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Addressing Patients Mobility through a Dynamic Performance Management perspective: the case of Sicily

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"We cannot solve our problems with the same thinking we used when we created them".

(Albert Einstein)

"If we want things to stay as they are, things need to change".

(Giuseppe Tomasi di Lampedusa, *The Leopard*)

"Would you tell me, please, which way I ought to go from here?"
"That depends a good deal on where you want to get to".
"I don't much care where".
"Then it doesn't matter which way you go".

(Lewis Carroll, *Alice in Wonderland*)

"The map is not the territory".

(Gregory Bateson)

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Abstract

Nowadays several Italian regions are dealing with the phenomenon of passive mobility for health care, which is the tendency of the residents of a certain area to move to another one (often characterized by better reputation) for receiving health care treatments.

As the Italian Health Care Service (Servizio Sanitario Nazionale, or SSN) is public and regionalized, each Regional government has the responsibility of the health care provision, guaranteeing anyway to every citizen the freedom to be treated out of the residential area, and compensating the destination Regions for the medical treatments provided to non-residents.

Despite the right of choice is a strength of the SSN, when the patients' mobility outflows are constant and always come from the same Regions, they can be seen as the symptom of lack in the real or perceived quality of the local health care offers. Sicily, Campania, and Calabria are the first three patients exporters regions, all of them located in the Southern Italy. On the contrary, the most attractive Regions are the Northern Lombardy, Emilia Romagna and Tuscany.

The financial dimension of the phenomenon is quite relevant, in particular as far as the mobility for hospitalizations is concerned, the financial value accounts for about 3 billion of euro per year, not to mention the private costs for travelling and accommodation sustained by the patients and their accompanying relatives.

The present research aims to address the patients mobility phenomenon making at the same time a theoretical and a practical contribution. In order to pursue this scope a one-year field research project was conducted in collaboration with the Sicilian Healthcare Administration.

This was an explanatory qualitative study mixing the case study method with a System Dynamics approach, and adopting a performance based inter-institutional perspective towards the pursuit of public value. The data was purposefully gathered through several sources, such as archival documents, clinical databases, unstructured and semi-structured interviews to the key actors of the system, questionnaires, observations.

In the first chapter of the thesis the patients' mobility is analyzed by making two critical literature reviews. One refers to the patients' mobility *per se* and identifies a shortcoming in the management literature regarding the design of tools to govern the phenomenon.

The other literature stream re-conducts the topic into the general theory of Public Management and Administration. In this regard, tackling the patients' mobility as a symptom of public value lacking, it is posed an overall research question, exploring the possibility to investigate the mobility issue in light of a pragmatic approach combining Public Value and Performance Management.

Afterwards, such general question is articulated into more specific ones, recognized to be functional to a better understanding of the problem. Then the research strategy is presented, giving an overview of the approaches and methods adopted along the research.

The second chapter provides some background information on the Italian and Sicilian political and institutional systems and describes the research framework. Then it is possible to read the qualitative analysis on interviews to key actors of the Sicilian Healthcare System, regarding their perception of the problem and the ongoing policies to contrast it.

The third chapter starts with the description of how System Dynamics, in combination with Performance Management, is able to trigger virtuous learning mechanisms for the Public Value achievement.

The main features of the System Dynamics and the Dynamic Performance Management are presented, together with the specific phases of their application to the Sicilian case, as well as the model description and the alternative policies analysis.

Chapter 1.

Introduction to the inter-regional patients' mobility phenomenon

1. About the patients' mobility phenomenon *per se*

Nowadays a growing attention is paid to the flows of people travelling for medical reasons. The phenomenon is often called medical tourism¹ (Carrera & Bridges, 2006; Snyder et al., 2011; Ormond, 2011), a general expression indicating organized travel outside one's natural healthcare jurisdiction for the enhancement or restoration of the individual's health through medical intervention. According to Henderson (2004), the healthcare tourism can be further distinguished in subcategories: illness (check-up, screening, surgery, transplant), wellness (thermal cure, massages, etc...), and reproduction (fertility treatments).

In the European context, the movements of patients outside their residential area has been addressed in terms of cross-borders mobility for health care (Carrera & Lunt, 2010; Andritsos & Tang, 2013; Legido-Quigley et al. 2007), focusing on the patients entitled to access health care services by the affiliation to public health systems or private health insurers in privately funded system (Glinos et al. 2010).

According to recent estimations (Van Ginneken and Busse 2011) European patients mobility between countries counted for about 1% of overall public expenditure on health care. Although this phenomenon is still of relatively modest scale, the recent adoption of the "Cross-border EU directive" (2011/24/EU), currently under legislative transposition and implementation by the Member States, raises at a country level a series of issues on how to plan and delivery sustainable care.

Despite the growing interest to cross-border patients flows within the EU, patients mobility taking place within the same country, e.g. from one region or federal state to another, did not received the same attention. In Italy, international mobility towards other countries did not assume a relevant proportion (Zecchetti, 2012). On December 2013 the

¹ Not to be confused with the congress tourism of the physicians.

national Parliament elaborated a first scheme of transposition decree for the Cross-border EU directive, which is currently been subjected to amendments and negotiations with the Regional Administrations. Nevertheless this debate intertwines the National and Regional Governments' concerns about the constants flows of patients mobility within the national borders.

In a public funded and regionalized Healthcare System like the Italian one (*Sistema Sanitario Nazionale*, or SSN) every Region, first administrative level of the State, has the responsibility of the health care provision and organizes autonomously its Regional Healthcare System (from now on RHS). In order to assure uniform standards of healthcare treatments throughout the Italian territory, the SSN guarantees everyone the possibility to use the public health services provided by another health authority, not necessarily located in the residential Region's territory.

On the one hand, such a mutual system, allowing freedom of choice to the patients, represents a strength of the SSN; on the other hand, at a Regional Government level such decision is not free of consequences, for both the local economy and the citizens.

First of all, the phenomenon has a financial impact: about the 7% of the hospitalizations takes place out of the residential Regions, for a financial value of 3 billion of euro on an annual basis (Petrelli et al. 2012). According to the Italian Healthcare System, in case a citizen decides to exercise the right to move to another Region, the destination Region is financially compensated by the residential one for the medical treatments provided to non-resident citizens.

In presence of a patient mobility deficit (where outgoing patients flows are higher than incoming patients flows) a Region has to support extra-costs in addition of the almost fixed costs requested to maintain the health care service at the required level. This worsen the financial position of those Regions which are already structurally in deficit (Bruzzi, 2012), and it is likely to make the costs rising without modifying the quality of the service (Zuccatelli, 2012:5).

The imbalance between supply and demand, when not falling in order to precise health policies, leads in the short-term to budget problems for the local health organizations

because it generates "full" additional costs (tariff to be paid to external providers) against the marginal costs that would be supported through their own productive structures (Baldessarelli 2005).

The annual amount of money transferred to other Regions can reach a considerable value. It can range in some cases from Eur 200 Million up to Eur 350 Million. Such figures, in particular in recession times, raise a high pressure on public decision makers as these resources represent a loss of economic growth opportunities they could fuel inside the Region (Bivona, 2013) and are a crucial factor for the sustainability of the Regional Healthcare Systems.

Furthermore, for those Regions characterized by high levels of passive mobility it is quite difficult to forecast at the beginning of the year the economic impact that the mobility systematically determines, as the financial values of the previous compensations are disclosed in the first half of the current year (Zuccatelli, 2012).

Moreover, the patients mobility catches the public attention when it is symptom of a real or perceived inadequacy of the local health care offer (Costa & Cislighi, 2012). It is worth to note that one part of the mobility is "physiological": these are the cases of patients occasionally living closer geographically to establishments in another Region, or temporarily studying or working there, or needing specialist treatment only available in certain hospitals (Zecchetti, 2012). For this reason the RHSs focus their efforts on the "avoidable" component of the mobility, motivated by quantitative-qualitative lacks of the local offers, such as long waiting lists and low perceived quality of the Healthcare Systems (Petrelli et al. 2012). While the emergencies such as the urgent healthcare interventions and the chronicity need to find local responses (networks of territorial emergency services and networks of services for elderly and disables), the citizen can decide where to receive the programmable services (Zuccatelli, 2012).

The relevance of the phenomenon does not refer only to the impact on the regional balance sheets and the financial resources allocation, but also to the opportunity it gives to the rethink the health care offer, especially for the Italian Regions subjected to repayment plans, which are supposed to undertake virtuous path of reengineering of the network of the hospital and community care supply (Moirano, 2012:8). In addition, the decision of mobility

leads to additional social costs citizens have to sustain to get the desired health care treatments in another region. Such social costs, often not refundable, mainly refer to travel and accommodation costs for both the patients and the accompanying person/s, and the related loss of working days associated to the period of the medical treatment (Bivona, 2013). Indeed for Fattore (2012) the mobility phenomenon raises issues of equity in the access to the health care depending on the socio-economic conditions of the patient. On the one hand the mobility improve the so-called “horizontal” (or territorial) equity because without this option many patients resident in weaker Regions would not access higher quality structures and innovative treatments.

On the other hand, the mobility poses a problem of “vertical” (or socio-economic) equity, as the economic and psychological costs of the mobility make it harder the access to further afield structures for the people facing unfavorable socio-economic conditions. “In addition to the costs for accommodation, meals and transport - the author argues -, the people travelling for medical assistance need to manage remotely the acquisition of the information and the booking process, and they often need relational resources in order be accompanied, advised and helped in the transfers” (Fattore, 2012:25).

So far the Italian investigations on the inter-regional patients’ mobility *per se* have been mainly conducted with traditional approaches: descriptive statistical analyses (Cipolla, & Foglietta, 2005; De Pascale et. al 2012; Falavigna et. al 2011; Petrarca et al. 2011) or econometric studies on the regional data flows (Fabbri & Robone, 2009; Levaggi, R., & Zanola, R. 2001). Although the National Agency for Regional Health Care Services (AGENAS, 2012) has recently released a special issue containing the distinct contributions of both epidemiologists and healthcare economists on the patients’ mobility, relatively scarce attention was devoted to the design of management tools to alleviate/prevent the phenomenon.

2. Framing the mobility phenomenon in the general Public Management and Administration theory.

2.1. The New Public Management wave

The patients' mobility has always been guaranteed to the patients, since the institution of the Italian Healthcare Service (*Servizio Sanitario Nazionale, or SSN*) in 1978², but only with the reform of 1992-1993 the phenomenon has assumed relevant dimensions as a consequence of new regulations³ that introduced structural changes into the Italian health care provision (Bruzzi, 2012). As recently asserted by Fattore (2012:24), "...such policies created new incentives on the supply side and produced distortive dynamics on the demand, with subsequent need for regulation".

