diagnosed by Endoscopy, treated with surgery	26	25	27	10	18	50	50
P 5,10	Patients diagnosed by Endoscopy, subjected to other treatment	7	7	7	3	4	13	13
P 6,0	Patients diagnosed post mortem	72	69	102	8	67	134	134
P 7,8	Patients reciving preoperative tratment before surgery	393	380	429	362	53	663	421
P 8,9	Patients that have had pre operative treatment to surgery	393	380	429	362	53	663	421
P 7,9	Patients not reciving pre-operative treatment before surgery	2633	2543	2869	560	2164	4438	2821
P 9,11	From surgical treatment to post cancer population	3027	2923	3298	922	2217	5101	3242
P 10,11	From other treatment to post cancer population	806	776	887	337	509	1513	1513
P 11,0	From post cancer population to death	498	481	544	151	382	860	618

Table 10: Results from all 7 runs of the model.

SUMMARY TABLE	2013					2040	
	Colorectal cancer			Rectal cancer	Colon Cancer	Colorectal cancer	
	Average Incidence	Trendline	Actual incidence	Real Incidence average parameters	Real Incidence average parameters	Real 2013 incidence, average parameters	Treatment capacity max 3242 patients
PATIENTS DIAGNOSED	3895	3747	4307	1279	2800	7310	7310
PATIENTS SCHEDULED FOR SURGERY	3017	2902	3318	933	2225	5663	5663
PATIENTS SURGICALLY TREATED	3027	2923	3298	922	2217	5101	3242

Table 11: Summary table.

STOCKS				S1	S7	S11
2013	Colorectal cancer	Averages	St-1	5051275	343	0
			St	5105238	333	3335
			ΔS	53963	**-10**	**3335**
		Trendlines	St-1	5051275	343	0
			St	5105383	322	3218
			ΔS	**54108**	**-21**	**3218**
		Actual numbers	St-1	5051275	343	0
			St	5104856	363	3640
			ΔS	**53581**	**20**	**3640**
	Rectal cancer	Averages	St-1	5051275	187	0
			St	5107790	198	1108
			ΔS	**56515**	**11**	**1108**
	Colon cancer	Averages	St-1	5051275	156	0
			St	5106328	164	2344
			ΔS	**55053**	**8**	**2344**
2040	Colorectal	Averages	St-1	6323562	0	0
			St	6347737	562	5754
			ΔS	**24175**	**562**	**5754**
		Max treatment capacity	St-1	6323562	0	0
			St	6347737	2421	4137
			ΔS	**24175**	**2421**	**4137**

Table 12: Calculated stocks for the 7 runs of the model.

3.1.1 Results from scenario 1 and 2

By taking the estimates from SSB for medium population growth, we see that in 2040 we have an overall population increase [13]. We see a shift in the overall age distribution, where the population of 2040 will be in average older than what it was in 2013. Looking at this in combination with the cumulative colorectal cancer incidence, we can expect an increase in number of people diagnosed with colorectal cancer in 2040.

The increased incidence with age results in 7310 patients diagnosed with colorectal cancer which corresponds to 3003 patients more than in 2013 or an increase of 69%. This is the same for both scenarios. We have no stock of patients at the start of 2040 waiting for treatment, which is unrealistic, but we assume this to be 0 for modeling purposes. For scenario 1, where we assume that the healthcare sector has gradually grown along the lines of the changing demographics. We can still follow the patterns from 2013 with a treatment capacity of 90% for surgical treated patients. From this follows the fact that there has to have occurred an increase in both employment and infrastructure.

For scenario 2 we assume that the demographic factors have "caught up" with both the demand and the supply of surgical treatment. That both patients and employees have aged and that only the retirement of healthcare personnel has been meet with new employment. The treatment capacity is at the same level in number of patients surgically treated as in 2013.

We can then clearly see that the number of patients surgically treated in the two scenarios is very different. In scenario 1, 5101 patients are surgically treated leaving a stock at the end of the year at 562 patients to be treated in 2041. Whilst for scenario 2 we treat the same number of patients as in 2013, 3242 patients. Leaving 2421 patients to be surgically treated in 2041 an increase of 330% from scenario 1.

3.2 System 2: Bottom up - short-term waiting times

The stocks of patients waiting for procedures or interpretation are the stocks in our system that are of most significance for the two additional layers, the supply of employment and the infrastructure requirements. If the two other layers were connected the variables of those two systems would be additional parameters for this layer (patients). The most common and preferred treatment for colorectal cancer is surgery; almost 80% of the patients are subjected to surgical treatment, figure 13. During surgery the tumour and often some parts of the colon or rectum are removed, alongside with the near lymph nodes to prevent spreading of the cancer.

The treatment capacity in system 1 directly relates to waiting times for the patients in system 2. Although we have not been able to quantify system 2, we can by analysing the data from the Norwegian Cancer registry (CR) show some valid points for waiting times. The treatment capacity is vital for our study; this parameter determines how many of the patients the healthcare sector has the capability to treat during a year. It will not be possible for all patients to be treated every year due to the time of diagnosis and whether they receive preoperative treatment or not. For instance, patients diagnosed in December will likely not be treated in December, but rather in January or February next year. Especially if the patient receives preoperative treatment this will delay the time of surgery [33–36]. For some patients, changing hospitals may also further delay the treatment. We have plotted a treatment matrix showing the month of diagnosis and the month of treatment, example for 2012 is shown in figure 13. We have taken the three first months of 2012 for all cancer types, figure 11 and 12. This shows that for colon cancer the majority of the patients are treated within the same month as they are diagnosed. For rectal cancer the majority is treated from the month after diagnosis and onwards. Looking at the diagonal in figure 13, we can see how many patients are surgically treated for each month only accounting for the patients that have activity in 2012.

Overall, we find the largest waiting times in number of days at the university hospitals, see figure 14. If we look at figure 13 we also have to take into consideration that the university hospitals also have a larger share of stage 3 and stage 4 patients who we might assume to be subjected to more complex treatment than stage 1&2 patients. Over half of the patients diagnosed are diagnosed with stage 3. The waiting time for rectal cancer patents are larger than colon cancer patients, this might be due to the fact that rectal cancer is only treated by few highly specialised hospitals. This is done to ensure the quality of treatment [33,35]. Most rectal cancer patients receive pre-operative treatment in the form of radiation therapy to shrink the tumour before the surgery [33,34]. By doing so, the time from diagnosis to surgery increases. For colon cancer, pre-operative treatment is not as common as for rectal cancer [33,34]. Unfortunately, we do not have enough information to say something concise about the timeframe between diagnosis, preoperative treatment and the surgery of the patient.

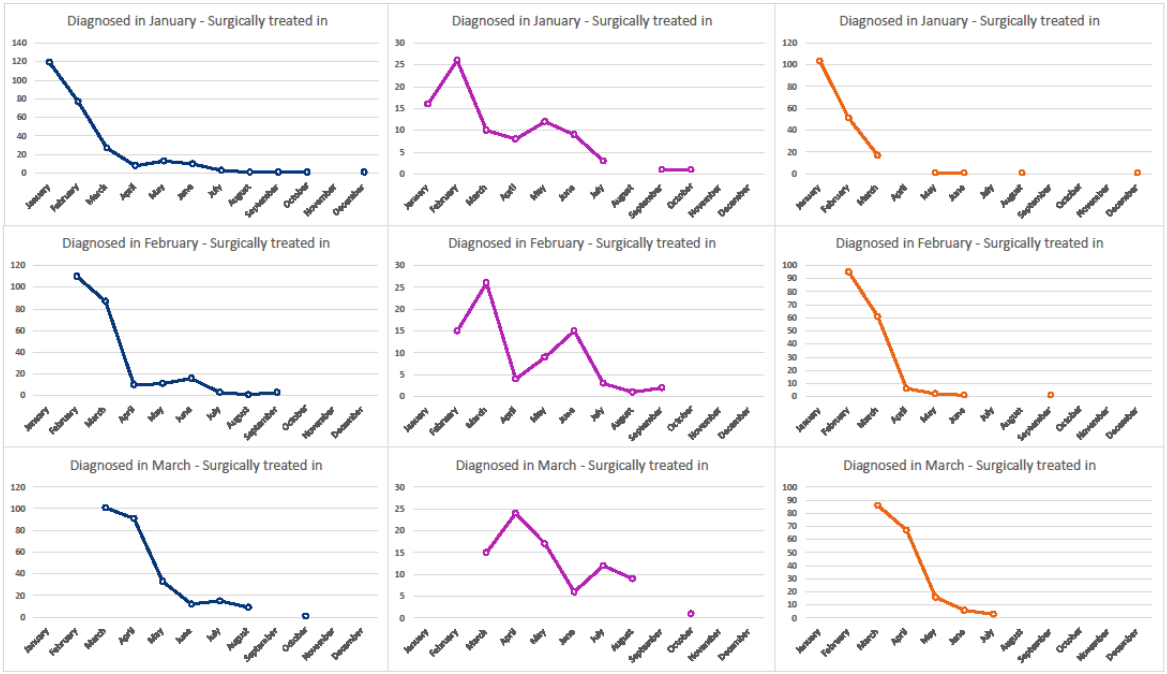

Figure 11: Results from the treatment matrix, Patients diagnosed in January, February and March 2012.

Colorectal cancer 2012		Diagnosed in											
		January	February	March	April	May	June	July	August	September	October	November	December
Surgically treated in	January	119											
	February	77	110										
	March	27	87	101									
	April	8	10	91	89								
	May	13	11	33	87	125							
	June	10	16	12	30	111	108						
	July	3	3	15	9	31	115	115					
	August	1	1	9	15	8	21	81	132				
	September	1	3		4	16	11	13	111	119			
	October	1		1	4	10	16	3	26	118	132		
	November				1	3	13	5	5	19	128	130	
	December	1				2	4	3	17	7	28	117	98

Rectal cancer 2012		Diagnosed in											
		January	February	March	April	May	June	July	August	September	October	November	December
Surgically treated in	January	16											
	February	26	15										
	March	10	26	15									
	April	8	4	24	12								
	May	12	9	17	23	21							
	June	9	15	6	16	37	8						
	July	3	3	12	4	14	41	15					
	August		1	9	13	5	11	18	14				
	September	1	2		3	13	8	8	31	17			
	October	1		1	4	8	13	2	14	35	15		
	November					2	12	5	4	10	32	15	
	December					1	3	3	16	6	11	31	11

Colon cancer 2012		Diagnosed in											
		January	February	March	April	May	June	July	August	September	October	November	December
Surgically treated in	January	103											
	February	51	95										
	March	17	61	86									
	April		6	67	77								
	May	1	2	16	64	104							
	June	1	1	6	14	74	100						
	July			3	5	17	74	100					
	August	1			2	3	10	63	118				
	September		1		1	3	3	5	80	102			
	October					2	3	1	12	83	117		
	November				1	1	1		1	9	96	115	
	December	1				1	1		1	1	17	86	87

Figure 12: The Cancer matrix only for activity in 2012.

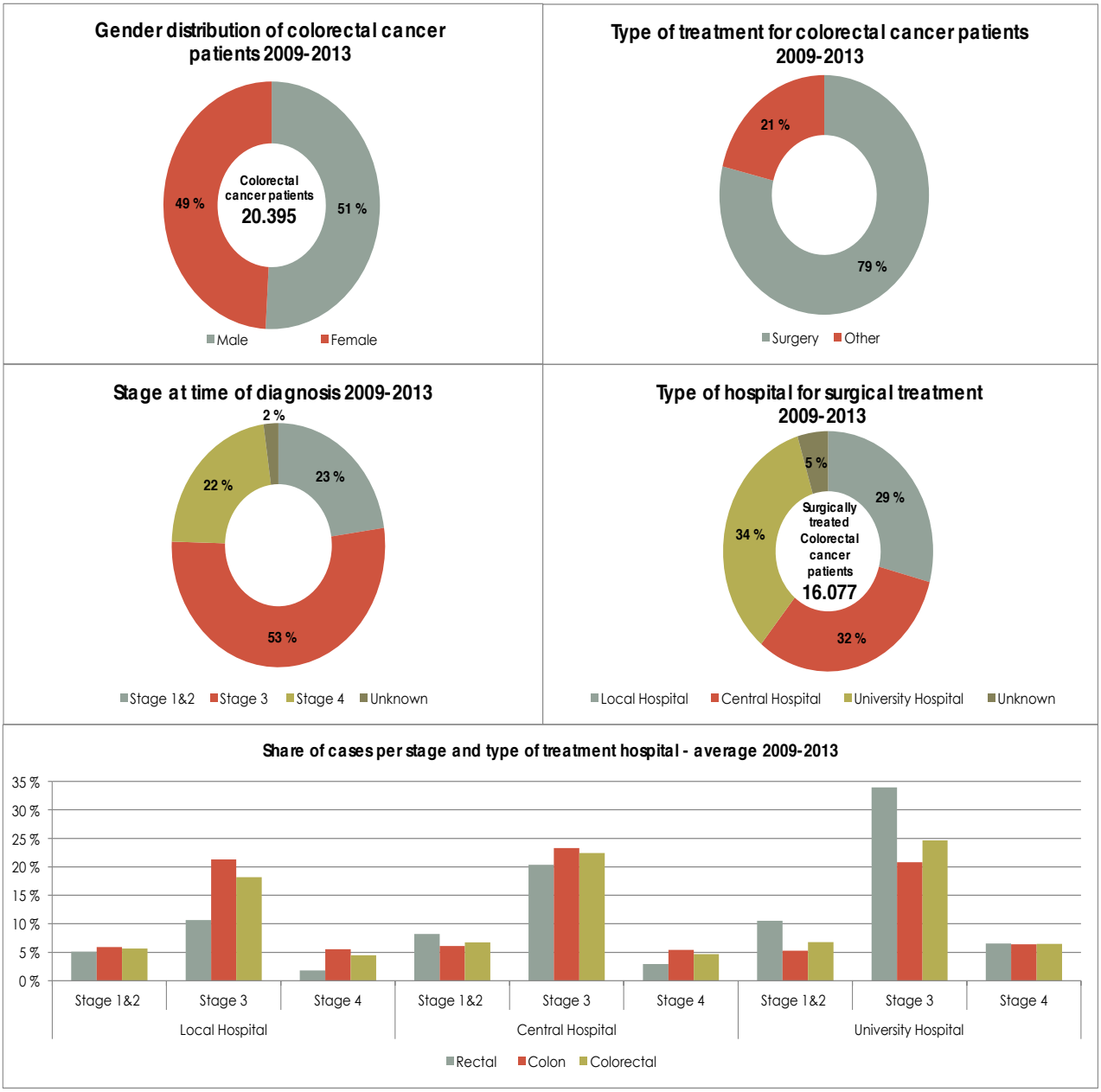

Figure 13: Gender distribution, treatment type, stages and type of hospital for the period 2009-2013

Figure 14: Waiting times differentiated by cancer, stage and type of hospital.