In order to evaluate the plausibility of the last sentence, it is worth to recall that the first Italian healthcare reform is timely at the wave of New Public Management (Hood, 1991). The NPM basic assumption was that the application of private-sector managerial techniques to public services would automatically lead to improvements in the efficiency and effectiveness of these services (Thatcher, 1995). It implied the growth of use of markets, competition and contracts for resource allocation and service delivery within public services affirmation, the disaggregation of public services to their most basic units and a focus on their cost management (Osborne, 2006).

Among the Hood's "doctrinal components" of NPM (1991: 4-5) there were: the introduction of explicit performance measures, the great attention to the results, in particular in terms of output, the tendency to disaggregate operational units in public Administration, the emphasis on competition in the public sector and the use of management practices of private-style in the Public Administration. This approach, implying the introduction of managerialism, regionalism and quasi-markets in the public sector (Le Grand, Bartlett, 1993), was synthesized by Ferlie and Steane (2002: 1461) with a three M *motto*: manager, market, measure.

² National Law 23/12/1978, n. 833, *Institution of the National Healthcare Service* (Istituzione del servizio sanitario nazionale).

³ Legislative Decree 30/12/1992, n. 502, *Reorganization of healthcare's discipline* (Riordino della disciplina in materia sanitaria).

As far as the first “M” is concerned, Anselmi (2003: 168) has shown that even in Italy, since the late ‘80s, the evolution of corporate doctrine was in the sense of overcoming the traditional bureaucratic model (Weber, 1980), which was based on a vision of public institutions that correlate the nature of the public almost exclusively to compliance with the formal legality and safeguards aimed at preventing negative behaviors with respect to public purposes, rather than to promote proactive behaviors (Borgonovi 2002: 5).

Regarding the second “M” (market), the Italian Healthcare Service, originally centralized, has been gradually devolving the jurisdiction over vast healthcare issues from the central government to the Regions, also enhancing their fiscal autonomy and responsibility. The cornerstone of these interventions was the introduction of the quasi-markets system, that implied the creation of mechanisms of competition between the Regional Healthcare Administrations and the separation between the functions of production and purchasing of healthcare packages. However, because of regionalization, in Italy quasi-market have been implemented with different features and extents across the 21 regions (Anessi Pessina, Cantu’ and Carbone 2001).

About the third “M” (measure), the search for multi-dimensional performance measurement tools flourished in the same period of the NPM theoretical elaboration. For instance Eccles (1991: 131) presented several criticisms emerged in the eighties against the traditional criteria for measuring the performance of the private companies and call for a “revolutions” whose core was “the radical decision to move from treating financial figures as the foundation for measuring the performance of firms to consider them as one of a broader set of measures”. Eccles’ remarks were developed and systematized by Kaplan and Norton (1992), who proposed to include the performance measurement of non-financial indicators rather than rely only on financial ones, formalizing the so-called "balanced scorecard" (BSC). More recently (Del Bene 2009; Bocci & Micheli, 2009) such an approach was also promoted for the public administrations performance management.

2.2. The Public Value Management and the emergence of new challenges for the performance management in the public sector

The previous heading highlighted that the performance measurement is claimed to be a constitutive part of the New Public Management paradigm. In Italy the regionalization of the Healthcare Service impacted on the performance measurement systems, as witnessed by a recent qualitative study of Vanieri and Nuti (2011). The authors analyzed the different features of 15 out of 21 Italian Healthcare Systems and outlined that, although national reforms have pushed the development of performance managerial tools, still few Regions have integrated all the healthcare performance dimensions of the OECD framework (Arah et. al, 2006): efficiency, responsiveness, equity in the access and health improvement/outcome. It is also reported a particular focus on efficiency and a general scarce attention to the equity and responsiveness areas. Such picture calls for another issue related to the application of NPM to the public sector: the pursuit of objectives whose achievement is easier to measure (quantity of services) by sacrificing those more difficult to measure (quality of services).

More in general, an a-critical adoption of formal performance management systems to the public sector proved to lead to unintended consequences, such as: an increase of bureaucratization; a myopic definition of goals and indicators; a lack of coordination between the political and managerial level, as well as among different institutions involved in the delivery of a public services; a prevailing view on the player rather than on the all system and an unfocussed communication to the community of the outcomes associated to undertaken policies (Bianchi, 2010).

This has often resulted in apparent improvements in efficiency without a corresponding increase in the value generated by public administrations in the assessments of citizens (Hinna, 2006; Anthony & Young, 1992). By recurring to Stoker's thought (2006:47), it is possible to assert that providing services is no longer a sufficient justification for state intervention funded by citizens and the real issue that needs to be addressed is whether the public intervention that they are directing is achieving positive social and economic outcomes. To know whether public value is delivered requires an engagement and an exchange between the relevant stakeholders and government officials.

Osborne (2006: 377) provocatively states that NPM is a transitory stage in the evolution from the traditional Public Administration (PA) and the New Public Governance (NPG)⁴. In Osborne's views NPG seems to be particularly suitable for addressing the complexity of the "relational" and "networked" organizations, since it stresses service effectiveness and outcomes concepts, rather than the only inputs and outputs typical of the traditional Public Administration and NPM. In addition, it gives emphasis to the design of inter-organizational relationships based on trust, in spite of the traditional bureaucracy and NPM, paying more attention to the intra-organizational borders.

In this regard, the Public Value management paradigm offers a broad framework in which to comprehend the management challenges posed by the networked governance (Stoker, 2006). At the same time, Hinna (2006: 28) affirms that the performance measurement systems of the Public Administrations have followed an evolution path overlapping the three management paradigms: their emphasis has been changing over time from inputs (Traditional Public Administration), to outputs (Public Administration Management stimulated by the New Public Management), to outcomes (the Public Value and the New Public Governance approaches).

Thus, knowing the most relevant characteristics of the three "umbrella concepts" of traditional Public Administration, New Public Management and Public Value Management can provide some "lenses" to analyze the reality and understanding "where we are" and "where we wish to go"⁵.

For this reason, in the following two tables it is possible to read the main features (general and management-specific) of the three public management and administration paradigms according to the selected foundational literature. For Stoker (2006), each of them is a reaction to the shortcomings of the previous one. For instance, the NPM is to some extent a response to the administrative inefficiencies associated with traditional public administration. On the other side, Public Value Management claims to overpass the

⁴ According to Osborne the public policies' implementation and the public services' provision evolved through three stages: the traditional Public Administration (from the late 19th Century to the early Eighties), the New Public Management from the early Eighties to the early years of this decade, and then one of the emerging New Public Governance.

⁵ Indeed, in the second chapter these paradigms provide the theoretical frameworks to conduct a qualitative analysis on some in-depth interviews to relevant healthcare actors involved in the patients' mobility policy making.

narrowly utilitarian character of New Public Management, indicating motivational forces others than rule compliance or incentives to achieve efficiency, accountability, and equity.

PARADIGMS/ GENERAL FEATURES	TRADITIONAL PUBLIC ADMINISTRATION	NEW PUBLIC MANAGEMENT	PUBLIC VALUE MANAGEMENT
Main Focus	<p>Focus on the inputs provided through the policy making process.</p> <p>Implementation is a “black box” and services are monitored through bureaucratic oversight.</p>	<p>Focus on inputs and outputs management to ensure internal efficiency of individual public administrations (intra-organizational focus).</p> <p>The implementation “black box” is addressed through application of private sector techniques to public sector and the promotion of competition among different public administrations and between public and private organizations.</p>	<p>Focus on public value which implies:</p> <ul style="list-style-type: none"> - tackling the problems that the public most cares about; - shift the focus from service delivery to system maintenance - looking at the efficiency and effectiveness of the entire system of public administration networks; - attention to the inter-organizational relationships and the governance of the processes through trust and relational capital; - systematic collaboration among various entities, both public and private (inter-organizational focus)
Worldview about people motivation	People need rules to follow	People need incentives	People need to develop ownership of issues and tasks
Role of managers	To ensure that rules and procedures are followed.	To help define and meet agreed performance targets.	<ul style="list-style-type: none"> - To steer networks of deliberation and delivery maintaining the overall capacity of the system. - To respond to citizens preferences, renewing mandate and trust through quality services. - To ask themselves if their actions are bringing a net benefit to the society
Relationship politicians/ managers	Separation between the political level and management level	Separation between the political level and management level	Overcome the dichotomy politicians-managers by recognizing the interrelatedness of both the policy making and the implementation/service delivery process

Figure 1. General features of different Public Management and Administration paradigms. Adapted from: Kelly, Mulgan and Muers (2002), Cepiku (2005), O’Flynn (2005), Osborne (2006) and Stoker (2006).

PARADIGMS/ SPECIFIC MANAGERIAL FEATURES	TRADITIONAL PUBLIC ADMINISTRATION	NEW PUBLIC MANAGEMENT	PUBLIC VALUE MANAGEMENT
Definition of public interest	Expressed by politicians or experts	Aggregation of individual preferences, in practice captured by senior politicians or managers supported by evidence about customer choice.	Individual and public preferences produced through a complex process of interaction that involves deliberative reflection over inputs and opportunity costs
Performance Objectives	Inputs provided by politics	Management of inputs and outputs to ensure economics and responsiveness to consumers	Multiple objectives pursued including: service outputs, satisfaction, outcomes, trust and legitimacy.
Preferred system for service delivery	Hierarchical department or self-regulating profession.	Private sector or tightly defined arms-length public agency.	Menu of alternatives selected pragmatically and a reflexive approach to intervention mechanisms to achieve outputs and outcomes
Efficiency	Break down complex tasks and get staff to follow procedures.	Set performance tasks that the organization is encouraged to achieve.	Check on a continuous basis that activity fits purpose.
Accountability	Competition between elected leaders provides an overarching accountability (leaders should steer and exercise oversight).	Politicians set public goals and set performance targets and then hold managers to account for their delivery: 1) Upward accountability via performance contracts, and 2) outward accountability via market mechanisms	By negotiated goal setting and oversight in a continuous process of dialogue and democratic exchange.
Equity	By treating all similar cases the same.	Offering frameworks of responsiveness to users and setting targets to achieve fair access to services.	Developing individual capacity so that rights and responsibilities are realized.

Figure 2. Specific managerial features of different Public Management and Administration paradigms. Adapted from: Kelly, Mulgan and Muers (2002), Cepiku (2005), O’Flynn (2005), Osborne (2006) and Stoker (2006).

3. Research questions

The critical review provided in the previous headings identified some *lacunas* in the management literature as far as the design of tools to alleviate/prevent the patients’ mobility

phenomenon are concerned. The present research primarily aims to contribute to fill this gap, suggesting an interventionist research framework to address the patients' mobility issues in Italy and to support the design of sustainable regional healthcare policies.

In order to pursue this scope, the mobility topic was re-conducted to the Public Management and Administration field, highlighting the challenges posed to the performance measurement systems by the emergence of public management paradigms such as the New Public Governance and the Public Value management.

The position assumed in the present work is rooted in the "public value pragmatism" proposed by Alford and Hughes (2008). According to the authors, all the management paradigms have the shortcoming to indicate a "one-best way" and are seen as a panacea by their supporters. The authors instead postulate that the most suitable management model to pursue public value strictly depends upon the particular circumstances with which the public manager deals.

Related to the stream of this argument, the overall research question driving the entire study is the following:

"How to combine Public Value Management and Performance Management to build an analytical framework to address the phenomenon of patients' mobility in Italy?"

The public value approach was privileged to the NPM approach for at least two reasons. First, the patients' mobility can be read as a symptom of public value loss/lacking: if people prefer to "emigrate" to other places to receive a treatment available in the residential area where it could be provided, some limitations in the public value deliver can be hypothesized. Second, it was also considered that the public value management can provide a wider spectrum (inter-organizational) based on collaboration, dialogue, sharing, rather than the NPM, which has a more intra-organizational focus and relies on mechanisms of competition and incentives. In this study, the public value ethos provides the *leitmotiv* basic principles leading the research activity, while the performance management approach is claimed to give practical content to the challenges posed by the public value management and networked governance, which otherwise are likely to remain mere statements of principle.

The overall research question was further articulated in more specific questions considered functional to a better understanding of the investigated problem:

RQ. 1) How the Regional Health Authorities are currently facing the patients' mobility issues? What are the main policies undertaken in the past to face the phenomenon? Did they work?

RQ. 2) Should the phenomenon of patients' mobility be addressed in general terms or would it be more appropriate to focus only on certain diagnostic groups?

RQ. 3) What are the key-actors' levels of integration providing health care in Sicily? How can a System Dynamics approach support their coordination for the design and implementation of effective patients' mobility policies?

The analyses conducted on the research questions are located in the later chapters, in particular chapter 2 mainly addresses RQ1) and chapter 3 contribute to provide an answer to question RQ2) and RQ3). The last part of the present chapter is dedicated to the description of the main features of the research methodology.

4. Methodological approach

The research strategy to address the above research questions consisted on the conduction of a one-year field research project in collaboration with a Regional Healthcare Administration.

This was an explanatory qualitative study mixing the case study method (Yin, 2003) with a System Dynamics (Forrester, 1961; Sterman, 2000) approach, and adopting a performance based inter-institutional perspective (Bianchi, 2010) towards the pursuit of public value.

The underlying research philosophy mixes: interpretivism (Collins, 2010: 38) because it aims to reach a better understanding about a complex, social, time-and-context related problem; pragmatism, because it is open "to the utilization of any of a variety of means to achieve program purposes, with the choice of these means focused on what is most appropriate to the circumstances" (Alford & Hughes, 2008: 132). It also has an interventist

connotation (Joˆnsson and Lukka, 2006) in order to make both a theoretical contribution and an organisational contribution by assisting organisations in implementing change (Dumay, 2010: 47).

Among the Italian regions experiencing the investigated phenomenon, Sicily was chosen as a case study because together with other two Southern Italian Regions (Campania and Calabria), it is of the major patients “exporters” all over the Italian State.

Furthermore, Sicily in 2007-2009, due to excessive healthcare deficit, was one of the seven Regions⁶ forced by the central State to start a recovery plan (still ongoing), thus it could be argued that there is room for application of some findings of the present work also to those regions having presented similar criticalities in the health care.

Indeed, paying attention to the patients’ mobility gives the opportunity to rethink the entire health care offer, especially for the Italian Regions subjected to repayment plans, which are supposed to undertake virtuous path of reengineering of the network of the hospital and community care supply (Moirano, 2012:8).

The adoption of a modeling and simulation method was motivated considering it would foster a better understanding of the problem, improving the communication of it. There is continuing discussion on which type of simulation is best suited to health-care modelling, especially between Discrete Event Simulation and System Dynamics: indeed Brailsford and Hilton (2001) compare the use of DES and SD in health care.

They underline that SD models are mainly used at a strategic or conceptual level, as their aim is to gain an understanding of feedback dynamics and long-term system behavior. On the contrary, DES models have traditionally been applied at a tactical, operational level, as they are more analytical and stochastic in nature.

⁶ The other Regions involved were: Abruzzo, Calabria, Campania, Lazio, Molise, Piemonte and Puglia.

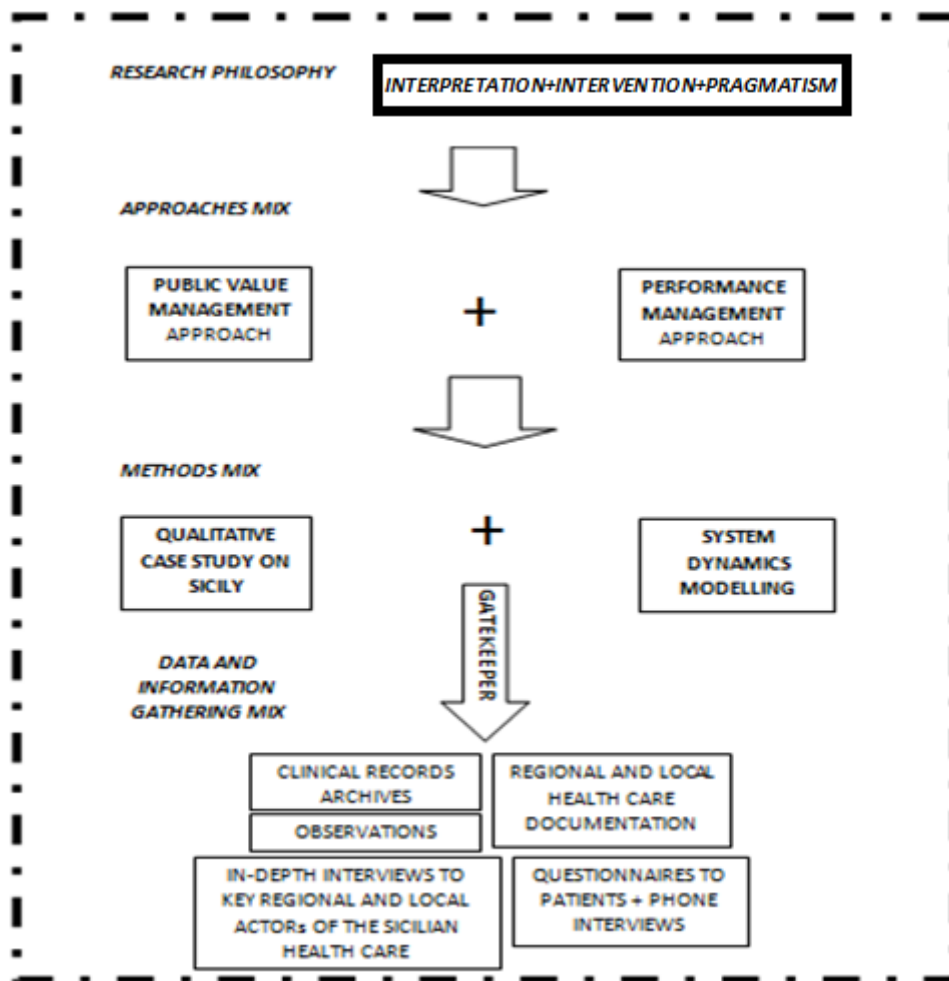


Figure 3. The research strategy adopted to address the patients' mobility phenomenon.

These arguments oriented the research towards System Dynamics, considered a better fitting for the investigated phenomenon. The decision was encouraged also by looking at the previous literature on the application of SD to health care issues, in particular for analyzing the long term effectiveness of health care policy making, thus it was evaluated its usefulness also in the Sicilian case.

General discussions on the application opportunities and the possible role of SD in analyzing the health care systems can be retrieved in Taylor & Lane (1998), Dangerfield (1999), Homer & Hirsh (2006) and Cooke et al (2007). Other authors underlined the validity of SD modeling for health care policy design (Royston et. al. 1999, Taylor and Dangerfield, 2005).

Taking into consideration the perspective of National Health Care Services, some authors focused on the long term effectiveness of the policies to manage the waiting lists (Van Ackere & Smith, 1999; Gonzales Busto, & Garcia, 1999), others addressed acute

patients flows in UK (Lane & Husemann 2008) and the impact of intermediate care as structural initiatives for relieving pressure on the NHS (Wolstenholme, 1999).

Several scholars and practitioners use the SD approach to explicitly pursue the creation of public value through stakeholder involvement in the public sector: for example, illustrating the participative process of building a strategic-level system dynamics model in environmental decisions (Stave, 2002) and water management (Stave, 2003). In the health care Vennix *et al* (1994) used a group model building approach to involve VT Medicaid experts and stakeholders; Ackermann *et al* (2010) addressed group of service providers' mapping sessions to address issues of service capacity for the provision of long term dementia services in the Scottish Borders; Merrill *et al* (2012) coped with the implementation of electronic health information exchange for public health reporting at a state health department.

So far it was not retrieved any System Dynamics contribution directly investigating the flows of people travelling for medical reasons, neither the cross-border nor the in-border mobility, thus this research also aims to contribute to fill this gap in SD literature.