4.0 Discussion

The service economy calls for new methods for understanding how we affect and interact with our environment. We currently live in a society in which services make up the majority of our consumer activities [46], although we still consume a great deal of physical products directly, but also indirectly through services. All services shares some similarities of components: (i) employment whether it is a taxi driver, a teacher or a doctor; (ii) infrastructure or physical materials, in the form of a car, a school or a hospital; and (iii) the demander, the population itself. To understand and estimate the impacts of services in our environment, all three components or layers are essential even if only the physical materials yields the impacts; it does so because we demand it. We therefore, when assessing the environmental impacts of services need to address the three layers and their relationships.

All layers are subjected to change and have their own dynamics and drivers. Currently the population in Norway, which is going through a process of aging, being both the demander and the supplier of services will change how and what we demand, and how and what we can provide for it. Infrastructure is also subjected to change, our physical surroundings also age, and as the population's demand-patterns change the infrastructure that we have today may not be able to provide what we need in the future. To be able to comprehend the complexity of such dynamic systems, the use of a holistic systems perspective - as Industrial Ecology and Material Flow Analysis can provide - gives us the opportunity to not only quantify the interactions between man and nature, but also to analyse how we can more efficiently utilize what we have both now and in coming years.

Scenario 1 and 2 for system 1 show the very valid point, regardless of the assumptions made, that most likely we will see an increase in colorectal cancer patients in the future due to the aging of the population and the correspondence of colorectal cancer incidence rates to age. In the very same period, the personnel in the healthcare sector will also age [47]. In 2013 12% of the total man-years in the sector was related to cancer tumours in general. The specialist healthcare sector itself consisted of 110.641 man-years in 2013, and the expected number needed with a medium population growth expectation until 2040 is 155.000 man-years, a 40% increase from 2013. Previous estimates have shown that in 2050, 20% of all Norwegian employment will be connected to the provision of healthcare services [47,48]. The potential doctors, nurses and radiologists in 2040 are already born and are as we speak working their way through the Norwegian education system. We also have to apprehend that although we

understand that we need more personnel in the healthcare sector in the future as this scenario shows us, we cannot force people to take those educational choices or career choices for that matter. The nation will have to prepare for this by internal promotion or importing of qualified personnel [47,48].

In scenario 2 for 2040, there is an increase in the stock of patients waiting for surgical treatment of 330%. The increase of 3003 patients diagnosed in 2040 shows us that we would need almost a doubling of resources in the two other layers to be able to meet the demand for colorectal cancer treatment, assuming no changes in the treatment procedures and resources requirements. Although our model yields several limitations as discussed earlier, it shows the need for long-term management and planning in the healthcare sector both in terms of employment and infrastructure if the same or an improved level of service is to be given in the future years.

Not only having a well-functioning service sector is important for patients and employees, it is also at the core of policy-making. Politics are defined as the management of scarce resources; we are very close to a future where labour, materials and our natural environment are scarce resources, most of them already are [48–50]. All of them deeply interconnected and they need to be understood as a unity. To be able to make good policies all information needs to be assessable and understood; medical information is a bit tricky in that sense. It is some of the most private information we have as individuals and it is something that we often do not wish to share with the public. Nevertheless, for researchers, not only medical researchers as such, this information can help to communicate to regulators how to better prepare for the future.

Being a public sector, governed by elected officials, and highly influenced by policy, the healthcare sector would greatly benefit from a reporting system in which particularly the interactions between the primary and the specialist healthcare were included. The cancer proceedings for colorectal cancer focus on the time the patient spend in the specialist healthcare sector. However, the majority of cancer patients start their journey in the primary healthcare sector with their GP. If we fast forward to 2040 and the same guidelines for treatment times in 2015 still apply, we continue to see the need for more employment and infrastructure based on the results from our scenarios.

Applying a system-analysis tool like MFA on the service sectors can help us to understand in which parts of the system we can more efficiently utilize resources. Although system

dynamics often are used in patient flow modelling, it sometimes suffers from being lost in the dilemma of building a complex versus quantifiable system; in addition they do not connect the third layer. Converting a casual loop-diagram, in which behavioural aspects also are involved, to a stock and flow model without losing information along the way is a very challenging and time-consuming task. On the other side, discrete event simulation models have their strengths in scenario building and the "what-if" questions and assessing efficiency in the system itself. However, none of the methods applies strict system boundaries, which also impose a modelling issue.

In this sense, building a dynamic MFA model with three layers as proposed in figures 1 and 10, could be a potential solution where the use of a relatively simple system and model does not imply lack of resolution, complexity, and analytical capabilities. By assessing each layer individually before combining them into a more comprehensive model, the modeller would also benefit from a broader understanding of how the totality of the system works. The major benefit that we would get from MFA with respect to alternative methods is the connection of the third layer, the infrastructure. Furthermore, environmental impacts in connection to services could more comprehensible quantified this way. All in one, the social metabolism of a service sector can be assessed.

5.0 Further work and concluding remarks

When modelling patients within the healthcare sector, data availability will always impose an issue. The level of detail that is necessary for us to model the complete flow of the colorectal cancer system in Norway is very high. Accessing these highly-level data, either from the Norwegian Cancer Registry or through individual hospitals, would required applying to the Regional Ethics Committee in Norway - a process that takes a considerable amount of time and effort not compatible with the timeframe of this master thesis -. However, this should be done in future work. Medical data also comes with a high level of responsibility, with the level of detail that is required to model all layers it would be possible for us to identify the patients, and we would need access to the full patient records, which is sensitive information. Before proceeding, we suggest that an analysis of the usage and benefit on acquiring such information, and how this information should be handled, should be carried out. For modelling the patient layer, individual patient records would be the best source of information. The two other layers would need a different approach to data collection based on the spatial scope of the assessment. Some information concerning health care employment is

available through SSB statistics, and they have also recently published a report on healthcare employment in 2040 [47]. If the geographical scale is a health region or a single hospital, questioners can be used to better understand the time consumed per colorectal cancer patient. Information about employment can also be acquired from the HR-section at the different hospitals and for some cases the health regions. Information regarding infrastructure, can be acquired from the real-estate companies that are connected to each health region and in some instances through the Matrikkel database[51].

The importance of providing the service of healthcare to the population cannot in any case be undermined. Medical research has provided giant leaps in our society regarding what we can survive and for how long. Before 1967 the thought of transplanting a heart would sound like science fiction to most people. Our increased life expectancy is owed to medical research and innovation in both treatment, understanding of the human body and medicine. But the societal aspects of increased lifetime have left us with a new type of demographics, new needs and new demands [52]. Reducing our current gap of knowledge on how services relates to emissions, in this case the service of colorectal cancer treatment, will also have to contain a higher level of understanding of the population, for instance how our lifestyle relates to our health.

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Overview Appendix

Appendix 1

MASS BALANCE EQUATIONS

EQUATION 1:

$$\Delta S1 = PO,1a + P0,1b - P1,0a - P1,0b - P1,2 - P1,3 - P1,4 - P1,5 - P1,6$$

EQUATION 2:

$$P1,2 = P2,10 + P2,7$$

EQUATION 3:

$$P1,3 = P3,10 + P3,7$$

EQUATION 4:

$$P1,4 = P4,10 + P4,7$$

EQUATION 5:

$$P1,5 = P5,10 + P5,7$$

EQUATION 6:

$$P1,6 = P6,0$$

EQUATION 7:

$$P7,9 = P2,7 + P3,7 + P4,7 + P5,7 + \Delta S7 - P7,8$$

EQUATION 8:

$$P7,8 = P8,9$$

EQUATION 9:

$$P9,11 = P7,9 + P8,9$$

EQUATION 10:

$$P10,11 = P2,10 + P3,10 + P4,10 + P5,10$$

EQUATION 11:

$$P11,0 = P10,11 + P9,11 - \Delta S11$$

STOCKS

EQUATION 12:

$$S1 = S1_{t-1} + \Delta S1$$

EQUATION 13:

$$S7 = S7_{t-1} + \Delta S7$$

EQUATION 14:

$$S11 = S11_{t-1} + \Delta S11$$

CONSTANTS

EQUATION 15:

$$P0{,}1a = BIRTHS$$

EQUATION 16:

$$P1{,}0a = DEATHS$$

EQUATION 17:

$$P0{,}1b = IMM$$

EQUATION 18:

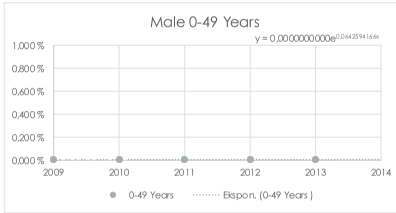
$$P1{,}0b = EM$$

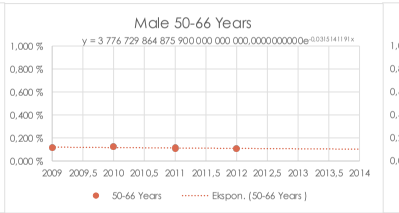
PARAMETERS

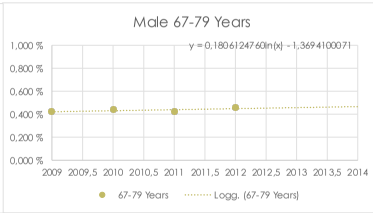
				2013										2040	
				Colorectal cancer						Rectal		Colon		Colorectal	
				Averages		Trend line - logarithmic		Averages - real incidence		Aveages - real incidence		Averages - real incidence		2013 Incidence - average parameters	
Name	Abbreviation	Unit	Source	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female		
Percentage share of people under the age of 50 diagnosed with colorectal cancer	U50_DCR	p/year	CR	0,01 %	0,01 %	0,01 %	0,01 %	0,01 %	0,01 %	0,00 %	0,00 %	0,00 %	0,00 %	0,01 %	0,01 %
Percentage share of people from 50-66 diagnosed withe colorectal cancer	50-66_DCR	p/year	CR	0,12 %	0,09 %	0,11 %	0,10 %	0,12 %	0,09 %	0,05 %	0,03 %	0,07 %	0,06 %	0,12 %	0,09 %
Percentage share of people from 67-79 diagnosed withe colorectal cancer	67-79_DCR	p/year	CR	0,44 %	0,23 %	0,46 %	0,10 %	0,39 %	0,33 %	0,14 %	0,08 %	0,25 %	0,23 %	0,39 %	0,33 %
Percentage share of people from 80-89 diagnosed withe colorectal cancer	80-89_DCR	p/year	CR	0,68 %	0,40 %	0,71 %	0,48 %	0,70 %	0,55 %	0,19 %	0,11 %	0,49 %	0,41 %	0,70 %	0,55 %
Precentage share of people over the age of 90 diagnosed with colorectal cancer	O90_DCR	p/year	CR	0,66 %	0,47 %	0,71 %	0,43 %	0,66 %	0,54 %	0,14 %	0,10 %	0,45 %	0,35 %	0,66 %	0,54 %
Share of Biopsy as mean basis for diagnosis	DB	p/year	CR	95,45399 %		95,45399 %		95,45399 %		97,08411 %		94,70871 %		95,45399 %	
Share of Others as mean basis for diagnosis	DO	p/year	CR	0,46124 %		0,46124 %		0,46124 %		0,73545 %		0,33805 %		0,46124 %	
Share of Image Diagnostics as mean basis for diagnosis	DID	p/year	CR	1,38638 %		1,38638 %		1,38638 %		0,49503 %		1,79247 %		1,38638 %	
Share of Endoscopy as mean basis for diagnosis	DE	p/year	CR	0,85999 %		0,85999 %		0,85999 %		1,02998 %		0,78384 %		0,85999 %	
Share of Death as mean basis for diagnosis	DD	p/year	CR	1,83839 %		1,83839 %		1,83839 %		0,65543 %		2,37693 %		1,83839 %	
Surgically treated colorectal patients	ST_CR	p/year	CR	79 %		79 %		79 %		73 %		81 %		79 %	
Other treatment colorectal cancer patients	OT_CR	p/year	CR	21 %		21 %		21 %		27 %		19 %		21 %	
Maximum treatment capacity	MAXT_CR	p/year	CR	90 %		90 %		90 %		82 %		93 %		90 %	**3242**
Colorectal cancer patients with pre operative treatment	PRE_ST	p/year	CR	13 %		13 %		13 %		39 %		2 %		13 %	
Colorectal cancer patients without pre operative treatment	NOPRE_ST	p/year	CR	87 %		87 %		87 %		61 %		98 %		87 %	
Relative Survival 1 year	SURV	p/year	CR	87 %		87 %		87 %		0,88		0,86		87 %	