4.1 Data and information gathering

Since the beginning of the project, the researcher was bearing in mind that obtaining the free access to the Sicilian Regional Healthcare Administration and peripheral offices would have been an issue: according to Alvesson and Deetz (2000: 193), "...organisations are often reluctant to allow access to researchers, especially in the case of critical research, if the research findings could be adverse to the organization". To overcome this issue, the researcher found it useful to rely on a "gatekeeper", a person within the organization who helped to "open the doors to the research project" (Creswell, 1998: 117). This actor promptly familiarized with the project aims and the methodological approach chosen and, evaluating the potential usefulness of the research, helped the researcher in a double way:

- 1) facilitating the introduction inside the organization. In this regards, the gatekeeper encouraged the researcher to submit a research protocol draft (enclosing research objectives and provisional field procedures) to the Sicilian Healthcare Councilor, who formally authorized the access to the organization. This way the public managers and the

administrative and the healthcare providers' staff were supposed to cooperate to the research;

2) indicating each time to the researcher "where to look" for matching the research requirements, e.g. to whom conducting an interview to gather certain data or information, how to deal with some routines within this or that office, etc..., in other world, She promoted the interaction of the researcher with the Sicilian Healthcare Administration.

As reported in the next chapters, the application of several data gathering techniques is due to the fact that each of them meets specific purposes along the stages of the research process. In particular:

- the analyses of archival documents, such as the internal reports and the clinical records databases, were iteratively used along all the project duration, in the early stage of problem definition as well as in the latter System Dynamics modeling;

- the unstructured and semi-structured interviews to the key actors of the system have investigated their perception of the problem, in order to access their mental model (Sterman, 2000);

- the questionnaire tool, in the perspective of the public-value management, was used to explore the Sicilian patients dimension;

- even the direct observations were considered sources of "subtle and significant data" (Johnsson and Lukka: 8). Particularly insightful the ones at the waiting halls of the Regional and Local Healthcare Administration offices, and the ones at the waiting halls of the healthcare providers.

The data gathering and analysis took place at the same time and iteratively, for example the key-stakeholders interview records were transcript forthwith, so that the next data requests were tailored according to the informative needs emerged from the analysis refinement.

Chapter 2.

The patients' mobility in Sicily

1. Definition of patients' mobility accepted in the present work

In the previous chapter, the patients' mobility phenomenon was outlined in general terms and inserted in a certain literature stream according to which it was possible to define the main questions driving the field research. As the desired contribution of such study is to support the policy making, considering the limited duration of the project (one year) the researcher considered to enucleate specific issues on which to focus, namely to proceed to a more precise problematization. This task took some time and required an iterative process of refinement.

As remarked by Zecchetti (2012), the inter-regional mobility can be due to the proximity of some Regions (for example Sicily and Calabria, or Lombardy and Veneto): in this case the phenomenon assumes specific characteristics depending on the Regions involved, and it is sometimes subjected to bilateral clearing arrangements between confining regions. On the contrary, the long distance mobility could be occasional (e.g. the patients was on vacation out of Region), or just apparent, when the patient formally resides in a Region and stays stably in another one, thus there is no a real movement of people, in spite of a financial compensation taking place according to the residence and not to the domicile.

There is also a intra-regional mobility, which takes place within the regional borders and although it brings different connotations in each Region, we can distinguish the flows of patients between distant provinces and between provinces characterized by proximity. In this case the financial compensation between provinces is still an important issue, but other themes emerge such as the programming of the supply network, the accessibility of the services, the basins served by the health care structures.

One part of the mobility is "physiological" (and for this reason unavoidable): these are the cases of patients occasionally living closer geographically to establishments in another Region, or temporarily studying or working there, or needing specialist treatment only available in certain hospitals (Zecchetti, 2012). According to a 2005 Censis panel analysis on a 2524 hospital patients "migrated" in the arch of the previous 5 year time

period from seven Italian regions (Umbria, Calabria, Marche, Molise, Veneto, Marche, Piemonte e Toscana), only the 8,8% the mobility was physiological e.g. in the cases the patient was accidentally out of the residential Region when needed the hospitalization, while in the other 91,2% of the cases the mobility was “elective” (Collicelli, 2012). For this reason the Regional Healthcare Systems focus their efforts on the “avoidable” component of the mobility, motivated by quantitative-qualitative lacks of the local offers, such as long waiting lists and low perceived quality of the Healthcare Systems (Petrelli et al. 2012).

In the perspective of the Health Administration (no matter if it is regional or local), the movements of patients can be outward (in this case the phenomenon in Italy is commonly named “passive mobility”), and inward (in this case the phenomenon in Italy is commonly named “active mobility”). It is also possible to address the phenomenon in terms of net flows.

Given the above possibilities, the researcher opted to focus her attention on:

- the inter-regional mobility: this choice is due to the fact that the main interlocutor of the research was the Regional Healthcare Department, which plays the role of coordinator of the healthcare provision in Sicily. The intra-regional mobility phenomenon is not neglected but treated as one of the components of the Regional Healthcare System;

- the “passive mobility”: at the beginning of the project, the researcher was oriented to analyze both the “active” and “passive” mobility, believing that this inclusiveness would have ensured a deep understanding of the phenomenon . Along the research development, it was decided to opt for a “passive mobility” focalization because in the Sicilian context the patients’ inflows from other Regions are not relevant, neither considering the aggregate mobility (i.e. without distinguish specific group of pathologies) nor for the cohort of patients that was finally enucleated. Furthermore, according to the opinion of the interviewed key actors, some of the policies undertaken to discourage the passive mobility could also favorably impact on the active mobility, which, once again, will not be ignored in the study, but treated only when functional to the passive mobility argumentation;

- the “avoidable” mobility: the focus will be the mobility motivated by quantitative-qualitative lacks of the local offers, such as long waiting lists and low perceived quality of

the Healthcare Systems, because this is the main concern of the regional and local policy makers.

In addition, at the beginning of the project the focus was the mobility for hospitalizations, as according to the Regional Healthcare database constitute the 85% of the total mobility, but in later stages of the research, in particular when the modeling process started, also the mobility for outpatients specialist services was taken into consideration.

2. The relevance of the patients' mobility phenomenon in Sicily

The present work suggests a framework to deal with the patients' mobility issues and to support the design of sustainable regional healthcare policies to contrast passive mobility. First of all, it appears appropriate to hint the quantitative relevance of the phenomenon.

In the period 2003-2007 the Sicilian patients' mobility towards other region has accounted for about 250 million of euro on an annual basis, registering a sensible reduction in 2009 (about the -17% decrease compare to the average of the previous year). This reduction is timely at the spending review plan that Sicily has undertaken since 2007 to reduce the healthcare structural deficit, which claimed to have specifically addressed the mobility phenomenon (more details of it will be given in a later heading of this chapter).

Looking at more recent data (Figure 5), it is possible to notice that in the time period 2010-2012, the Sicilian Healthcare System has registered a sensible disequilibrium between the patients' outflows towards other regions (passive mobility) and the patients' inflow from other regions (active mobility).

	2010	2011	2012	Δ 2010-2011	Δ 2011-2012	TOT Δ 2010-2012
(A) Passive Mobility (Hospitalizations OUT)	43.724	42.147	38.809	-3,607%	-7,920%	-11,527%
(B) Sicilian Residents' Hospitalizations IN	606.346	579.011	568.037	-4,508%	-1,895%	-6,403%
(C) Sicilian Residents' Demand For Hospitalizations (IN&OUT) (A)+(B)	650.070	621.158	606.846	-4,448%	-2,304%	-6,752%
(D)Active mobility (Hospitalizations Non Sicilian IN Sicily)	10.372	10.126	10.318	-2,372%	1,896%	-0,476%
(E) Supply Of Hospitalizations In Sicily (Residents&Non Residents) (B)+(D)	616.718	589.137	578.355	-4,472%	-1,830%	-6,302%
(F) Financial Value of Passive Mobility (.000 euro)	193.438	190.511	182.594	-1,513%	-4,156%	-5,669%
(G) Financial value of Sicilian Residents' hospitalizations IN&OUT (.000 euro)	2.159.646	2.162.824	2.174.576	0,147%	0,543%	0,691%
(H) Financial Value Of Hospitalizations In Sicily	1.966.208	1.972.313	1.991.982	0,310%	0,997%	1,308%
(I)Active mobility financial value (.000 euro)	36.090	37.197	39.664	3,067%	6,632%	9,700%
(L)Financial Value of Passive Mobility Over Financial Value Of Demand (F)/(G) %	8,957%	8,808%	8,397%			
(M) Financial Value Passive Mobility Over Financial Value Of Supply (F)/(H)	9,838%	9,659%	9,166%			
(N) Fugue Index (A)/(C) %	6,726%	6,785%	6,395%			
(O) Attraction Index (D)/(E) %	1,673%	1,711%	1,773%			
(P) Passive Mobility/Production (A)/(E) %	7,090%	7,154%	6,710%			
Acute Beds In Sicily	15.371	14.741	14.558	-4,099%	-1,241%	-5,340%
% Of Potentially Inappropriate Hospitalizations In Sicily	4,570%	19,230%	17,690%			
Average Drg Weigth	1,440	1,081	1,100			
Acute Beds Turnover In Sicily	73%	74%	75%			

Figure 5. Data about hospitalizations in and out of Sicily. (Source: elaboration from data provided by the Sicilian Healthcare Administration)

On the one hand the hospitalizations of Sicilian residents out of region were about 40.000 on an annual basis, accounting for 190 million of euro and representing the 8-9% of the total Sicilian expenditures for hospitalizations. On the other side, in the same time horizon the active mobility didn't show significant figures: the attraction index (proportion of not Sicilian residents being treated in Sicily over the total hospitalizations provided in Sicily) was the 1,7-1,8%, despite to a fugue index (proportion of Sicilian patients treated out-of-region on the total hospitalizations for Sicilian residents) that ranged from 6,4 and 6,8%.

Although the unbalance between the active and passive mobility and the substantial stability of the active one, the hospitalizations out-of-region are decreasing, both in frequency (-11,5%) and financial value (-6,3%) in the triennial. These improvements could make think that the policies activated by the regional healthcare government are achieving good results. But looking at the trend of the number of hospitalizations, it is realized that they are decreasing by the 6% in the three years period, in pace with the -5% variation in the number of acute beds, in spite of a slight increase in the hospitalizations of Sicilian patients' cost.

In addition, the “qualitative” composition of the hospital supply in Sicily appears deteriorated: in spite of better bed turnovers, the percentage number of potentially inappropriate hospitalizations⁷ over the total is dramatically increasing. Furthermore, the average Diagnosis-Related-Group is still relatively low, meaning that the Sicilian clinical records do not present more complex casuistic than the past.

Furthermore, the fact that the total variation of the Sicilian demand for hospitalization decreased less than the passive mobility could mean that there is a part of demand that did not receive an answer neither in Sicily nor in other Regions.

These figures call for further analyses, in particular the first research question (RQ.1) arises spontaneously:

1) How the Regional Health Authorities are currently facing the patients’ mobility issues? What are the main policies undertaken in the past to face the phenomenon? Did they work?

Giving an exhaustive answer to the latter cannot disregard a premise about the national and regional institutional frameworks in which the Sicilian patients’ mobility phenomenon is embedded.

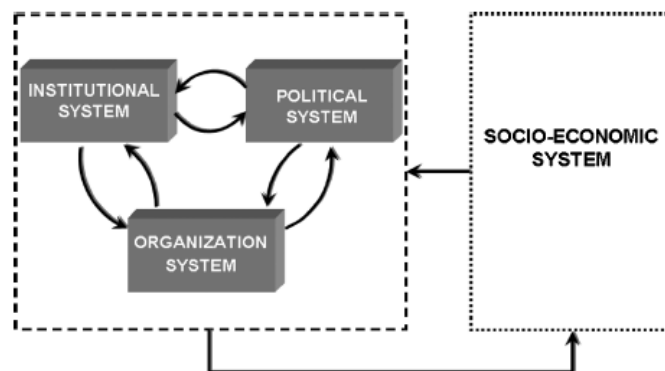


Figure 6. Four sub-systems affecting organizational change interdependently in the public sector (adapted by Bianchi 2004, p.32 on the basis of Borgonovi, 1996, p. 105)

⁷As in some border cases it is not easy to distinguish when the hospital treatment is appropriate or not, the central Government established, with technical regulation, a list of some potentially inappropriate hospital packages: a list of 43 DRG reported in the appendix 2C of the Prime Minister Decree 29/11/2001.

This analysis is considered functional to the investigation of the phenomenon as the implementation of programs aimed at fostering any change cannot limit the attention to the organizational level (e.g. processes, roles and responsibilities, planning and reporting, career and reward/incentive schemes of Regional Healthcare Administration, Local Healthcare Administration, single healthcare provider, etc...),

Ignoring the wider socio-economic, political, and institutional systems with whom an organization in the public sector interacts may cause a failure in reaching the objectives stated. A public sector organization is connected to other independent public sector organizations according to rules defined by an institutional system, which also defines the relationships between the public administration system and external actors (e.g. citizens and private sector organizations).

The system of formal rules, aiming to ensure the balance between formal powers and rights/duties, interacts with an informal political system defining how power is actually exerted and how the different roles which are ruled by the institutional system are played. Both the institutional and political systems are an expression of values, expectations and interests of a wider socio-economic system. (Bianchi; 2004: 32; Bianchi, 2010; Bianchi et al. 2010).

3. The National context: the Italian Healthcare Service towards the decentralization

The National Healthcare Service (*Servizio Sanitario Nazionale*, SSN), was instituted with the national Law 833/1978 and it is accountable for prevention and healthcare education, diagnosis, care and rehabilitation. As remarked in the article 32 of the Italian Constitution, the SSN is based on the principle that all persons have the right to receive the required health care treatments in spite of their social or economic position.

Originally the SSN was centralized and financed by national health taxation, that flowed into a dedicated national fund. The healthcare resources were then distributed to the regions to finance the services produced at a local level by comprehensive providers, called USL (*Unità Sanitarie Locali*), belonging to the local municipalities.

As reported by Anselmi (2003) this system caused the vertiginous increase and unmanageability of the national health expenditure: the spending power, held by the municipal health providers (USL) was totally undocked from the funding responsibility of the State. Moreover, as there was not a continual planning activity at national and local level, the quota of national funding annually assigned to each region was calculated by referring to the historical spending, not to the real needs of the population. Then the regional budget assigned to each USL was determined by referring to the expenditures of the previous year, increased by a certain rate (incremental mechanism). In addition, the region intervened to set off the USL deficits (*rimborso a piè di lista*) and afterwards asked reimbursements to the central government.

As a consequence, the national health expense, equal to the 4.5% over the GDP in 1970, increased up to the 6.4% in 1990⁸. “Due to the incremental budgeting mechanism, the economic and financial disequilibria were perceived to be more rewarding. The citizens felt the healthcare as a zero-price service, while the medical class had the tendency to underestimate the economic reflexes of their actions”(Anselmi L., 2003).

When the Italian Government took the decision to participate to the European Monetary Union, Italy pursued the goal of containing the health care expenditures’ rate of growth by requiring accountability to the Regions (Velo & Bruzzi, 2004). Consequentially the SSN in 1992 was subject to a reform (Legislative Decree 502/1992), which introduced the decentralization and regionalization of the health care. This means that Regions, first-level administrative divisions of the State, are in charge for the health care provision, making sure that inhabitants receive the care treatments needed in their residential territory.

The regional autonomy in the health services organization finds two limitations: (1) a budget constraint, represented by the financial resources transferred by the State for the annual health care; (2) a positive limit, consisting on the so-called “minimum levels of healthcare assistance” (*Livelli essenziali di assistenza*, LEA), a list of standard services (health packages) to be provided uniformly to the population in Italy.

⁸ OECD Health Data 2002.

The cost associated with the LEA is fully covered by the State, except for small contribution fees, called “tickets”, which vary in pace with the treatment provided and the users’ annual income.

Despite of the mentioned process of regionalization, in order to assure consistent treatment throughout the Country, the SSN guarantees everyone the choice of the public establishment in which to receive health care, that can be located not only in their place of residence but also into a different Region. In case a citizen decides to exercise his/her right to be treated outside his/her residential Region, the respective expenses are covered by the Region of origin through a financial compensation mechanism.

Every Regional Healthcare Administration, according to the annual budget mentioned above, allocates the resources among the different Local Health Authorities (more than 150 in Italy), who are responsible for the coordination of the health care services in their jurisdiction area, provided by public and private operators, these ones must be authorized under specific requirements that have applied for become eligible for SSN reimbursements and can be contractualized if LHA evaluate their services are needed. In this case private operators are subsidiary. On the contrary, when they only authorized, they figure as competitors of the public level.

4. The Regional context: the Sicilian Healthcare System and the recovery plan

According to the actual regulation, the regional government is at the head of a system made up of three category of subjects:

- 1) the financier: the regional government through the Regional Healthcare Department (making use of both regional and national funds);
- 2) the supplier: Local Healthcare Authorities (ASP, *Aziende Sanitarie Provinciali*) through their structures, public hospitals, private accredited hospitals;
- 3) patients: for their access to the Sicilian Healthcare System, it is necessary a medical prescription, except for emergencies, obligatory treatments and preventive medicine.

The Legislative Decree n.229/1999 links the national and regional planning in healthcare. In order to provide the LEAs defined in the national healthcare plan, the Regions (together with their Healthcare Authorities) have an high degree of freedom in organizing their regional healthcare systems. Still, in defining and negotiating with public and private providers the specific conditions for health packages supply, they have to take into account some main principles defined at the national level, such as: appropriateness between the observed diseases and the provided treatments, clinical effectiveness and economical affordability.

In Sicily for decades those principles seem not to have received practical implementation: since its institution along with the regionalization of Healthcare Service in Italy, the Sicilian regional healthcare system have experienced financial disequilibria. The annual deficits were often covered by commercial and financial borrowings, hence creating vicious circles of new borrowings to cover previous deficits and the interests' accrues.

In 2006-2007s, the financial disequilibria in the healthcare systems of seven Italian regions (Sicily included) pushed the central government intervention: a new institution, called "Health agreement" (Patto per la salute) was legislated. According to it, the State makes available financial resources for the requalification of the regional healthcare systems, who have to implement recovery plans (*Piani di rientro*), characterized by sets of goals of expenditure reduction, higher health standards provided to the population and correction of the behaviors that had provoked the unsustainable structural deficit⁹.

The table below shows the behavior of the Sicilian structural deficit in the years immediately before the start of the reform. It is worth to underline that a direct intervention of the State to set off the regional deficit was not a feasible option, as the Legislative Decree n.56/2000 about the "Fiscal federalism", cutting all the central transfers toward the periphery, practically eliminated this possibility.

Sicilian RHS Deficit	2002	2003	2004	2005	2006	2007	2008	2009
	-375.004	-424.132	-926.834	-30.358	-863.280	-630.483	-320.885	-266.732

Figure 7. Structural deficit of the Sicilian RHS (in thousands of euro). Source: Libro Bianco della Salute 2011. Regione Siciliana – Assessorato della Salute.

⁹ Health Agreement State-Region-Autonomous provinces 5/10/2006 (Patto sulla salute 2006).

On the contrary, the “Health agreement” (*Patto per la salute*) made available financial resources in the technical form of State treasury anticipation to be returned according to a thirty-year amortization schedule¹⁰.

Although the recovery plan is formally dated 2007, the promotion of effective structural adjustments was started two years later¹¹, with the legislation of the Regional Law 5/2009 (Norms for the reorganization of the Regional Health Service), that changed the governance asset of the Sicilian RHS. After this intervention, a new timing was established for the completion of the recovery plan, supposed to take place by the end of 2012, according to the “Operational plan 2010-2012”¹².

The plan is based on two main pillars: structural economies in healthcare expenditures and targeted investments to re-qualify the healthcare toward more appropriate and less expensive services.

It identified some macro areas¹³ to act on, as judged characterized by pockets of inefficiency, inadequacy or diseconomy:

¹⁰ The condition to benefit of this financial resources, is that the regional RHS Department have to implement a recovery plan for its RHS (*Piano di rientro*), characterized by intermediate targets that must be monitored regularly. In case of failure in the milestones’ achievement, the new regulation states that the central Government can substitute the authority of the regional one in the healthcare management (healthcare commissioning), and the automatic increase in the health regional taxation over the limits established by the national regulation, up to the coverage of the missed targets. The completion of the recovery plan is a necessary condition to be fulfilled in order to have accredited definitively the national funding for deficit setting off, otherwise the last tranches of the financing will not be dispensed and also the previous anticipations will be given back to the national government, with subsequent recalculation of the economic and financial results of the previous years.

¹¹ In 2008, when the fulfillment of the milestones was subject to annual state verification, the central Government found out that the financial and operational objectives for the first year were not fully achieved and the needed structural changes were not implemented. Thus the Sicilian Healthcare Department had to increase the taxation on the regional health, and also to launch structural measures to achieve the intermediate objectives of the plan.

¹² Programma operativo 2010-2012 per la prosecuzione del piano di contenimento e riqualificazione del sistema sanitario regionale 2007-2009. Regione Siciliana – Assessorato della Salute.