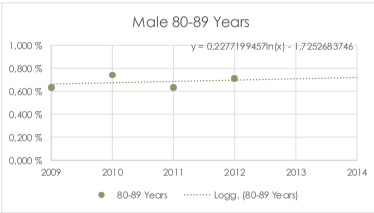
CONSTANTS

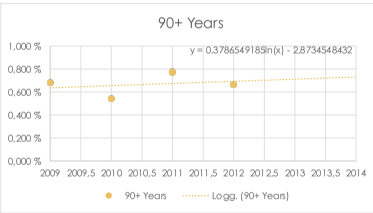
Name	Abbreviation	Unit	Source
Births	BIRTHS	p/year	SSB
Deaths	DEATHS	p/year	SSB
Emigration	IMM	p/year	SSB
Immigration	EM	p/year	SSB
S1 at t-1	S1t-1	p/year	SSB
S7 at t-1	S7t-1	p/year	CR
S11 at t-1	S11t-1	p/year	Assumed 0

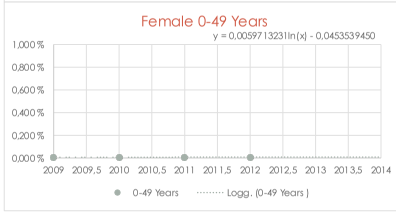

Male 0-49 Years
y = 0,000000000e^0,0642594166x
1,000 %
0,800 %
0,600 %
0,400 %
0,200 %
0,000 %
2009
2010
2011
2012
2013
2014
0-49 Years
Ekspon. (0-49 Years)

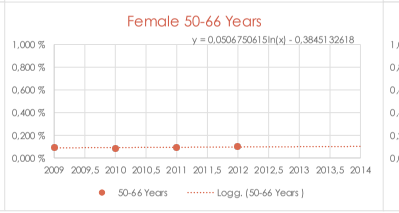

Male 50-66 Years
y = 3 776 729 864 875 900 000 000 000,0000000000e^-0,03154111 91x
1,000 %
0,800 %
0,600 %
0,400 %
0,200 %
0,000 %
2009
2009,5
2010
2010,5
2011
2011,5
2012
2012,5
2013
2013,5
2014
50-66 Years
Ekspon. (50-66 Years)

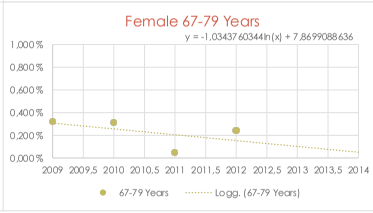

Male 67-79 Years
y = 0,180612476 0ln(x) - 1,3694100071
1,000 %
0,800 %
0,600 %
0,400 %
0,200 %
0,000 %
2009
2009,5
2010
2010,5
2011
2011,5
2012
2012,5
2013
2013,5
2014
67-79 Years
Logg. (67-79 Years)

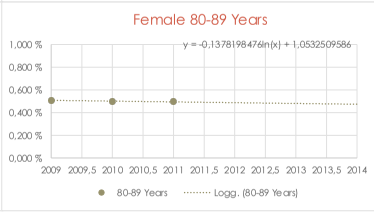

Male 80-89 Years
y = 0,2277199457ln(x) - 1,7252683746
1,000 %
0,800 %
0,600 %
0,400 %
0,200 %
0,000 %
2009
2010
2011
2012
2013
2014
80-89 Years
Logg. (80-89 Years)

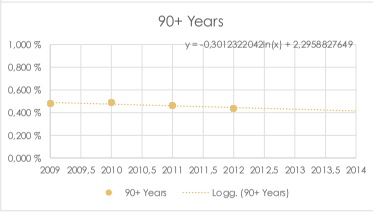

90+ Years
y = 0,3786549185ln(x) - 2,8734548432
1,000 %
0,800 %
0,600 %
0,400 %
0,200 %
0,000 %
2009
2009,5
2010
2010,5
2011
2011,5
2012
2012,5
2013
2013,5
2014
90+ Years
Logg. (90+ Years)


Female 0-49 Years
y = 0,0059713231ln(x) - 0,0453539450
1,000 %
0,800 %
0,600 %
0,400 %
0,200 %
0,000 %
2009
2009,5
2010
2010,5
2011
2011,5
2012
2012,5
2013
2013,5
2014
0-49 Years
Logg. (0-49 Years)


Female 50-66 Years
y = 0,0506750615ln(x) - 0,3845132618
1,000 %
0,800 %
0,600 %
0,400 %
0,200 %
0,000 %
2009
2009,5
2010
2010,5
2011
2011,5
2012
2012,5
2013
2013,5
2014
50-66 Years
Logg. (50-66 Years)


Female 67-79 Years
y = -1,0343760344ln(x) + 7,8699088636
1,000 %
0,800 %
0,600 %
0,400 %
0,200 %
0,000 %
2009
2009,5
2010
2010,5
2011
2011,5
2012
2012,5
2013
2013,5
2014
67-79 Years
Logg. (67-79 Years)


Female 80-89 Years
y = -0,1378198476ln(x) + 1,0532509586
1,000 %
0,800 %
0,600 %
0,400 %
0,200 %
0,000 %
2009
2009,5
2010
2010,5
2011
2011,5
2012
2012,5
2013
2013,5
2014
80-89 Years
Logg. (80-89 Years)


90+ Years
y = -0,3012322042ln(x) + 2,2958827649
1,000 %
0,800 %
0,600 %
0,400 %
0,200 %
0,000 %
2009
2009,5
2010
2010,5
2011
2011,5
2012
2012,5
2013
2013,5
2014
90+ Years
Logg. (90+ Years)

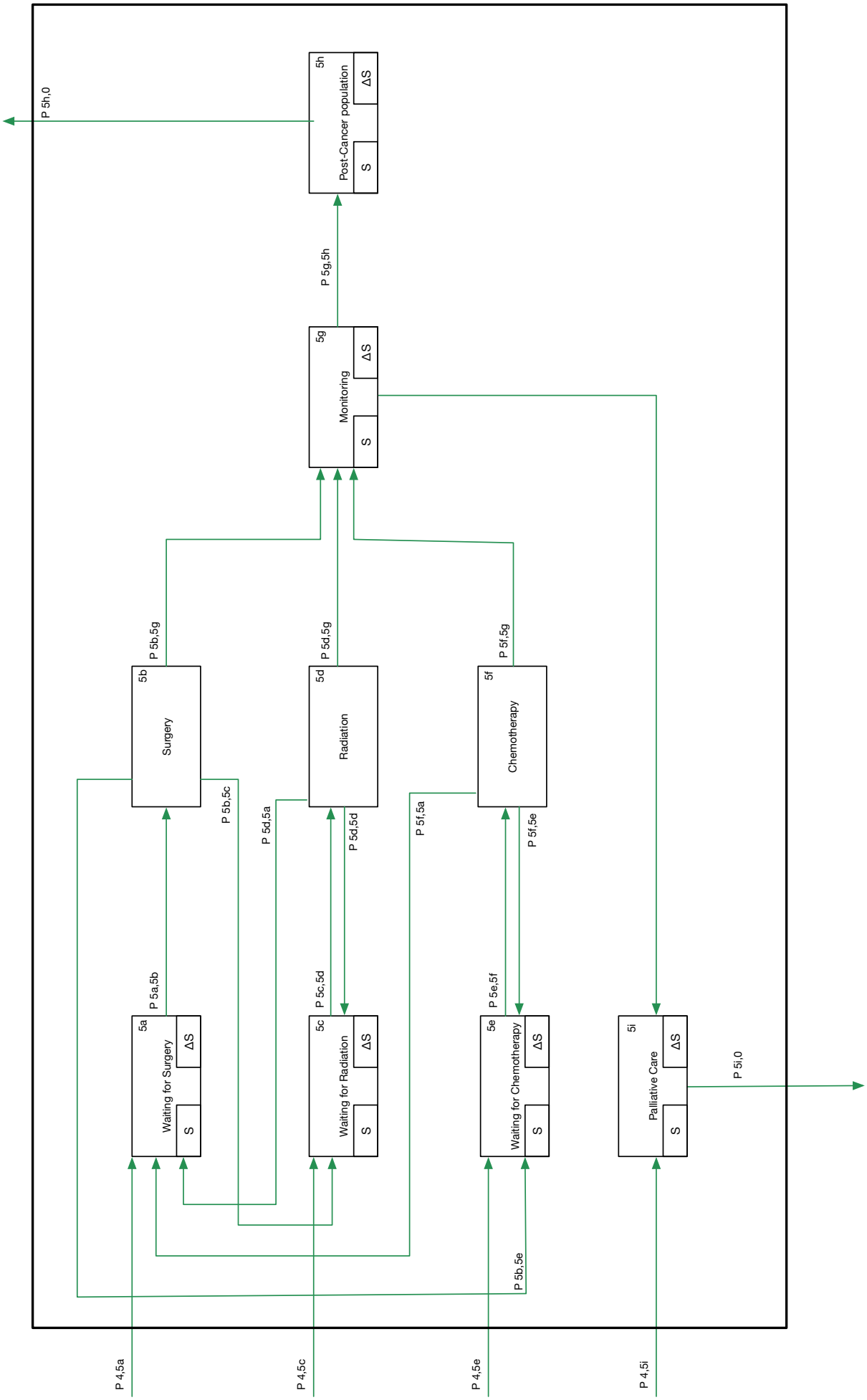
Appendix 4

Surgically treated rectal cancer patients with and without pre-operative treatment, average 2009-2012
Average patients per year 926
39 %
61 %
Pre-operative treatment
No pre-operative treatment
Surgically treated colon cancer patients with and without pre-operative treatment, average 2009-2012
Average patients per year 2.247
2 %
98 %
Pre-operative treatment
No pre-operative treatment
Surgically treated colorectal cancer patients with and without pre-operative treatment, average 2009-2012
Average patients per year 3.173
13 %
87 %
Pre-operative treatment
No pre-operative treatment

Appendix 5

P 2,4a
P 2,4a
Waiting for Colorectoscopy
S
ΔS
4a
P 4a,4b
Colorectoscopy
4b
P 4b,4c
P 4b, 4e
Waiting for Pathology
S
ΔS
4e
P 4e, 4f
Pathology
4f
P 4f, 4g
Waiting for Interpretation Pathology
S
ΔS
4g
P 4g,4d
Waiting for Interpretation Colorectoscopy
S
ΔS
4c
P 4c,4d
Interpretation Colorectoscopy
4d
P 4d,1
P 4d,5
P 2,4l
P 3,4l
P 2,4p
P 3,4p
P 4d,4p
P 4d,4l
P 4d,4h
P 2,4h
P 3,4h
Waiting for MRI
S
ΔS
4p
P 4p,4q
Waiting for CT
S
ΔS
4l
P 4l,4m
Waiting for Ultrasound
S
ΔS
4h
P 4h,4i
MRI
4q
P 4q,4r
CT
4m
P 4m,4n
Ultrasound
4i
P 4i,4j
Waiting for Interpretation MRI
S
ΔS
4r
P 4r,4s
Waiting Interpretation CT
S
ΔS
4n
P 4n,4o
Waiting for Interpretation Ultrasound
S
ΔS
4j
P 4j,4k
Interpretation MRI
4s
P 4s,1
P 4s,5
Interpretation CT
4o
P 4o,1
P 4o,5
Interpretation Ultrasound
4k
P 4k,1
P 4k,5

Appendix 6


5h
Post-Cancer population
ΔS
S
P 5h,0
P 5g,5h
5g
Monitoring
ΔS
S
P 5b,5g
P 5d,5g
P 5f,5g
5b
Surgery
5d
Radiation
5f
Chemotherapy
P 5b,5c
P 5d,5a
P 5d,5d
P 5f,5a
P 5f,5e
P 5a,5b
P 5c,5d
P 5e,5f
5a
Waiting for Surgery
ΔS
S
5c
Waiting for Radiation
ΔS
S
5e
Waiting for Chemotherapy
ΔS
S
5i
Palliative Care
ΔS
S
P 5i,0
P 5b,5e
P 4,5a
P 4,5c
P 4,5e
P 4,5i

Arne Wibe
NTNU
Kopi til M. Lundhaug

Deres ref.: **Vår ref.:** 15/59 **Dato:** 29.4.2015

Datautlevering fra Kreftregisteret

Det vises til henvendelse vedrørende prosjektet «En sosioøkonomisk analyse av spes.helsetjenestesektoren». Vedlagt finner dere datafilen. Informasjon om uttrekket som er gjort, samt dokumentasjon av variabler er også vedlagt. Vi ønsker at du/dere leser de følgende vilkårene for bruk av data nøye.

Vilkår for utlevering av data:

- Dataene er avidentifiserte, og kan ikke knyttes til en enkeltperson.
- Opplysningene skal kun brukes til det formål som er nevnt i søknaden. Opplysningene skal ikke overlates til andre enn prosjektmedarbeidere som er oppgitt i søknaden/prosjektprotokollen.
- Hvis opplysningene ønskes brukt til andre formål, må det søkes på nytt om dette.
- Alle som mottar datasettet har taushetsplikt i henhold til lov av 14. april 2000 nr. 31 om behandling av personopplysninger (personopplysningsloven) § 2. Opplysningene skal oppbevares betryggende og på en slik måte at uvedkommende ikke får tilgang til dem, og ellers i samsvar med sikkerhetsbestemmelsene i forskrift av 23. desember 2003 om behandling av personopplysninger (personopplysningsforskriften) § 2.
- Mottatt materiale skal slettes innen 5 år etter prosjektslutt (jfr. Helseforskningsloven § 38). Skriftlig bekreftelse på at materialet har blitt slettet skal sendes til Kreftregisteret.
- Bakveisidentifisering eller forsøk på rekonstruksjon av identitet på utlevert materiale er ikke tillatt.
- Publisering og annen offentliggjøring skal gjøres på en slik måte at enkeltpersoner ikke kan identifiseres.
- Kreftregisteret har ikke ansvar for analyser eller konklusjoner basert på de utleverte data, og ved publisering skal nedenforstående ansvarsbegrensing (disclaimer) benyttes.

  "The study has used data from the Cancer Registry of Norway.

  The interpretation and reporting of these data are the sole responsibility of the authors, and no endorsement by the Cancer Registry of Norway is intended nor should be inferred."

  (Norsk versjon finnes på våre hjemmesider.)

Hjemmelsgrunnlaget for utlevering av disse dataene er forskrift fra 21. desember 2001 nr. 1477 om innsamling og behandling av helseopplysninger i Kreftregisteret (Kreftregisterforskriften) § 3-4.

Kreftregisteret har plikt til å vurdere institusjoners og enkeltpersoners behandling av utleverte data. Dersom ovennevnte vilkår brytes vil Kreftregisteret vurdere fremtidige utleveringer til virksomheten og/eller enkeltpersoner.

Vi ber deg snarest om å kontrollere at den mottatte filen er i orden. Dersom du oppdager feil ønsker vi at du tar kontakt med oss, slik at vi kan få muligheten til å rette opp i eventuelle feilregistreringer i Kreftregisteret. Hvis noe er uklart, er det bare å ta kontakt.

Dette er et enkeltvedtak som kan påklages etter forvaltningslovens § 28. En eventuell klage sendes til Kreftregisteret **innen tre uker** etter at du har mottatt brevet.

VENNLIGST ADRESSER POST TIL KREFTREGISTERET OG IKKE TIL ENKELTPERSONER

Postadresse PB 5313 Majorstuen 0304 OSLO | Kontoradresse Fr. Nansens vei 19 | Telefon: 22 45 13 00 Telefaks: 22 45 13 70 | E-post: kreftregisteret@kreftregisteret.no Internett: www.kreftregisteret.no | Org. nr.: 974707160 Bankkonto: 1607.45.02427

Lykke til med prosjektet!

Med vennlig hilsen

Anna Skog

Datautleveringsenheten
Kreftregisteret
Postboks 5313, Majorstuen
0304 OSLO
Tlf.: 22 45 13 03

Dokumentasjon av variablene i Kreftregisterets data

De nedenstående variablene kan finnes flere ganger, da de inneholder informasjon om hvert enkelt sykdomstilfelle for de ulike pasientene.

Diagnosedato (dd.mm.åååå)

Dato og årstall for diagnosetidspunktet.
Som sykdommens *diagnosedato* regnes tidspunktet sykdommen ble bekreftet etter utredning. *Diagnosedato* er i databasen satt lik den tidligste av følgende datoer: Diagnosedato opplyst av kliniker på klinisk melding, dato for tidligste histologiske verifikasjon (dato for prøvetaking) og dødsdato.

DS (Diagnosens sikkerhet)

Informasjon om to forskjellige variabler: svulstens malignitetsgrad (malignitetspotensiale) og grad av sikkerhet svulstens utgangspunkt er bestemt med.

Kode	Definisjon
0	Det foreligger SVULST MED USIKKER MALIGNITET og USIKKER TOPOGRAFI
1	Det foreligger SVULST UTEN PÅVIST MALIGNITET og SIKKER TOPOGRAFI
	i. Det foreligger benign svulst og sikker topografi. Gjelder *sentralnervesystemet* og visse andre organer
	ii. Det foreligger atypi i epitel/carcinoma in situ og sikker topografi
	iii. Det foreligger usikker malignitetsgrad (usikkert benign/premalign/malign svulst) og sikker topografi
2	Det foreligger SVULST MED SIKKER MALIGNITET og USIKKER TOPOGRAFI (benyttes bare for solide svulster)
3	Det foreligger SVULST MED SIKKER MALIGNITET og SIKKER TOPOGRAFI
4	Der foreligger SVULST MED SIKKER MALIGNITET hos pasient som er registrert med premalign tilstand i samme organ mer enn fire hele måneder forut for diagnosemåneden til aktuelle krefttilfelle og SIKKER TOPOGRAFI
5	Det foreligger *KLINISK* SIKKER KREFT og SIKKER TOPOGRAFI
6	Det foreligger SOLID SVULST MED SIKKER MALIGNITET men USIKKERHET OMKRING SVULSTENS OPPHAV i følgende situasjoner
i.	Når det er usikkert om det foreligger METASTASE FRA ANNEN SVULST (TIDLIGERE ERKJENT ELLER IKKE) eller NY PRIMÆRSVULST

ii.	Når det foreligger *METASTASE* med opphav i *METASTASE* MED OPPHAV I ÉN AV TO ELLER FLERE TIDLIGERE REGISTRERTE PRIMÆRSVULSTER (uten at det vites fra hvilken) eller *METASTASE* MED OPPHAV I ANNEN ENNÅ IKKE ERKJENT PRIMÆRSVULST
7	Det foreligger *histologi/cytologi-melding* eller *dødsattest* om SVULST MED USIKKER MALIGNITETSGRAD (usikkert benign/premalign/malign svulst) og SIKKER TOPOGRAFI *før klinisk melding* er registrert

Lok_Icd7

Informasjon om svulstens utgangspunkt kodet etter ICD-7 med noen modifikasjoner. Lok_ICD7 er i forskningsfilen angitt som en firesifret kode, der punktum mellom 3. og 4. siffer er fjernet.
For nærmere forklaring til kodene, se vedlegget «Lokalisasjon ICD 7.pdf».

Topografi_ICDO3

Informasjon om svulstens utgangspunkt kodet etter ICD-O (3. revisjon). Automatisk konvertert med utgangspunkt i Lok_ICD7 eller Topografi. Topografi_ICDO3 er i forskningsfilen angitt som en tresifret kode, der punktum mellom 2. og 3. siffer er fjernet, samt første bokstav.

Referanse:
International Classification of Diseases of Oncology
Third Edition
World Health Organization
Geneva 2000
ISBN 92 4 154534 8

http://apps.who.int/iris/bitstream/10665/96612/1/9789241548496_eng.pdf?ua=2

I tillegg finnes kodene:
42.7 - Leukemi (eller beslektet tilstand) er meldt, men TOPOGRAFI er uavklart.
77.6 - Malignt lymfom/leukemi utgått fra benmarg.
77.7 - Topografi foreløpig ubestemt (tilfredsstillende klinisk melding foreligger ikke). (Benyttes som purregrunnlag.)

Morfologi_ICDO3

Svulsttype, for maligne tilstander kodes differensiering i 6. siffer. Automatisk konvertert med utgangspunkt i Hist_MoTNaC eller Morfologi. Hovedsakelig angitt som ICD-O (3. revisjon). Morfologi_ICDO3 er i forskningsfilen angitt som en sekssifret kode, der </> mellom 4. og 5. siffer er fjernet, 6. siffer er differensieringsgrad.

Referanse:
International Classification of Diseases of Oncology
Third Edition

World Health Organization
Geneva 2000
ISBN 92 4 154534 8

http://apps.who.int/iris/bitstream/10665/96612/1/9789241548496_eng.pdf?ua=2

I tillegg finnes kodene:
690099 – Mikroskopisk undersøkelse foretatt, men morfologi er ikke meldt.
699999 – Mikroskopisk undersøkelse ikke foretatt, ukjent om mikroskopisk undersøkelse er foretatt.

ICD10_gr

Informasjon om svulstens utgangspunkt. Konvertert med utgangspunkt i lokalisasjonskodene og morfologikodene, og angitt som ICD 10-gruppe.
Se Cancer in Norway for inndeling av ICD 10-gruppene.
www.kreftregisteret.no/no/Generelt/Publikasjoner/Cancer-in-Norway

Basis

Basis for diagnosen. Angir mest pålitelige diagnostiske metode som ligger til grunn for diagnosen.

Kode	Definisjon
00	Klinisk undersøkelse uten tilleggsundersøkelser *utenfor sykehus*
10	Klinisk undersøkelse uten tilleggsundersøkelser *i sykehus*
20	Bildediagnostikk (røntgen, UL, CT, MR)
22	Klinisk melding når det vites at det er gjort cytologisk undersøkelse av primærsvulst eller metastase som bekrefter diagnosen
23	Sykdomstilfelle generert på bakgrunn av stråleterapidata + pas.adm.data Sykdomstilfelle generert på bakgrunn av dødsattest + pas.adm.data
29	Prostata-spesifikt antigen (PSA) (basis for kreft i blærehalskjertel)
30	Biokjemisk undersøkelse, elektroforese
31	Endoskopisk undersøkelse (uansett organ, inkl. ERCP)
32	Cytologisk undersøkelse (inkl. celleblokk), punksjonscytologi, Frantzens biopsi fra primærsvulst
33	Blodutstryk (cytologisk undersøkelse av perifert blod under mikroskop)
34	Benmargsutstryk (benmargsaspirat, sternalpunksjon, sternalmarg)
35	Spinalvæskeundersøkelse
36	Cytologisk undersøkelse av metastase
37	Cytologisk undersøkelse av lokalt residiv (tilbakefall av sykdommen i samme kroppsområde som primærsvulsten satt)
38	Cytologisk undersøkelse med immunfenotyping, immuncytokjemi eller cytogenetikk
39	Cytologisk undersøkelse, usikkert om fra primærsvulst eller metastase

	(Benyttes selv om cytologiske spesialundersøkelser er utført)
40	Operativt inngrep (eksplorativt eller terapeutisk) uten morfologisk undersøkelse
41	Obduksjon uten histologisk undersøkelse
45	Ploiditetsanalyse, flowcytometri eller billedanalyse [uten histologisk undersøkelse besvart på aktuelle remisse]
46	Hormonreceptoranalyse
47	Molekylærgenetisk undersøkelse, PCR
57	Histologisk undersøkelse av lokalt residiv (tilbakefall av sykdommen i samme kroppsområde som primærsvulsten satt)
60	Histologisk undersøkelse av metastase
(68) (kodes ikke på noen melding)	Histologisk undersøkelse av metastase og obduksjon BASIS 68 genereres automatisk i SYKDOMSTILFELLE på grunnlag av BASIS 60 og BASIS 80 eller 82 enten disse kodekombinasjoner forekommer på forskjellige meldinger, mellom SYKDOMSTILFELLE og ny melding eller mellom obduksjons-journalens to basis-koder. Benyttes kun for *solide* svulster.
70	Histologisk undersøkelse av primær solid svulst og alle non-solide svulster som ikke kodes BASIS 74, 75 eller 76. Benyttes også på residiv av non-solide svulster
(71)	Dersom, etter ordinær oppdatering av SYKDOMSTILFELLE, DS ∈ {5} og BASIS ∈ {32, 33, 34, 35, 39, 70, 74, 75, 76}, settes automatisk BASIS = 71 i *sykdomstilfelle*
72	Klinisk melding når det vites at det er gjort histologisk undersøkelse av primærsvulst eller metastase som bekrefter diagnosen (uansett om histologi-remissen er registrert eller ikke)
74	Histologisk undersøkelse med elektronmikroskopi (ultrastrukturell diagnostikk) av non-solid svulst (fra 01.01.93) og solid primærsvulst (fra 01.01.94)
75	Histologisk undersøkelse med **immunfenotyping** (immunhistokjemi, immunfluorescens, væskestrømcytometri) av non-solid svulst (fra 01.01.93) og solid primærsvulst (fra 01.01.94)
76	Histologisk undersøkelse med cytogenetisk/molekylærgenetisk undersøkelse / billedanalyse (D score, MNA-10, MAI) av non-solid svulst (fra 01.01.93) og solid primærsvulst (fra 01.01.94)
(78) (kodes ikke på noen melding)	Histologisk undersøkelse av primærsvulst og obduksjon basis 78 genereres automatisk i sykdomstilfelle på grunnlag av basis 70 og basis 68, 80 eller 82 enten disse kodekombinasjoner forekommer på forskjellige meldinger, mellom sykdomstilfelle og ny melding eller mellom obduksjons-journalens to basis-koder. Benyttes kun for solide svulster
79	Histologisk undersøkelse, ukjent om vevsprøven er fra primærsvulst eller metastase
80	Obduksjon med histologisk undersøkelse, obduksjon med forutgående histologisk undersøkelse

81	Tilfeldig funn ved obduksjon med histologisk undersøkelse
82	Partiell obduksjon
83	På klinisk melding anføres, i tillegg til ordinær BASIS, /83 når det vites at det er utført obduksjon (uansett obduksjonens omfang, om krefttilfellet er et tilfeldig funn ved obduksjon eller om obduksjons-rapporten er registrert eller ikke)
(84)	Historisk, benyttes ikke etter 01.01.93: Obduksjon uten restsvulst
90	Dødsmelding
98	Vevsprøve (histologisk eller cytologisk) uten svulstvev
99	Diagnosebasis ukjent

Metastase

Utbredelse på diagnosetidspunktet.
METASTASE-koder (etter omkoding) benyttet for de fleste lokalisasjoner t.o.m. 31.12.85 (og for brystkreft, C50, igjen f.o.m. 01.01.94).