¹³ The table shown in figure 8 is a summary of the main goals stated in the planning document 2010-2012 (Programma operativo 2010-2012 per la prosecuzione del piano di contenimento e riqualificazione del sistema sanitario regionale 2007-2009. Regione Siciliana – Assessorato della Salute).

AREAS OF INTERVENTION	MAIN GOALS
Control on the pharmaceutical spending	The plan has goals to increase the use of generic medicines, the verification of the prescriptive appropriateness of GPs and specialists, and improvement of procurement processes through the introduction of forms of partnership spending.
Control on the expenditures for goods and services purchasing:	The plan aims to promote the use of centralized purchasing in e-procurement.
Policies for personnel	The interventions for personnel consisted essentially on: the block of the turnovers, the reformulation of the organizational charts, the reduction of complex operational units (with a consequent reduction of the management positions) and, for the cases of overstaffing, the application to the inter-firm mobility between the operating structures within the same provinces.
Reorganization of the Hospital network	Reorganization of the overall bed capacity to align it to national standards, reduction of resources dedicated to public and private hospitals, with the decrease of the inappropriate hospitalizations and the inter-regional mobility for healthcare ¹⁴ , and the enhancement of the territorial outpatient structures.

Figure 8. Main features of the Sicilian Recovery plan (source: Elaboration from Programma operativo 2010-2012 per la prosecuzione del piano di contenimento e riqualificazione del sistema sanitario regionale 2007-2009. Regione Siciliana – Assessorato della Salute).

The changes were welcomed under the name of “reform” by the political class ruling those years and succeeded in the purpose to set the healthcare deficit at a zero level in 2012.

5. Ongoing policies to contrast the inter-regional passive mobility

Among the others, the recovery plan set the goal of reduction of the inter-regional mobility. Indeed, in the 2009-2012 timeframe the Sicilian Healthcare Administration identified specific policies to contrast the passive mobility phenomenon that could impact also to the enhancement of the active mobility.

For the private health sector, in 2010 a list of the main DRG treatments taken from Sicilian residents in other Italian Regions (so called “DRGs fugue”) was released and an extra budget assigned (decree n. 957 dated 2010 April 2nd). Such a policy envisaged the possibility for private hospitals to get from the Regional Healthcare Administration additional financial resources, ranging from a minimum of the 50% up to the 70% of the regular DRG cost, in case the treatments provided in 2010 complied with the following two rules. First, the treatments must be included in the pre-assigned DRG list. Second, to get the

¹⁴ The mobility for healthcare is defined as the tendency for people within a State to use the public health services of another region, or in general of another Health Authority.

70% of the DRG cost, the annual passive patients mobility flow must record at regional level a 20% reduction.

In June 2012, the Sicilian Department of Health reiterated a similar policy (decree n. 1060 dated 2012 June 4th). The measure assigned a maximum budget for each Sicilian Province (which accounted in total for Eur 15 Million) and set the refund up to the 70% of the DRG treatment cost. Such an amount is recognised only for those private hospitals able to provide in 2012 a number of pre-identified DRGs treatments higher than the average number of DRGs delivered in the previous three years (2009-2011).

In July 2013, the same policy with minor changes has been introduced (decree n. 1384 dated 2013 July 22nd). This time the maximum budget amount was Eur 9 Million and the refund (still the 70% of the DRG treatment cost) was destined only to private hospitals able to deliver in 2013 a number of pre-identified DRGs treatments higher than the average number of DRGs supplied in the previous four years (2009-2012).

Furthermore, in the triennial period under consideration, the Sicilian Department of Health signed agreements of collaborations with some Italian private providers, characterized by national excellent reputation. The nature of the arrangements was the creation of highly specialized spin-off of those operators within Sicilian hospitals.

This way the passive mobility was supposed to be discouraged and processes of know-how transfers were assumed to take place in the following areas: Pediatric Surgery (agreement with the Pediatric Hospital “Bambin Gesù”, located in Rome, dated 2010 May); General Orthopedics, Orthopedic Surgery, Physical Medicine and Rehabilitation, Intensive Care (agreement with the Orthopedic Institute Rizzoli, located in Bologna, dated 2011 October); Neurologic Rehabilitation (agreement with Fondazione Maugeri, sited in Pavia, Lombardy, dated 2011 October).

In the public hospitals context, with the legislation of the Regional Law 5/2009 (norms for the reorganization of the Regional Health Service), it was pursued the rationalization of the whole hospital network according to an hub and spoke logic, the overall bed capacity was reduced and aligned to national standards (in particular, as far as the distribution of acute, post-acute and rehabilitation beds is concerned).

On the other side, this policy was supposed to be paired with an empowerment of the outpatient community sector¹⁵, whose implementation haven't take place yet due to the previous political instability and the subsequent healthcare top management turnovers. Outbreaks of discontent arose within different political and social groups, expressing disappointment for the “horizontal cuts” of expenditures and claiming for further policies to reorganize the Sicilian health service in a patient-centered way.

In-depth interviews conducted by the researcher revealed that a more systematic approach for the healthcare services planning is particularly felt by the actual regional and local healthcare policy makers. Before going through the analyses of such interviews, it will be presented a summary of the research framework.

6. The research framework

In this heading it is presented the framework leading the one-year research activity being carried out with the collaboration of the Sicilian Healthcare Administration (please see figure 9). The expected output of such analysis was the design of a System Dynamics model to support the Regional Healthcare Administration in outlining patients' mobility policies. Assuming an inter-institutional perspective (Bianchi, 2010), in-depth interviews were conducted both to the Regional the Local Healthcare Authorities' (LHA) management and the hospital management.

Such perspective of analysis considers that the Regional Healthcare Administration plays the role of decision maker and coordinator in a system whose performance is affected by the roles and interrelations of different institutions, both public and private.

¹⁵ Beyond the Regional Law 5/2009, the 2010 Guidelines of the territorial reorganization (Healthcare Councillorship Decree 703/2010) confirmed the necessity of investments in the territorial medicine, but the regulation have not been applied yet.

PHASES OF THE PROCESS OF HEALTH CARE	RESEARCH MILESTONES	MOST RELEVANT SOURCE OF DATA/INFORMATION
1) Use of Regional Mobility Flows’ Measurement System	1) Quantitative Identification of the phenomenon	<p>Regional Database Access</p> <p>+</p> <p>Regional Healthcare Department – Division “Strategic Planning”: In-Depth Interview To The Manager Responsible for ITC, Statistics & Monitoring In-Depth Interview To The Hospital Planning Manager</p> <p>+</p> <p>Regional Healthcare Department –Division “Healthcare Activity and Epidemiological Observatory”: - In-Depth Interviews To Staff</p>
2) Regional Healthcare Policy Design	2) Analysis of the policy levers activated to contrast the phenomenon at the regional level	<p>Regional Healthcare Department – Division “Strategic Planning”: In-Depth Interviews to General Manager Strategic Planning Department</p>
3) Implementation of the regional policies at a LHA’s level	2) Analysis of the implementation features of the regional policies at a LHA’s level	<p>Local Healthcare Authority Of Palermo: In-Depth Interview To The Chief Medical Officer</p>
4) Health care supply	4) Analysis of the effective quality of supply	<p>Public Hospital Azienda Ospedaliera “Ospedali Riuniti Villa Sofia-Cervello” (Palermo): In-Depth Interviews To The General Manager</p> <p>+</p> <p>In-Depth Interviews To Physicians</p> <p>In-depth Interview to a Local Private Accredited Hospitals Representative</p>
5) Patients’ perception on health care supplied	5) Analysis of the perceived quality of the supply	In-Depth Interview To Staff of the Regional “Healthcare Activity and Epidemiological Observatory” – Service 5 “Quality, Clinical Governance and Patient Safety”
		Panel of patients belonging to a specific disease cohort

Figure 9. Research framework

The research framework was built according to the following steps. First of all, it was taken into consideration each phase of the health care provision according to the institutional framework previously described, reported in logical and chronological order in the first column from the left.

As a starting point of such sequence it was located the “Use of Regional Mobility Flows’ Measurement System”, as the Sicilian Healthcare Administration is endowed with a mature regional informative system, also fueled at a national level, able to track the clinical records starting from the Hospital Discharge Registers (*Scheda di dimissione ospedaliera, SDO*). The other phases are: the regional healthcare policy design, the implementation of the regional policies at a LHA’s level, the health care supply and the patients’ perception on health care supply.

Based on these figures, it was possible to plan five main research steps, shown in the second column. Then specific sources of data or information were identified: the access to the regional database as far as the first research step is concerned, in-depth interviews with reference key-actors of the Sicilian Healthcare System at the regional and local level for the other steps, also including the administration of questionnaires to the patients.

The above framework is just a synthesis of the most relevant contributions to the research: other interviews and data gathering were put in practice during the research and their aid, when necessary, will be described in later parts of the thesis.

Although all the interviewed actors were crucial for the problem definition, problem analysis and for the System Dynamics modeling, the in-depths interviews to the Regional Healthcare Administration General Manager, the Chief Medical Chief of the Local Health Authority and Public and Private Accredited Hospitals’ Physicians Representatives provide deep insights to address the first research questions and their analyses is provided in the next headings of this chapter. The other research milestones will find place in later chapters.

In the research process the interviews to key- stakeholders had three main functions:

- problem definition: as previously stated, the focus refinement was an iterative process, aided by the interviewed people sharing their concern about specific health care areas;
- problem analysis: each stakeholder was asked to provide his/her personal interpretation of the mobility phenomenon, pointing out the factors that according to his/her “mental database” could contribute to the problem occurrence and contrast;
- system dynamics modeling: sketches of the model was shared with the interviewed in order to gather feedback and suggestions for improvement.

The interviews were semi-structured¹⁶ and had the objective to explore the perception of:

- 1) the main causes of the mobility according to the interviewee's perspective;
- 2) the socio-economic implications of the mobility within the Sicilian Healthcare System;
- 3) the level of priority assigned to the contrast to the mobility¹⁷;
- 4) the policies adopted to contrast the mobility and the priority assigned to each of them;
- 5) the role of the other key-actors in the activity of design and implementation of policies to govern the mobility phenomenon.

The information gathered from the interviews was analyzed through the emic-etic technique (Joñsson and Lukka; 2006: p. 3), consisting of a first phase (so-named "emic") where the researcher steps inside the organization gathering data and information and interacting with the stakeholders, and a second reflexive phase outside the organization (called "etic") where the researcher analyze the data using one or more purposeful theoretical frameworks.