Kode	Definisjon
0	Ingen direkte innvekst i omliggende vev/organ, lymfeknutemetastase eller organmetastase. Metastase innen samme organ som primærsvulsts utgangspunkt
A	Regionale lymfeknutemetastaser (klinisk eller histologisk).
B	Fjerne lymfeknutemetastaser eller organmetastaser
C	Metastase påvist, men ukjent hvor
D	Direkte innvekst i omliggende vev eller organ
9	Ukjent utbredelse på diagnosetidspunktet

METASTASE-koder med generelle definisjoner benyttet f.o.m. 01.01.86.

Kode	Definisjon
0	Ingen direkte innvekst i omliggende vev/organ, lymfeknutemetastase eller organmetastase. Metastase innen samme organ som primærsvulstens utgangspunkt
1	Lymfeknutemetastase til samme kroppsavsnitt
2	Lymfeknutemetastase utenfor samme kroppsavsnitt
3	Organmetastase til samme kroppsavsnitt
4	Organmetastase utenfor samme kroppsavsnitt
5	Mikroskopisk innvekst i nabostruktur
6	Makroskopisk innvekst i nabostruktur (alle typer undersøkelsesmetodikk)
7	Metastase påvist, men ukjent hvor
8	Mikroinvasiv vekst, karsinom med begynnende infiltrasjon
9	Ukjent utbredelse på diagnosetidspunktet

For lokalisasjonskodene 206.X og 207.X (non-solide svulster) vil metastasevariabelen stå tom eller ha fått verdien '9', da det ikke er aktuelt å kode metastase for disse lokalisasjonene. Det samme vil i noen tilfeller gjelde for lokalisasjonskoder 199.X. (ukjent utgangspunkt).

NB! Kreftregisteret har en lang periode fra starten av 1990-tallet kodet metastase = '9' dersom det ikke er gitt spesifikke opplysninger om svulstens utbredelse fra kliniker/patolog. Ukjent utbredelse kan derfor både bety at utbredelse faktisk ER ukjent på diagnosetidspunkt, men også at Kreftregisteret ikke har mottatt opplysninger om utbredelsen.

Gruppering av metastasekoder til stadier
Lokalisert: 0 og 8
Regional spredning: A, D, 1, 5 og 6
Fjernmetastaser: B, 2, 3 og 4
Annet/ukjent: C, 7 og 9

Kirurgi

Kode	Diagnostiske inngrep
00	Intet inngrep (gammel kode)
01	Biopsi *uten* kirurgisk inngrep/eksplorasjon (basis 70, 72, 74, 75 eller 76) *Solide* svulster: Biopsi rettet mot *primærsvulst* uten kirurgisk eksplorasjon *Non-solide* svulster: Biopsi av enhver type (lymfeknutebiopsi, ekstirpasjon av overfladisk lymfeknute i diagnostisk øyemed, benmargsbiopsi, annen organbiopsi)
02	Kirurgisk åpning/eksplorasjon (f.eks. kraniotomi, torakotomi, laparotomi, osteotomi) med eller uten biopsi
07	Vaktpostlymfeknute (sentinel node): Uttak av én eller flere lymfeknuter etter injeksjon av fargestoff eller radioaktiv isotop [For C50 Brystkreft i bruk f.o.m. 22.11.2001] [For C44 Malignt melanom i bruk f.o.m. 24.03.2003]
95	Biopsi fra metastase (BASIS 60), lokalt residiv (BASIS 57), svulst som verken kan klassifiseres som primærsvulst eller metastase (BASIS 79) eller biopsi uten svulstvev (BASIS 98) på histologisk melding. Klinisk melding krever BASIS 72 (benyttes bare for *solide* svulster) [Gyldig for svulster med diagnosedato f.o.m. 01.01.2001, tatt i bruk i 2003]
96	Cytologisk prøve (celleundersøkelse ved aspirasjon av svulstceller, blodutstryk, benmargsutstryk og kroppsvæskeundersøkelser). [I bruk f.o.m. 01.02.2002]
99	Mangelfulle opplysninger om kirurgisk inngrep
Kode	**Terapeutiske inngrep**

01	Denne koden har spesiell betydning for brystkreft*
09	Lokal ablativ terapi av primærsvulst (behandling som ødelegger svulsten) med eller uten tidligere/samtidig diagnostisk biopsi. Omfatter laserbehandling (men ikke laserkniv), fotodynamisk behandling (PDT), kryokirurgi, radiofrekvensablasjon (RFA), fulgurasjon o.a. Tatt i bruk i 2003
10	Kirurgisk fjernelse av primærsvulst sammen med deler av eller hele organet (evt. med lymfadenektomi) C61: Radikal prostatektomi C44: Fjernelse av svulst i hud C50: Benyttes for kvinner ikke etter 01.01.1993 C53: Trakelektomi
11	Kirurgisk fjernelse av primærsvulst (ev. med lymfadenektomi) For C50-svulster benyttes KIRURGI 11 for kvinner bare for aberrant brystkjertel (C50.9/170.8) etter 01.01.1993
12	Lymfadenektomi (systematisk dissikering av lymfeknuter) (partielt eller totalt)
13	Prostatektomi, transvesikal (suprapubisk)
	Transvesikal reseksjon av blæresvulst (cystectomi kodes KIRURGI 10, transvesikal biopsi kodes KIRURGI 02)
14	C50: Mastektomi *uten* lymfadenektomi (kirurgi 10 t.o.m. 31.12.92) C61: Cystoprostatektomi. Fjerning av prostata og urinblære i samme seanse (Tatt i bruk 01.01.2008) C67: Cystoprostatektomi. Fjerning av prostata og urinblære i samme seanse (Tatt i bruk 01.01.2008) C73: Hemithyreoidectomi (Tatt i bruk 01.01.2010)
15	Mastektomi *med* lymfadenektomi (KIRURGI 10 t.o.m. 31.12.92)
16	Mastektomi, lymfadenektomi ikke spesifisert (KIRURGI 10 t.o.m. 31.12.92)
17	Brystbevarende kirurgi (lumpektomi, kvadrantektomi) uten lymfadenektomi, biopsi i betydningen fjernelse av hele svulsten i terapeutisk øyemed) (KIRURGI 11 t.o.m. 31.12.92)
18	Brystbevarende kirurgi (lumpektomi, kvadrantektomi) *med* lymfadenektomi (KIRURGI 11 t.o.m. 31.12.92)
19	Brystbevarende kirurgi, lymfadenektomi ikke spesifisert (KIRURGI 11 t.o.m. 31.12.92)
20	Transurethral reseksjon (TUR) (transurethral *biopsi* kodes KIRURGI 01) Konisering (inkl. laser) og amputasjon av livmorhals Gammel koding: bronkoskopi+laser ved lungecancer (brukt på DNR-meldinger) Gammel koding: Reseksjon av hjernetumores (unntatt inngrep på meningiomer, nevrinomer og hypofyseadenomer som kan kodes 11)

21 Historisk kode	Terapeutisk inngrep mot metastase (OBS: lymfadenektomi kodet KIRURGI 12)
25	Mastektomi med uttak av vaktpostlymfeknute (Tatt i bruk i 2003)
26	Mastektomi med uttak av vaktpostlymfeknute og lymfadenektomi [Kan benyttes fra 01.01.1993, tatt i bruk i 2004, bare for kvinner]
28	Brystbevarende kirurgi (lumpektomi, kvadrantektomi) med uttak av vaktpostlymfeknute (Tatt i bruk i 2003)
29	Brystbevarende kirurgi (lumpektomi, kvadrantektomi) med uttak av vaktpostlymfeknute og lymfadenektomi [Kan benyttes fra 01.01.1993, tatt i bruk i 2004, bare for kvinner]
30	Anastomose- og drenasjoeoperasjoner som etablerer ny passasje utenom tumor uten å fjerne denne. Herunder: Ventriculostomi (i hjernen), Tracheostomi, Gastrostomi, Gastro-enterostomi, Colostomi, Coecostomi, Transversostomi, Sigmoideostomi, Cholecysto-duodenostomi, Cystostomi, Nephrostomi (gammel kode)
35	Utvidet eksisjon (re-eksisjon) etter tidligere eksisjon av primærsvulst (Tatt i bruk i 2003)
40	Andre rent palliative inngrep, ikke direkte rettet mot tumor eller met. Herunder: Splenectomi, Cordotomi, Denervasjon (gammel kode)
43	Prostatacancer primært hormonbehandlet og senerer resesert transvesikalt (gammel kode)
50	Prostata resesert transurethralt (gammel kode)
97	Terapeutisk inngrep rettet mot residiv eller metastase (lymfadenektomi kodes KIRURGI 12), avlastende/palliativ kirurgisk behandling med eller uten reseksjon av primærsvulst eller metastase, annet terapeutisk inngrep som ikke er rettet mot primærsvulst, residiv eller metatase. *Unntak:* TUR av residiv i urinblære og blærehalskjertel kodes KIRURGI 20
98 Historisk kode	Operert uns
	Andre og uspesifiserte inngrep
99	Mangelfulle opplysninger om kirurgisk inngrep

* I perioden 1993-2000 har lumpektomi på histologisk melding i stor grad blitt kodet som biopsi (kirurgi 01) for brystkreft.
Kirurgi trekkes opp i sykdomstilfellet dersom operasjonsdato er innenfor ett år (<365 dager) fra diagnosedato.
For non-solide er det ingen begrensning i tid. For brystkreft gjelder egne regler.

Kodebok

-utdrag

Kreftregisteret
ICD-7
1953-1992

Lok. Ca. labii (leppestift-området)
140.0: Overleppe.
140.1: Underleppe.
140.2: Begge lepper.
140.7: Kommissurer, før 1983
140.8: Andre spesifiserte lokal. bl.a. kommissurer.
140.9: Leppe i.n.s.

Lok. Ca. linguae
141.0: Tungebasis, tungerot, tungemandel (tonsilla lingualis).
141.1: Tungens overside.
141.2: Tungespiss eller tungerand.
141.3: Tungens underside.
141.8: Omfatter store tumores med utbredelse over flere lok.
141.9: Tunge, i.n.s.
Gamle koder
- Tungens høyre/venstre side ble tidligere kodet både på 141.9 (før 1983) og på 141.8 (fom. 1983 tom. 1985).
- Tungemandel ble tidligere (før 1986) kodet 145.0.

Lok. Ca. glandula salivariae
142.0: Glandula parotis.
142.1: Glandula submandibularis.
142.2: Glandula sublingualis.
142.7: Samlekode for Glandula submandibularis, før 1983
142.9: Stor spyttkjertel i.n.s.

Lok. Ca. baseos oris
143.0: Gingiva inferior (nedre). Tannkjøttet i underkjeven.
Gumme. Slimhinnen svarende til processus alveolaris inferior.
143.1: Regio sublingualis. Ikke på tungens underside, men munngulvet under tungen.
143.8: Svulster over flere sublokalisasjoner.
143.9: Munngulv i.n.s.

Lok. Ca. cavum oris
144.0: Bløte/harde gane (palatum molle/durum). Drøvelen (uvula).
144.1: Gingiva superior (øvre). Tannkjøttet i overkjeven.
Slimhinnen svarende til processus alveolaris superior.
144.2: Bucca. Kinnslimhinne. Omfatter også slimhinnesiden av leppene.
144.8: Andre spesifiserte lokalisasjoner i munnhulen.
144.9: Munnhule i.n.s. Gingiva i.n.s.

Lok. Ca. mesopharyngis (oropharyngis)
145.0: Tonsille, halsmandel (tonsilla palatina).
145.1: Vallecula epiglottica.
145.2: Overside av epiglottis.
145.7: Mesopharynx , andre lokalisasjoner. Ble kodet som 145.8 før 1983
145.8: Mesopharynx i.n.s., før 1983
145.9: Mesopharynx i.n.s
Gamle koder:
- Tungemandel (tonsilla lingualis, tidligere 145.0) kodes til 141.0.
- Falsk mandel (tonsilla pharyngea, tidligere 145.0) kodes til 146.0.

Lok. Ca. epipharyngis
146.0: Epipharynx = nasopharynx = rhinopharynx,
tonsilla pharyngea (falsk mandel).
Gamle koder
146.0 Falsk mandel (tonsilla pharyngea) ble før 1986 kodet 145.0.

Lok. Ca. hypopharyngis
147.0: Hypopharynx, nederste del av svelget.
Hypopharynx i.n.s. og epiglottis i.n.s.
Omfatter bl.a. plica pharyngo-epiglottica, den frie øvre rand
av epiglottis, plica aryepiglottica, tuberculum cuneiforme,
tuberculum corniculatum, incisura inter-arytenoidea, regio
retroarytenoidea, recessus piriformis, regio retro-cricoidea,

Lok. Ca. pharyngis i.n.s
148.0: Svelg i.n.s.
148.1: Bronchiogen halscyste

Lok. Ca. oesophagi
150.0: Oesophagus, spiserør, 15-23 cm fra tannrekken,
øvre (proximale) 1/3.
Overgang hypopharynx - oesophagus.
150.1: 24-32 cm fra tannrekken, midtre 1/3.
150.2: 33-44 cm fra tannrekken, nedre (distale) 1/3.
150.8: Utbredt over flere sub-lokalisajoner.
150.9: Oesophagus i.n.s.

Lok. Ca. ventriculi
151.0: Pars pylorica, canalis, angulus, antrum.
151.1: Corpus.
151.2: Cardia, fundus, øvre del av ventrikkel.
151.3: Utbredt ventrikkelcancer. Utgått.
151.4: Tidligere ventrikkel-recessert pga. godartet sår
i ventrikkel/duodenum.
151.5: Curvatura minor (fom. 01.01.83).
151.6: Curvatura major (fom. 01.01.83).
151.8: Utbredt over flere sub-lokalisasjoner.
151.9: Ventrikkel i.n.s.

Lok. Ca. duodeni, jejuni, ilei
152.0: Duodenum.
152.1: Jejunum.
152.2: Ileum.
152.3: Meckels divertikkel.
152.7: Jejunum og ileum, før 1983
152.8: Utbredt over flere sub-lokalisasjoner.
152.9: Tynntarm i.n.s.

Lok. Ca. coli
153.0: Caecum, colon ascendens, iloecaecal-overgangen.
153.1: Colon transversum med flexura hepatica og lienalis
(høyre og venstre flexur).
153.2: Colon descendens.
153.3: Colon-sigmoideum (evt. 21cm eller mer fra analåpningen).
153.4: Recto-sigmoideum (20 cm fra analåpningen).
153.5: Polypper.
153.6: Appendix.
153.9: Colon i.n.s, eksklusive rectum i.n.s.
Gamle koder
153.6 ble 01.01.83 konvertert til 153.9: Colon, eksklsuve rectum i.n.s.
153.8 ble 01.01.83 konvertert til 159.0: Tarm i.n.s.
Fra 01.01.83 ble 153.8 brukt for "andre spesifiserte lokalisasjoner
i colon". Utgår f.o.m 01.01.86.

Lok. Ca. recti, ani
154.0: Rectum, ampullen, rectum i.n.s.;
tarmavsnittet 5-19 cm fra anal-åpningen.
154.1: Analkanal, endetarm;
tarmavsnittet 0-4 cm fra anal-åpningen.
154.5: Polypper.

Lok. Ca. hepatis
155.0: Leverparenchym.
155.1: Intrahepatiske galleganger.
155.7: Galleveier i.n.s., før 1983.
155.9: Lever i.n.s.

Lok. Ca. vesica felleae
156.0: Galleblære
156.1: Ekstrahepatiske galleganger (ductus hepaticus, ductus cysticus,
ductus choledochus).
156.2: Papilla Vateri.
156.8: Utbredt over flere sub-lokalisasjoner.
156.9: Ekstrahepatiske galleveier i.n.s.
Gamle koder
156 før 1983:
Metastaser og uspesifiserte maligne svulster i lever og
galleveier.
Fra 1970 bare brukt på dødsattester, men etterhvert gikk man over

til lok. 199 for alle meldinger med følgende informasjon:
"Tumor i lever, ins. om primær eller sekundær".
Fra 01.01.86 vil disse bli kodet til 159.2 (lever/pancreas/
galle-veier, -ganger i.n.s.).
Konverteringer 01.01.83:
156 konvertert til 199.9 (Helt uten opplysning om lokalisasjon).
155.1 konvertert til 156.0 (Galleblære).
155.2 konvertert til 156.1 (Ekstrahepatiske galleganger).
155.3 konvertert til 156.2 (Papilla Vateri).

Lok. Ca. pancreatis
157.0: Caput.
157.1: Corpus.
157.2: Cauda.
157.3: Svulster utgående fra de Langerhanske øyer (endocrine svulster)
157.7: Andre spesifiserte lokalisasjoner i pancreas, før 1983
157.8: Utbredt over flere sub-lokalisasjoner.
157.9: Pancreas i.n.s.

Lok. Ca. peritonei, omenti, mesenterii
158.0: Peritoneum, bukhinnen.
158.1: Retroperitoneum. Bak bukhinnen. På bakre bukvegg.
158.8: Andre spesifiserte lokalisasjoner, f.eks. oment, krøs.
158.9: Peritoneum/retroperitoneum i.n.s.

Lok.
159.0: Tarm i.n.s. (uvisst om tykk- eller tynntarm).
159.1: Milt
159.2: Lever/pancreas/galle-veier, -ganger i.n.s.
Gamle koder
01.01.83 ble 153.8 overført til 159.0
01.01.86 159.2 (ny). Tidligere 156 og 199.

Lok. Ca. cavi nasi, sinuum nasi, auris mediae, tubae Eustachii.
160.0: Nesehule, ikke ytre hud.
160.1: Sinus maxillaris.
160.2: Sinus ethmoidalis, sphenoidalis, frontalis.
160.3: Bihuler i.n.s.
160.4: Tubae Eustachii, mellomøret, indre øre.
160.8: Utbredt over to eller flere sub-lokalisasjoner.
160.9: i.n.s. lokalisasjon i nese/bihule-systemet.

Lok. Ca. laryngis.
161.0: Supraglottisk (strupesiden: baksiden av epiglottis),
strupelokket, plicae ventricularis, de falske stemmebånd,
arytenoidebrusken, cuneiform-bruskene, corniculat-bruskene,
ventriculus laryngis, vestibulum laryngis med sinus Morgagni.
161.1: Glottisk inkl. de ekte stemmebånd (plicae vocalis).
161.2: Subglottisk, cricoidbrusken.
161.3: Utbredt cancer i larynx, før 1983

161.8: Utbredt over flere sublokalisasjoner.
161.9: Larynx i.n.s.; omfatter brusk i larynx.

Lok. Ca. tracheae, bronci, pulmonis.
162.0: Trachea, luftrør.
162.1: Bronchier, lunger.
162.3: Før 1983: Multiple lokalisasjoner.
162.7: Før 1983: "Neopl.mal. bronchi, pulmonis et pleurae primarium sive secundarium non descriptum." Før 1983: 163.x.
162.9: Nedre luftveier i.n.s.

Lok. Ca. pleurae.
163.0: Brysthinne, pleura.
Gamle koder/konverteringer.
Tidligere 163.0: Sekundære eller i.n.s. svulster i i bronchier, lunger og brysthinne; nå lokalisasjon 199.

Lok. Ca. mediastini, thymi, cordis.
164.0: Mediastinum.
164.1: Hjerte, cor.
164.2: Hjerteposen, pericard.
164.3: Brissel, thymus.
Gamle koder/konverteringer:
164.3: ble tidligere kodet på 195.x.

Lok. Ca. mammae.
170.0-170.3: se nedenfor
170.4: Samtidig tumor i begge mamma, før 1983
170.5: Mamma, brystkjertel, inkl. papillen.
170.8: Andre spesifikke lokalisasjoner i mamma, aberrant mamma.
170.9 Mamma i.n.s. Før 1986.
Kommentar
170.0-170.3 kodes kun på meldinger fra DNR.
170.0 Vesentlig medialt beliggende.
170.1 Vesentlig lateralt beliggende.
170.2 Vesentlig sentralt beliggende.
170.3 Utbredt tumor som inntar det meste av eller hele mamma.

Lok. Ca. cervicis uteri.
171.0: Livmorhalsen, cervix

Lok. Ca. corporis uteri.
172.0: Livmorlegemet, corpus uteri.
172.1: Malign tumor oppstått i endometriosefocus.

Lok. Placenta.
173.0: Placenta, morkake.

Lok. Ca. uteri i.n.s.
174.0: Ca. cervicis et corporis uteri

174.9: Uterus/cervix i.n.s.

Lok. Ca. ovarii, tubae, ligamenti.
175.0: Ovarium, eggstokk.
175.1: Bilateral, før 1983.
175.2: Tube, eggleder.
175.3: Ekstragonadal germinalcellesvulst.
175.8: Andre spesifiserte lokalisasjoner i adnex, f.eks.
parametriet/ligamenter.
175.9: Ovarium, tube, adnexstruktur i.n.s.

Lok. Ca. vulvae, vaginae.
176.0: Vulva, ytre genitalia, inkluderer clitoris,
gl. Bartholini, labium majus og minus.
176.1: Vagina, skjede.
176.2: Uterus og ovarium samtidig (før 1983).
176.8: Utbredt i ytre genitalia eller vagina.
176.9: Kvinnelige genitalia i.n.s. (ytre og indre)

Lok. Ca. prostata.
177.0: Prostata, blærehalskjertel.
177.1: Vesiculae seminales.
177.9: = 177.0 (alle før 1980)

Lok. Ca. testis.
178.0: Testis (inkluderer tubuli seminiferis og rete testis).
178.1: Ektopisk testis. Retinert testis. Både operert og ikke operert.
178.2: Epididymis.
178.3: Ductus deferens, funiculus spermaticus.
178.4: Ekstragonadal germinalcellesvulst.

Lok. Ca. penis.
179.0: Glans penis, inkl. sulcus coronarius.
179.1: Preputium, forhud.
179.2: Scrotum.
179.3: Corpus penis.
179.4: Penis uspesifisert.
179.8: Utbredt over flere sublokalisasjoner.
179.9 Mannlige genitalia i.n.s.
Kommentar
Malignt melanom på scrotum kodes på 190.6.

Lok. Ca. renis.
180.0: Nyre.
180.1: Nyrebekken, pelvis.
180.2: Ureter, urinleder.
180.8: Utbredt over flere sublokalisasjoner. Ved tvil spør lege.
180.9: Øvre urinveier i.n.s.

Lok. Ca. vesicae urinariae.
181.0: Blære.
181.1: Urethra.
181.3: Paraurethrale kjertler (brukes ved tvil om prostata eller blære).
181.4: Urachus rest.
181.8: Utbredt over flere sublokalisasjoner. Ved tvil spør lege.
181.9: Nedre urinveier i.n.s.

Lok. Ca. cutis - basalcellecarcinom.
189.0: Hud, ytre øre.
189.1: Øyelokk med øyenvinkel, unntatt conjunctiva oculi.
189.2: Ansiktet og hodet forøvrig, inkl. hodebunn, orbitalregionen, hake, kinn.
189.3: Hals, kropp, nakke, skulder, lyske, axiller, nates, hofte unntatt genitalhud (lok. 176/179).
189.4: Perianalt, perineum.
189.5: Overekstremiteter.
189.6: Underekstremiteter.
189.8: Multiple lokalisasjoner, se kommentar.
189.9: Hud i.n.s.
Kommentar:
Denne lokalisasjon taes i bruk fom. 01.01.86.
189.8 brukes ved 2. gangs opptreden av ny hudtumor efter 4 måneder. Personen får da en ny akkumulert record med 189.8 mens den første blir stående med spesifikk lokalisasjon. Ved ny hudtumor innen 4 måneder skal det være kun en akkumulert record, men lokalisasjonen skal endres til 189.8. (fom. 01.01.86). Denne lokalisasjonen er fjernet fra standarduttrekk, jf. Cancer in Norway.

Lok. Ca. cutis - melanoma malignum.
190.0: Ansikt inkl. øyelokk, hals, nakke, hodebunn, ytre øre og øregang.
190.1: Kropp, skulder, hofte, lyske, axiller, nates.
190.2: Overekstremiteter.
190.3: Føtter, nedenfor ankel.
190.4: Underekstremiteter over eller på ankel.
190.5: Perianalt.
190.6: Scrotum.
190.7: Mamma (begge kjønn). For menn: kun pigmentert område.
190.8: Andre spesifiserte lokalisasjoner / sub-unguinalt.
190.9: Hud i.n.s.

Lok. Ca. cutis - (ekskl. melanom, basalcellecarcinom).
191.0: Hud, ytre øre.
191.1: Øyelokk med øyenvinkel, unntatt conjunctiva oculi.
191.2: Ansiktet og hodet forøvrig, inkl. hodebunn, orbitalregionen, hake, kinn.
191.3: Hals, kropp, nakke, skulder, lyske, axiller, nates, hofte unntatt genitalhud (lok. 176/179) samt Paget's sykdom i papilla mammae.
191.4: Perianalt, perineum.

191.5: Overekstremiteter.
191.6: Underekstremiteter.
191.8: Multiple lokalisasjoner, se kommentar.
191.9: Hud i.n.s.
Kommentar:
191.8 brukes ved 2. gangs opptreden av ny hudtumor etter 4 måneder. Personen får da en ny akkumulert record med 191.8 mens den første blir stående med spesifikk lokalisasjon. Ved ny hudtumor innen 4 måneder skal det være kun en akkumulert record, men lokalisasjonen skal endres til 191.8. Gjelder også Kaposis sarcom.

Lok. Ca. oculi.
192.0: Øyet, bulbus oculi, unntatt øyelokk.
192.1: Orbita; dvs. bløtdeler.
192.2: Tårekjertler, tåresekk.
192.3: Tårekanal.
192.4: Conjunctiva (øyets bindehinne, øyelokkets innside).
192.5: Andre spesifiserte lokalisasjoner i øyet.
192.7: Øye og orbita (ekskl. øyelokk), før 1983
192.8: Utbredt over flere sublokalisasjoner.
192.9: Øye i.n.s.

Lok. Ca. cerebri, medullae, meningum, systematis nervosi.
193.0: Hjerne og medulla oblongata (forlengede marg).
Omfatter ikke hypofyse og corpus pineale; -
bruk underlokalisasjon 393.x (Se kommentar).
193.1: Hjernenerver, intrakranielt forløp.
193.2: Hjernehinner, meninger.
193.3: Medulla spinalis, ryggmargen.
193.4: Ryggmargens hinner.
193.5: Perifere nerver, også hjernenerver når de går ekstrakranielt.
193.6: Sympatiske nervesystem.
193.7: Andre spesifiserte lokalisasjoner i CNS og PNS.
193.8: Utbredt over flere sublokalisasjoner.
193.9: Nervesystem i.n.s.