The theoretical frameworks chosen to conduct such analysis were the Public Management and Administration paradigms, thus the interviews are red with the "lenses" of the (supposed) transition from the traditional Bureaucratic Administration to the New Public Management and to the Public Value Management.

The researcher is aware that the three paradigms of them are just ideal archetypes, probably never achievable in the real life, but She believes that comparing the reality with them could help to be retrieve deep insights to improve it. Moreover, it is worth recalling that the Sicilian Healthcare System is passing through a reforming period, and the remarks do not mean to be sterile critics, but have the scope to support constructively the public management.

¹⁶ A list of question was prepared in advance in order to have an organic trace and also because it was sometimes requested by the interviewee. Anyway during the meetings there was room for other questions, often stimulated by an occasional silence.

¹⁷ In a scale from 1 (minimum) to 5 (maximum).

7. Exploring the key actors' approaches to the mobility phenomenon

The first aim of the interviews was to investigate how the key-actors of the Sicilian Healthcare System are currently coping with the patients' mobility phenomenon. It is worth remarking that the respondents are in charge of the regional and local healthcare management for just an year and a half¹⁸, timely at the last regional government turnover, thus some strategies and policies have not been fully implemented yet.

All the respondents declare to attribute high relevance to the mobility, but the interviewer registered a greater concern in the Local Health Authority. Indeed, the LHA's management claimed that "Considering the actual context of austerity and the crisis of the welfare state, the patients' spillover towards other Italian Regions are draining financial resources out of the Sicilian system. For example, every year the 40 million of euro flow out from the LHA of the province of Palermo ". The private accredited providers seem to look at the problem with a wider concern declaring "it is a proxy for the scarce quality of the Sicilian Healthcare System".

The interviewees also agreed on the importance of analyzing the phenomenon both in general and in DRG-specific terms. In order to evaluate if a certain DRG in mobility assumes a critical dimension, they compare the number of cases treated out of Sicily to the local production (number of people treated in Sicily). By the way, in some cases the same approach led to different findings.

For instance, the mobility for the chemotherapy DRG, one of the most frequent provided out of Region, according to the Regional Healthcare Department management is physiological and should be evaluated in pair to the DRGs related to the first diagnosis ("...the mobility cases accounts for the 19% of the local chemotherapy supply: this is tackled as a physiological phenomenon because it means that Sicily produce enough chemotherapy"). On the contrary, the concern of the Local Health Authority about the same DRG is higher, as it is claimed to be a proxy of patient dissatisfaction (no matter if considered alone or in pair to other DRGs): due to the imprinting from the first diagnosis, people show "fidelity" to the Regional Healthcare System and in particular "... to the physician who saved my life".

¹⁸ The interviews took place on the first semester of 2014, while the political turnover is dated on November 2012.

It was also highlighted that the trend of the Sicilian patients outflows is decreasing: in this regard the operators admitted that this favorable tendency cannot be fully ascribable to the effectiveness of the regional policies activated, but other factors concur to it: for instance, the general reduction of the hospitalizations. Referring to the province of Palermo, the LHA management argued that the reduction of the hospitalizations may be due to the social crisis: “...people tend to postpone to think about their health because more intent on dealing with the daily problems of subsistence: indeed the reduction of the hospitalizations takes place principally in hard sectors, not secondary ones such as otolaryngology”.

On the contrary, the other respondents argued that the decrease of the hospitalizations may also be due to the National government directions to reduce beds and hospitalizations, aligning the regional and local parameters to the national ones.

The regional management showed to pay particular attention to the inappropriate hospitalizations: “In the future, a hard work needs to be done by the Local Health Authorities to develop a diffuse community healthcare offer to avoid the excessive recourse to hospitalizations, even when not needed”.

In spite of such concern, the local management underlines the lack of coherence of the national and regional policies: on the one hand in the local context the LHAs are requested to contrast the inappropriate hospitalizations and thus apply a strong filter to the provision of inappropriate DRGs¹⁹. On the other side it does not exist a State control to check if the health services provided in other Regions are appropriate. “When a Sicilian provider undertake opportunistic behaviors and hospitalizes people not needing hospitalizations – the local healthcare manager explains -, the LHA applies a sensible reduction in the reimbursement (one third of the tariff), both to the public and the private accredited providers. This way the LHA of Palermo recoveries 20 million of euro per year. But when a similar case happens for the patients’ mobility, it is hard to apply the same policy of reduction in the remuneration”. The reason of such paradox lies in the architecture of the inter-regional financial compensation system, which elapses the data about the mobility flows in June of the year after the mobility episode took place. Only at that time

¹⁹ The deterring mechanism for inappropriate hospitalizations consists of the decision of not to remunerate the inappropriate packages. This fact would cause the production of deadweight losses, which in turn lead to the removal of the Director General of the hospital organization.

the purchasing Regions can dispute the requirements from the destination Regions through a long formulary: “If the residential Region do not apply for contestation by 60 days from the reception of the requirement of money transfer, then the amount due to the requiring Region is definitive, even if the services provided were not appropriate”.

Similar arguments were reported by Longo (2012:75), who remarks how “in the actual economy of the Italian Healthcare Service the passive mobility services are associated to the potentially inappropriate ones, given that they represent an extra-budget for the producer and the actual structure of the SSN does not allow the LHA, who pays for the mobility, to intervene on the producers, especially if they are extra-regional. This imposes to the residential LHA (the financial payers) an internal strategy to govern the mobility phenomenon”.

Regarding this point, the Regional Healthcare management highlighted that a general strategy to contrast the mobility could be misleading, while it is worth to focus on the most relevant Diagnosis Related Groups. That is why He was cautious in generalizing the good results in terms of mobility reduction, which are only partially due to the effectiveness of the regional policies. He rather admitted that some criticalities can still be detected, for example in the Oncology, for which the policies adopted are expected to fully disclose their effect in the long period. In addition, the LHA management considers that the mobility flows can find some kinds of justification if related to more complex DRGs, such as the neurosurgical ones. These arguments were particularly useful to help the researcher in the refinement of the focus towards the so-called “avoidable mobility”²⁰.

7.1. The stakeholders’ perception about the main factors contributing to the phenomenon

During the meetings the interviewees were asked if in their perception the patients’ passive mobility in Sicily was a phenomenon going beyond the real reception capacity and the actual level of service provided by the regional health system. The respondents

²⁰ In the last chapter of this work an oncologic DRG having characteristic of “avoidable mobility” will be addressed using a Dynamic Performance Management approach.

expressed the impossibility to generalize: Sicily is able to express “great reception capacity and professionalism in some areas, in others we are weak in terms of professionalism”.

The General Manager of the Regional Healthcare System hypothesizes there is a gap between the perceived and the effective quality. “For long periods – he argued -, the extra-regional health care was actually more qualified. Although this fact has changed and since 2009 policies were implemented to enhance strategic branches such as Neurosurgery and Orthopedics, the perception of people remained the same. Thus it is crucial to work on communication and word of mouth mechanisms”. Similar opinion for the private provider representative, who relates the mobility to the citizens’ mistrust towards the Sicilian system. The LHA manager attempted a more inclusive analysis of the mobility issue. According to his view, many factors play a role in the phenomenon occurrence.

First of all, in some cases the physician professional skills are low and this fact undermines the credibility of the entire system. In addition, there is a matter of low perceived quality in comparison with the destination Regions, to be kept as benchmarks as far as the healthcare strategies are concerned. “...These Region are chosen not just for the technical aspect of the specific DRG provision, what we call the hard aspect of the problem: beds, human resources, equipment, etc...”. He lists a series of “soft variables” in which the Sicilian system is lacking, tackled as crucial determinants of the “overall offer system taking the patient in charge”: reservation and booking systems for the medical services, reception and accommodation systems for the patients and their family. Furthermore, although the mobility phenomenon primarily refers to hospitalizations, it is important to remark that the hospital admission is just a moment of the healthcare path, so other portion of the health care sectors need to be considered, e.g. the community care, not sufficiently developed.

“Another problem which only apparently has nothing to do with the passive mobility, consists of the operational mechanisms not properly working, for instance the information and rewarding systems. The actual Sicilian Healthcare System do not push to good practices, thus patients are not guaranteed since the excellent professionals work hard alongside a series of mediocre ones, without identification and exclusion of the bad practices”.

In addition, the long waiting times to access the health care also impact on the perceived quality of the system (not to mention the impact of a loss of time on the outcome of more acute treatments). The local management claimed the scarce attention devoted to all those factors in the past. He also punctuates that the regional and local health care administrations are currently working in order to address these aspects of the problem.

7.2. The ratio of the policy making

Within the public providers' sphere, there is not a real policy designed and/or implemented to specifically contrast the passive mobility. The only thing the regional and local healthcare administration do is not to give any limitation to the production of the DRGs usually provided in regime of mobility, in spite of the normal DRGs for which this quotas and tariff reductions are designed. "We do not give a goal, but a free way and it cannot be considered a real policy" states the LHA manager.

As mentioned in an earlier heading of this chapter, the policies directly targeting the passive mobility are basically referred to the private accredited providers.

In order to confer financial stability to the system, the 2009 recovery plan changed the expenditure's mechanisms and created aggregated funds of expenditures (the so-called *aggregati di spesa*) which define insurmountable budget limits. One of these aggregated fund of expenditure is destined to the purchasing of the health packages from the private accredited providers.

Starting from 2010, the Regional Administration introduced mechanisms of incentives for private operators to reduce the patients' extra-regional mobility. It was identified a group of Diagnosis-Related-Groups for which the Sicilians frequently travel other Regions, the so-called "DRG fugue". Then the Sicilian Healthcare Administration established additional financial resources (15 million of euro) to contrast the mobility, namely to induce private providers to produce in Sicily the DRGs fugue. This budget was in turn subdivided among the nine provincial Local Health Authorities according to the historical trends, and by this way to accredited providers.

For the production of the DRGs fugue, the providers are remunerated with reduced tariffs from the 30 to the 50%: it is a supply agreement that allows the Sicilian Healthcare System to purchase some volumes of health packages at reduced tariffs. On the other side, the incentive mechanism attributes to the private providers producing “DRGs fugue” additional revenues in extra-budget²¹.

The Regional management underlines that “In order to avoid the selection of inappropriate/low complexity cases it was intentionally built a complex system of extra-budget attribution: only the providers who have increased the production of the DRGs fugue in the previous three years can benefit of the extra-budget”.