Lok. Ca. thyreoideae.
194.0: Skjoldbruskkjertelen. Glandula thyreoidea.
194.1: Ektopisk skjoldbruskkjertel.

Lok. Ca. glandulae endocrinae.
195.0: Binyre. Glandulae suprarenalis.
195.1: Parathyreiodae, biskjoldbruskkjertelen.
195.3: Hypofyse.
195.4: Corpus pineale.
195.5: Cranieopharyngealkanal.
195.6: Andre spesifiserte lokalisasjoner i endokrine organer
(glomus jugulare, glomus caroticus, autonome ganglier).
195.8: Andre, før 1986
195.9: Endokrine organ i.n.s.

Lok. Ca. ossis/cartilaginis.
196.0: Hode, unntatt underkjeve.
196.1: Underkjeve (mandibula).
196.2: Ryggrad (columna).
196.3: Ribben (costa), brystben (sternum), kraveben (clavicula).
196.4: Skulderblad (scapula), over- og underarm.
196.5: Hånd, fingre, fot, tær.
196.6: Bekkenben (pelvis)): os coecygis, sacrum, ischii, ilii.
196.7: Lår, legg over ankelen.
196.8: Andre spesifiserte lokalisasjoner inklusive multiple lokalisasjoner
196.9: Knokler i.n.s.
Lok. Bløtdeltumores.
197.0: Hode, ansikt, hals.
197.1: Kropp, inkl. nates, axille, lyske.
197.2: Skulder, overekstremitet.
197.3: Hofte, underekstremitet.
197.7: Multiple svulster i bløtvev, før 1983
197.8: Andre spesifiserte lokalisasjoner i bløtdeler.
197.9: Bløtdeler i.n.s.
Kommentar
Bløtdelssvulster i ledd, leddbånd, leddkapsel, sene, seneskjede, muskulatur, fettvev, bindevev når den er lokalisert utenom spesifikke organer med eget lokalisasjonsnummer.

Lok. Andre og uspesifiserte organer.
199.0: Ukjent, før 1993
199.1: Utilstrekkelig spesifiserte lokalisasjoner i hode/hals/ansikt.
199.2: Utilstrekkelig spesifiserte lokalisasjoner i thorax.
199.3: Utilstrekkelig spesifiserte lokalisasjoner i abdomen.
199.4: Utilstrekkelig spesifiserte lokalisasjoner i pelvis.
199.5: Utilstrekkelig spesifiserte lokalisasjoner i ekstremiteter.
199.6: Generalisert carcinomatose.
199.8: Utilstrekkelig spesifiserte lokalisasjoner andre steder.
199.9: Helt uten opplysninger om lokalisasjon.

Lok. Ca. lymphonodorum.
206.0: Hals, inklusive fossa supraclavicularis, pre- og retroauricularius, samt suboccipitale lymfeknuter.
206.1: Intrathoracalt.
206.2: Intraabdominalt.
206.3: Axiller, andre lymfeknuter på overekstremiteter.
206.4: Lysker, andre lymfeknuter på underekstremiteter.
206.5: ved underlok.
206.6: "Hud (mycosis fungoides)", før 1986
206.8: "Multiple lokalisasjoner", "Generell glandelsvulst", før 1993
206.9: Lymfeknuter i.n.s.
Kommentar:
Ved malignt lymfom i andre organer brukes 206.5 med spesifikk under-lokalisasjon. Gjelder også hud.

Benmargsaffeksjon betyr stadium IV, og skal ha lokalisasjon 206.9.

Lok. Benmarg
207.0: Benmarg

Ved dobbeltmelding leukemi/lymfom skal lokalisasjon 206.5 med underlok 207.4 brukes.

06.07.2015

UTTREKK FRA KREFTREGISTERET TIL PROSJEKTET "EN SOSIO-METABOLSK ANALYSE AV SPESIALHELSETJENESTESEKTOREN"

Det er tatt utgangspunkt i alle tilfeller av rektumkanser (lok. ICD-7 154.0) i perioden 2000-2013, og colonkanser (lok. ICD-7 153.x) i peridoen 2007-2013. Filen inneholder 35 217 krefttilfeller hos 33 919 pasienter. Kun kreftdiagnoser som er av typen som regnes med i kreftstatistikken i Cancer in Norway er tatt med. Det vil si alle maligne tilfeller med få unntak, for mer informasjon om inklusjon av diagnoser se tabell side 12 i Cancer in Norway 2013.

Filen "Utlevert_Wibe_2015.csv" inneholder følgende variabler:

PID	Prosjektspesifikk ID for hver person
Foedt	Fødselsdato. Angitt som 15.mm.åååå
Kjoenn	M = Mann, K = Kvinne
SID	Prosjektspesifikk ID for hvert sykdomstilfelle. En pasient kan ha flere sykdomstilfeller.
Diagnosedato	Dato for diagnose. Se "Dokumentasjon av variabler.doc". Angitt som 15.mm.åååå
DS	Diagnosens sikkerhet. Se "Dokumentasjon av variabler.doc"
Lok-ICD7	Svulstens utgangspunkt, ICD-7. Se "Dokumentasjon av variabler.doc" og "Lokalisasjon ICD 7.pdf"
Topografi_ICDO3	Svulstens utgangspunkt, ICD-O-3. Se "Dokumentasjon av variabler.doc"
Morfologi_ICDO3	Svulstens morfologi, ICD-O-3. Se "Dokumentasjon av variabler.doc"
ICD10_gr	Svulstens utgangspunkt, ICD-10. Se "Dokumentasjon av variabler.doc"
Basis	Basis for diagnosen. Se "Dokumentasjon av variabler.doc"
Metastase	Spredning. Se "Dokumentasjon av variabler.doc"
Kirurgi	Kirurgi. Se "Dokumentasjon av variabler.doc"
Utredningssykehus/Operasjonssykehus	Tallkode som viser hvilke utredninger/operasjoner som er gitt ved samme sykehus, men som ikke viser identiteten til hvert enkelt sykehus
Dato_*	Dato for operasjon, preoperativ behandling, likalt residiv, fjernmetastase og symptom. Gitt på formen 15.mm.åååå
Anastomoselekkasje	1- Ja, 0 - Nei
Andre_komplikasjoner	1- Ja, 0 - Nei
antall_dager_diagnose*	Antall dager fra diagnose til residiv-, metastase-, operasjons-, statusdato
Antall_dager_symptom_diagnose	Antall dager fra symptomdato til diagnosedato.
Status*	B = I live og bosatt i Norge, E = Emigrert, D = Død
Statusdato*	Dato for emigrasjon eller død. Angitt som 15.mm.åååå

*Oppfølging t.o.m. 30. juni 2014

QUESTIONS FOR HEALTH PERSONNEL AND PROCEDURES

1. Type of treatment/procedure
    a. Machinery involved
    b. Other Equipment
    c. If you have, what type of equipment would be critical if you did dot have it, what would limit the possibility for the procedure?
    d. What type of investigation/treatment is involved for colorectal cancer
2. Personnel
    a. Which types of personnel is involved (Education)?
    b. How many? Are they all needed throughout the whole procedure?
    c. Critical personnel, which types of personnel must be involved, what could stop the treatment/procedure?
    d. Are there currently enough personnel to get through the current workload?
3. Technicalities
    a. How long time does it take on average and are there differences between diagnosis/stages of colorectal cancer?
    b. How much space is needed, does the patient needs to get undressed (wardrobe), preparation room and is there a laboratory connected for imaging and so on?

KREFT registeret
INSTITUTT FOR POPULASJONS-BASERT KREFTFORSKNING

Appendix 11

MELDING TIL COLORECTALCANCERREGISTERET
Kreftregisteret, Postboks 5313 Majorstuen, 0304 Oslo

Svulster i colon/rectum – skjema i kraft fra 01.01.2007

1. PASIENT/BEHANDLINGSINSTITUSJON

Fødselsnr |__|__|__|__|__|__|__|__|__|__|__|

Fornavn .....

Etternavn .....

Postnr |__|__|__|__| Poststed .....

Institusjon .....

Avdeling .....

○ Innlagt ○ Poliklinisk Dato |__|__|__|__|__|__|

Utskrevet ○ I live ○ Død

2. MELDINGSTYPE (bare ett kryss)

○ Primær tumor ○ Residiv* Dato |__|__|__|__|__|__| ○ Metastase* Dato |__|__|__|__|__|__|

○ Obduksjon** Dato |__|__|__|__|__|__|

* Gå til punkt 5 * *Fyll kun ut punkt 4

3. SYKDOMSTEGN OG DIAGNOSTIKK

Hadde pasienten symptomer?	○ Ja ○ Nei Symptomdebut (måned/år) |__|__|__|__|	
Arvelig predisposisjon	○ Ja ○ Nei	
Colo/rectoskopi	○ Ja, tumor sett ○ Utført, tumor ikke sett ○ Ikke utført	
Rtg colon	○ Ja, tumor sett ○ Utført, tumor ikke sett ○ Ikke utført	
CT-abdomen	○ Ja, tumor sett ○ Utført, tumor ikke sett ○ Ikke utført	
Colografi (CT)	○ Ja, tumor sett ○ Utført, tumor ikke sett ○ Ikke utført	
Klinisk undersøkelse alene	○ Ja, sikker tumor	
Biopsi av tumor	○ Ja ○ Nei Pat. lab	Diagnosetidspunkt |__|__|__|__|__|__|

4. TUMORS LOKALISASJON

Tumors lokalisasjon (Hvis flere, kryss av for de aktuelle)

☐ Appendix ☐ Cøkum ☐ Ascendens ☐ Høyre fleksur

☐ Transversum ☐ Venstre fleksur ☐ Descendens ☐ Sigmoideum (≥ 20 cm)

☐ Rectosigmoid (16–< 20 cm) ☐ Rectum (< 16 cm fra analåpning på stivt skop) ..... cm

Målt ved MR: øvre kant av m. puborektalis til nedre kant av tumor ..... cm

5. SYKDOMSUTBREDELSE VED DIAGNOSE

		Utførte undersøkelser (basis for diagnostikk)	
Levermetastaser	○ Nei ○ Ja ○ Mistenkt →	☐ Ultralyd ☐ CT ☐ MR ☐ Ingen	
Lungemetastaser	○ Nei ○ Ja ○ Mistenkt →	☐ Rtg thorax ☐ CT ☐ MR ☐ Ingen	
Andre fjernmetastaser (inkl. perit. carcinomatose)	○ Nei ○ Ja ○ Mistenkt →	☐ Ultralyd ☐ CT ☐ MR ☐ Ingen	
	Hvis ja, hvor:	**CEA:**	
Dybdevekst av tumor i rectum og rectosigmoid	○ I tarmvegg (T1-T2) ○ Gjennom tarmvegg (T3) ○ Innvekst naboorgan (T4) →	☐ Ultralyd ☐ CT ☐ MR ☐ Ingen	

Antatt CRM |__|__| mm **Antatt positive lymfeknuter** ○ Ja ○ Nei ○ Ikke utført

6. FORBEHANDLING

☐ Ingen ☐ Strålebehandling ☐ Kjemoterapi ☐ Radiokjemoterapi ☐ Avlastende stomi ☐ Stenting

Pasientinitialer ..... Fødselsnr |__|__|__|__|__|__|__|__|__|__|__|

7. BEHANDLING

Operert ○ Ja Dato |__|__|__|__|__|__| ○ Nei Årsak:

Hastegrad ☐ Elektiv ☐ Akutt pga obstruksjon ☐ Akutt pga perforasjon

☐ Akutt pga annet .....

Kirurgens preop. intensjon ○ Kurativt ○ Palliativt ○ Usikker ASA-score:

GJENNOMFØRT OPERASJON **Opr. type** ○ Åpen ○ Laparoskopi ○ Laparoskopi, konvertert åpen

a) Reseksjon av tumor ○ Ja ○ Nei (gå til b) Pat. lab .....

Colon		**Rectum**	
☐ Hemicol. dxt	☐ Utvidet hemicol. dxt	☐ Fremre reseksjon	☐ Hartmann
☐ Hemicol. sin	☐ Utvidet hemicol. sin	☐ Amputatio recti	☐ Polypektomi
☐ Transv. reseksjon	☐ Transv. + fleksurreseksjon	☐ Lokal reseksjon	☐ Transanal endoskopisk mikrokirurgi
☐ Sigmoidreseksjon	☐ Subtotal kolektomi	☐ Annen	
☐ Annen			
○ Medialt/sentralt først	○ Lateralt først	**Anastomosenivå** |__|__| cm over analåpning	

Lymfeknutedisseksjon

○ D3 Kar avsatt inntil a. mes. sup./aorta
○ D2 Intermediær avsetting av kar
○ D1 Tarmnær avsetting av kar

Anastomoseteknikk:
○ ende-ende ○ side-ende ○ J-Pouch/Reservoir

Anastomose etter reseksjon ○ Ja ○ Nei **Avlastende stomi etter res./anast.** ○ Ja ○ Nei

Endestomi ○ Ja ○ Nei

b) Operasjon uten reseksjon av tumorbærende tarmsegment:

☐ Bypass ☐ Avlast. stomi ☐ Kun ekspl. lap. ☐ Stenting

INTRAOPERATIVT FUNN/DIAGNOSE:	**KONSEKVENS:**				
Levermetastaser	○ Nei	○ Ja, klinisk sikker	○ Ja, mistenkt	☐ Biopsi tatt	☐ Reseksjon utført
Peritoneal met./carcinomat.	○ Nei	○ Ja, klinisk sikker	○ Ja, mistenkt	☐ Biopsi tatt	☐ Reseksjon utført
Lymfeknutemet. utenfor res. område	○ Nei	○ Ja, klinisk sikker	○ Ja, mistenkt	☐ Biopsi tatt	☐ Reseksjon utført
Innvekst i naboorgan	○ Nei	○ Ja, klinisk sikker	○ Ja, mistenkt	☐ Biopsi tatt	☐ Reseksjon utført

Hvilke(t) organ: .....

Perforasjon under operasjonen ☐ Nei ☐ Tarm ☐ Tumor

Resttumor lokalt (kirurgens vurdering) ○ Nei ○ Ja, sikker ○ Mulig

8. KOMPLIKASJONER TIL OPERASJON

Komplikasjoner ☐ Nei ☐ Anastomoselekkasje ☐ Annen Spesifiser: .....

Reoperasjon ○ Nei ○ Ja Dato |__|__|__|__|__|__| Spesifiser: .....

9. ETTERBEHANDLING

Planlagt etterbehandling ☐ Nei ☐ Ikke avklart ☐ Ja

Hvis ja: ☐ Strålebehandling ☐ Kjemoterapi ☐ Radiokjemoterapi ☐ Kirurgi for metastaser

Institusjon: .....

Meldingsdato	Meldt av (navn (blokkbokstaver) + ID-nr.)	Signatur
|__|__|__|__|__|__|		

Manual

Melding til Colorectalcancerregisteret Kreftregisteret

for svulster i colon og rectum

Innhold

1 Introduksjon

Fra 1. januar 2007 innfører Kreftregisteret i samarbeid med Norsk Colorectalcancer Gruppe nytt meldeskjemaet for svulster i colon og rectum. Skjemaet er utviklet av gastrokirurger og referansegruppemedlemmer i Norsk Rectum Cancer Gruppe og bearbeidet av Kreftregisteret for tilpasning til den tidligere databasen. Skjemaet erstatter både det tidligere kliniske Registreringsskjema for rectumcancer og skjemaet Melding til Kreftregisteret for solide svulster.
Formålet er å få et spesialregister for colorectalcancer som både er et insidens-, utrednings-, diagnostikk-, og behandlingsregister. Målet er å skaffe kunnskap som kontinuerlig vil bidra til å optimalisere behandlingsforløpet for denne pasientgruppen.

2 Lovhjemmel

Kreftregisteret har fra 1953 hatt et omfattende landsdekkende kvalitetssikret register med alle nødvendige konsesjoner fra Datatilsynet. I desember 2001 fikk Kreftregisteret en forskrift som ytterligere sikrer innsamling av personidentifiserbare kliniske data om diagnostikk og behandling av kreftpasienter for hvert organ/hver kreftform.

3 Opprettelsen av Norsk Colorectalcancer Gruppe

Norsk Colorectalcancer Gruppe ble opprettet i februar 2006. Det er en utvidelse av Norsk Rectum Cancer Gruppe til å også omfatte registrering av coloncancer. Det innebærer et utvidet samarbeid med Kreftregisteret. Samarbeidet mellom Krfetregisteret og Norsk Colorectalcancer Gruppe er regulert i egne statutter.

4 Om Melding til Colorectalcancerregisteret Kreftregisteret for svulster i colon og rectum

Skjemaet Melding til Colorectalcancerregisteret og Kreftregisteret for svulster i colon og rectum skal fylles ut ved følgende hendelser:

- Primærtumor i colon og rectum
- Lokalt residiv av cancer i colon og rectum
- Metastaser fra tumor i colon og rectum

4.1 Utfylling av skjema for primærtumor

I den påfølgende oversikten vil hvert punkt i skjemaet bli presentert. Det er i hovedsak fokusert på opplysninger av spesiell viktighet og informasjon om punkter som kan misforstås.

1. Pasient/Behandlingsinstitusjon
Pasientrelatert informasjon skal fylles ut i kolonnen til venstre. Institusjonsdata er plassert til høyre slik at stempel kan anvendes.

2. Meldingstype
Her skal det fylles inn hva som meldes, er det en primærtumor, et residiv, metastase eller er tumor funnet ved obduksjon? Merk følgende:

- Dersom pasienten har både residiv og metastase skal det fylles ut et skjema for hver av tilstandene for å kartlegge behandlingsforløpet.
- Dersom pasienten har en annen cancer i et annet organ som blir oppdaget samtidig med coloncancer eller rectumcancer, skal denne meldes på et eget skjema *Melding til Kreftregisteret for solide svulster.*
- Dersom den preoperative utredningen av en pasient med rectumcancer viser at det også foreligger en coloncancer, skal bare ett skjema fylles ut.
- Dersom colon-eller rectumcancerdiagnosen stilles og behandlingen startes ved et sykehus for så å fullføres på annet sykehus, skal melding sendes fra begge sykehus. *Eksempel; Et sykehus legger ut en avlastende stomi før strålebehandling av cancer recti og pasienten strålebehandles og opereres ved et annet sykehus.* I slike tilfeller vil meldinger fra begge sykehusene bli samordnet i databasen til Colorectalcancerregisteret.

3. Sykdomstegn og diagnostikk
Dette punktet skal bare fylles ut ved primærtumor. Kommentarer:

- Diagnosetidspunktet er den dato diagnosen klinisk sikker cancer ble stilt. Dersom det klinisk ikke kunne stilles en sikker diagnose, benyttes dato for biopsi.
- Det er ikke lenger nødvendig å fylle ut patologiremissenummer. Det er tilstrekkelig å fylle ut navnet på patologilaboratoriet som ble benyttet.
- Punktet klinisk undersøkelse alene benyttes for pasienter som ikke skal undergå videre utredning eller behandling. *Eksempel: Sykehjems-pasienter som ved rektaleksplorasjon/palpasjon av abdomen får oppdaget en tumor, men der alder/allmenntilstand ikke tilsier videre utredning*

4. Tumorlokalisasjon
Her skal tumoren(e)s lokalisasjon merkes. Ved rectumcancer skal radiologene angi avstand fra øvre kant av m.puborectalis til nedre kant av tumor. Målet er at MR i framtiden skal kunne måle avstand fra analåpning til nedre kant av tumor og gi et mer nøyaktig mål enn det rectoskopi med stivt skop angir.

5. Sykdomsutbredelse ved diagnose

- Feltene om metastaser preoperativt skal fylles ut for ***alle*** colorectalcancere.
- CEA verdi tatt preoperativt (ved diagnosetidspunkt) angis i mikrogram per liter.
- Det fargede feltet ***gjelder kun cancere i rectum og rectosigmoid***. Disse opplysningene kan hentes ut fra en preoperativ MR-undersøkelse.
    - Dybdevekst av tumor.
    - CRM står for Circumferentiell Resection Margin. CRM er den korteste distanse fra den ytre del av tumor til reseksjonskanten, eller ytre kant av malign lymfeknute til reseksjonskanten. Radiologene skal ut fra MR angi antatt CRM.
    - Antatt positive lymfeknuter kan radiologene angi ut fra MR.

6. Forbehandling
Har pasienten fått ***preoperativ*** onkologisk eller kirurgisk behandling krysser melder av her. Merk at det er et skille på om pasienten har fått strålebehandling alene, eller radiokjemoperati (kombinasjonsbehandling). Postoperativ behandling skal det ikke krysses for her.

7. Behandling
Dersom pasienten har blitt operert skal opplysningene om operasjonstype og funn registreres her.

- Kirurgens preoperative intensjon er ment å reflektere hva kirurgen vurderer som mulig ut fra den preoperative utredning. Det er **ikke** identisk med kirurgens vurdering av resttumor som er det siste spørsmålet under punkt 7.
- ASA-klassifisering har vist seg å være en prognostisk faktor for pasienter som opereres for coloncancer. Tabell 1 viser grunnlaget for klassifiseringen.

Tabell 1: ASA-klassifisering: Pasientene vurderes preoperativt og plasseres i en av fem grupper uavhengig av planlagt operativt inngrep. (men pasientenes aktuelle lidelse vurderes med)

1. "Frisk pasient" Ingen organisk, fysiologisk, biokjemisk eller psykiatrisk forstyrrelse. Aktuell lidelse er lokalisert og gir generelle symptomforstyrrelser. Røker < 5 sigaretter daglig Alder < 80 år.	**4. Livstruende organisk sykdom som ikke behøver å være relatert til den aktuelle kirurgiske lidelse eller som ikke alltid bedres ved det kirurgiske inngrepet.** **Eksempel:** Malign hypertensjon Nylig (< 6 mndr) gjennomgått hjerteinfarkt Sterkt fremskreden lever, nyre, lunge eller endokrin dysfunksjon. Manifest hjertesvikt. Ustabil angina pectoris. Subarachnoidal blødning, våken – somnolent pasient.
2. Moderat organisk lidelse eller forstyrrelse som ikke forårsaker funksjonelle begrensinger, men som kan medføre spesielle forholdsregler eller anestesitekniske tiltak. Lidelsen(e) kan enten være forårsaket av den aktuelle sykdom pasienten skal opereres for, eller av annen patologisk prosess. Alder > 80 år	**5. Moribund pasient som ikke forventes å overleve 24 timer med eller uten kirurgi.** **Eksempel.** Pasient med aortaaneurisme i sjokk. Dypt comatøs pasient med intracraniell blødning.

Nyfødt < 3 mndr Røker > 5 sigaretter daglig **Eksempel:** Lett organisk hjertesykdom Ukomplisert diabetses (type 1 og 2) Benign ukomplisert hypertensjon Frisk 20- åring med kjeveleddsperre.	
3. Alvorlig organisk sykdom eller forstyrrelse som gir definert funksjonelle begrensinger. **Eksempel:** Diabetes med organkomplikasjoner Invalidiserende hjertesykdom Moderat til alvorlig lungesykdom Angina pectoris Gjennomgått hjeteinfarkt (> 6 mndr)	**D. Donor.** Hjernedød pasient som preserveres for organdonasjon.

- Det er nødvendig å oppgi patologilaboratorium for operasjonspreparatet da det kan være forskjellig fra laboratoriet biopsien ble sendt til.
- Operasjonstypene og metodene er delt mellom colon (til venstre) og rectum (til høyre.
- ***Colon***: Det skal krysses av hvorvidt lymfeknutedisseksjon var utført med
    - D3 reseksjon: Karene settes av sentralt og inntil arteria mesenterica superior eller aorta
    - D2-reseksjon: Karene settes av et sted mellom arteria mesenterica superior/aorta og tarmnært
    - D1-reseksjon: Karene settes av tarmnært

- ***Rectum***: Ved fremre reseksjon skal anastomosenivå og anastomoseteknikk registreres.

Spørsmålene fra og med ***Anastomose etter reseksjon*** og ***Avlastende stomi etter reseksjon*** gjelder for både colon-og rectumcancer.

8. Komplikasjoner

Her registreres komplikasjoner i løpet av de 30 første dager etter kirurgi. Det gjelder både anastemoselekkasje og alle typer reoperasjon. Ved reoperasjon spesifiser hva årsaken til reoperasjon er. Det er bare plass til å registrere første reoperasjon. Alle komplikasjoner som er viktige nok til å igangsette behandling (kurve, journal, epikrise) og få en egen DRG-kode tas med.

9. Etterbehandling

- Her krysses av dersom pasienten skal til kirurgisk eller onkologisk behandling postoperativt, eller når det er planlagt onkologisk behandling som eneste behandling.
- Det er lagt vekt på at meldeskjemaet skal kunne fylles ut når pasienten skrives ut fra sykehuset. Noen ganger vil ikke svaret på den histologiske undersøkelsen foreligge før pasienten utskrives. Kryss da av for ikke avklart.

4.2 Utfylling av skjema for lokalt residiv

Når en pasient som er diagnostisert og operert for primærtumor får lokalt residiv, skal skjemaet fylles ut. Det skal da krysses av for ***Residiv*** under **2. Meldingstype**, og melder skal ikke fylle inn punkt 3 og 4. Det er viktig at melder noterer dato for residivet under punkt 2. Fra **5. Sykdomsutbredelse ved diagnose** skal skjemaet fylles ut som for primærtumor.

4.3 Utfylling av skjema for metastaser

Når en pasient som er diagnostisert og operert for primærtumor får metastaser, skal skjemaet fylles ut. Følgende opplysninger skal registreres ved metastaser:

2. Meldingstype
Det skal krysses av for ***Metastase*** og datoen for metastasen skal noteres.

3. og 4. skal ikke fylles ut

5. Sykdomsutbredelse ved diagnose
Her kan lokalisasjonen på metastasene registreres i tillegg til hvilke undersøkelser som har blitt gjort for å detektere dem.

6. Forbehandling
Fylles inn hvis pasienten preoperativt har fått onkologisk behandling for sine metastaser.

7. Behandling
Her skal bare noen få opplysninger fylles ut:

- Operert og eventuelt operasjonsdato
- Kirurgens preoperative intensjon
- Resttumor lokalt (kirurgens vurdering)

8. Komplikasjoner til operasjon
Her skal det krysses av om pasienten har komplikasjoner etter metastaseoperasjonen og hvis pasienten blir reoperert.

9. Etterbehandling
Her krysses det ut hvis pasienten skal til onkologisk behandling postoperativt.

4.4 Utfylling av skjema ved obduksjon

Hvis det ved obduksjon blir funnet en cancer i rectum eller colon skal ***Obduksjon*** krysses av under **2. Meldingstype**. For denne pasientgruppen skal bare **4. Lokalisasjon** registreres.

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5 Kontaktpersoner på Kreftregisteret

Forskningsassistent:
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Manualen ligger elektronisk på Kreftregisterets hjemmeside:
www.kreftregisteret.no.