At the opposite, the private sector representative showed a critical point of view about such policy making. First of all, the system of budget attribution was tackled to be “supply-centered”, not contemplating the possibility to make analyses of demand (i.e. the population health needs from epidemiology) and an effective activity of healthcare planning. Attributing cascading funding to every province does not motivate private virtuous mechanisms: every operator aims at selling what it is able to do and not what the patients need. Thus the suggestion is to start from an analysis of the healthcare demand, which would be the base for a real budget negotiation. They also suggest to introduce elements of flexibility and merit, rewarding the most efficient private structures that have behaved coherently with the regional healthcare planning objectives of mobility reduction. In addition, the savings from reduction of the expenditure to compensate the destination regions should be re-invested in contrasting the mobility itself, consolidating the good results already obtained.

Finally, they wish the creation of a public-private integrated system with no lacking and/or duplications, which implies “the empowerment of the LHAs’ top management for the negotiation and promotion of meritocracy. This choice has also a value connotation: private providers would have the awareness of their practical contribution to the

²¹ Of course the private providers are for profit operators, so they accept to provide “DRGs fugue” under reduced compensation tariff according to a strategic business choice. Indeed, through a balanced tariff mix, they are able to maintain positive economic results in spite of the production of a certain number of DRGs fugue (compensated with reduced tariffs) because the costs’ coverage came from the use of the business margin generated by the DRGs normally remunerated with entire tariff. For instance, the marginal profit of a DRG fugue compensated with a -50% tariff would be negative only in case the company provides only health packages at reduced tariffs.

implementation of health policies aimed at the wellness of the patients and enlargement of the right to be treated close to home”.

The private view of the mobility phenomenon can be pigeonholed under the umbrella concept of New Public Management, in particular for the role played by incentives in directing people behaviors and performances within a competitive environment.

Such idea “is not applicable in the field of public health – the LHA manager states - because of the different missions and visions of the public and private sectors” . The LHA manager remarked that the public provider are already part of a system of peer operators through the accreditation mechanism. According to his view, the LHA is already able to read the healthcare need performing several data analyses and it was recently (2009) provided with a territorial commissioning function (healthcare packages purchases). When this function will be more developed, the LHA will be able to ask the private provider specific health packages, refusing to reimburse them if the production goals are not achieved. Until that moment the private providers may produce “whatever they want within the regional production roofs”. “For this reason – he claims - it could be useful to create shared plans for cooperation through formal partnerships with different responsibilities, according to a logic of governance”. This view seems more public-value oriented, as it assumes that the performance enhancement passes through sharing and endorsement mechanisms leading people to develop ownership of issues and tasks (Stoker, 2006).

8. The patients’ mobility as a cornerstone for challenging a new model of public governance

The discursive analyses of the interviews provided above did not mean to be exhaustive, however it helped the researcher to get some insights about the perceptions of different actors about the mobility phenomenon.

All the meetings revealed (with different nuances and facets) the need for a more systematic approach to deal with the problem, in line with the governance logic that the Sicilian Healthcare Administration declares to pursue: “We are currently working for the

creation of a healthcare system where the actors talk each other's and the Local Health Authorities are supposed to play a relevant role of purchasers”.

Within the healthcare sector, the patients' mobility phenomenon can be read as a proxy of the public value that the entire system is able to create for the citizens. In this regard the role of the LHA cannot be underestimated: “...the patients' mobility makes the complexity of the system increase and so the strategic actions the LHA can undertake (Longo, 2012: 75).

Following the New Public Management principle of separation between the healthcare providers and purchasers, the LHA should play the role of a “meso-level” institution, focusing on the purchase rather than the delivery of healthcare services and governing the amount of public resources spent by public and private producers to satisfy the citizens' health needs. By the way, a recent study conducted by Longo *et al.* (2011) showed that LHAs managers are still more oriented to focus on internal production and direct delivery of health care services rather than on the desired “steering” role previously described.

In the Sicilian context the LHAs played a delivering role until 2009, when the reorganization of the entire healthcare system took place in pair with the recovery plan mentioned above.

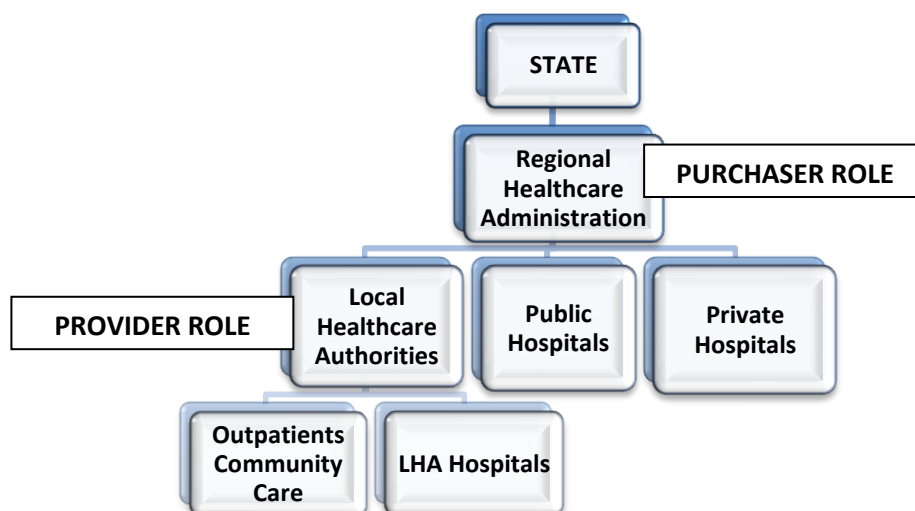


Figure 10. The Sicilian Healthcare System Before The Regional Law n. 5/2009. (Source: own elaboration based on interviews' insights)

In the previous system architecture (figure 10) the Local Healthcare Authority was one of the health care providers to whom the Regional Healthcare Administration interacted.

In such a system, the sphere of influence of the LHA was limited to its productive structures (community care and LHA hospitals). The LHA's concern about the mobility flows was relatively limited, as it was competing with all the remaining purchasers. In a certain way, the only mobility the LHA was paying attention was the "mobility from LHA", consisting of all the cases when people pertaining to the LHA's jurisdiction preferred not to refer to the LHA healthcare facilities. In this limitative and intra-organizational conception of the term, it wouldn't have made any difference if a patient went to another town within the same province or far to another Region. Furthermore, even supposing a real interest of LHA in contrasting the mobility, the LHA-provider would not be aided of operational levers to compete with the high specialization of the independent hospitals and polyclinics in the provision of more complex DRGS, which constitute a big portion of the mobility to other regions. The Regional Law 5/2009 modified the structure of the system, empowering (at least formally) the Local Health Authorities (figure 11).

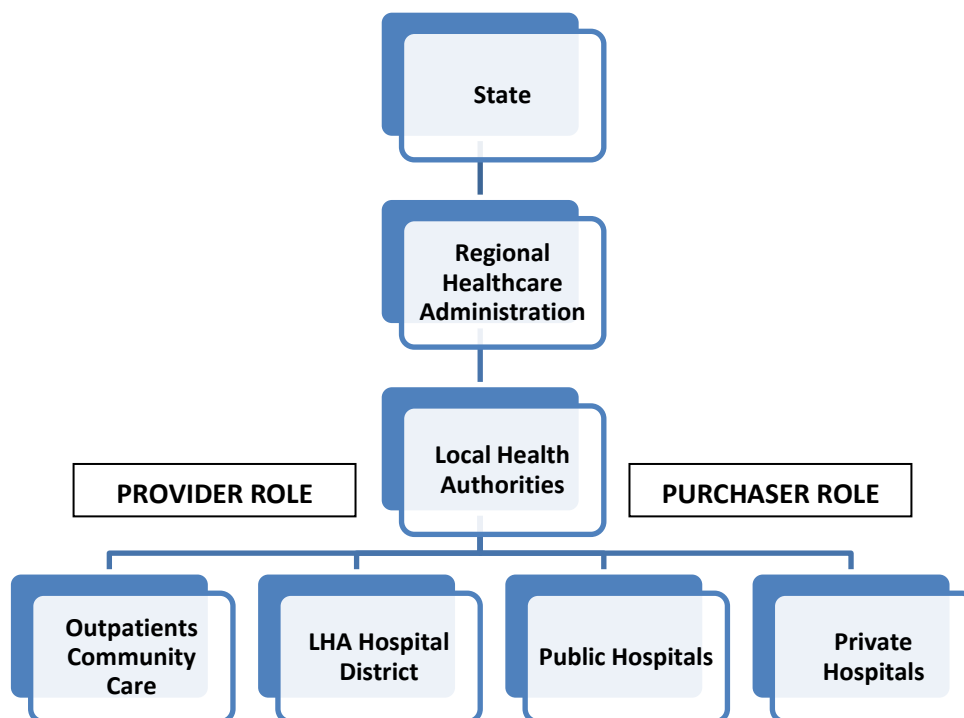


Figure 11. The Sicilian Healthcare System After The Regional Law n. 5/2009. (Source: own elaboration based on interview insights and the dictation of the Regional Law, 14/04/2009 n. 5, Norms for the reorganization of the Regional Health Service, *Norme per il riordino del Servizio Sanitario Regionale*).

The Local Health Authorities (also called ASP, *Azienda Sanitaria Provinciale*) are provincial institutions with public legal personality, responsible to provide the essential levels of assistance, though maintaining the economic equilibrium at the provincial level. In line with the quasi-markets' logic, every ASP is financed by the Region according to capitation quotas (weighted with epidemiologic coefficients), and in turn assigns funds to the competing providers. The ASP in turn finances the hospital sector through two funding cycles: the payment of the DRG tariff for hospitalization episodes, and the so-called “quota for functions”, referred to services (emergency room, anesthesia and intensive care, ect ...) not susceptible to tariff.

In the Sicilian Healthcare System there are nine LHAs, each of them matching the territory of a Sicilian province²².

Law 5/2009 defined and ratified the double role of provider and purchaser of the LHA towards public and private providers. As a provider, it operates in two strategic areas, articulated in districts:

1) the community care (also called *the territory*): through its own structures and some accredited private operators, is responsible for prevention, basic and specialist outpatients health services, integrated with the social ones;

2) the LHA hospital district: the hospitals belonging to the ASP are not highly specialized and are supposed to join a wider hospital network, that the LHA are supposed to steer, which include:

--- the public hospitals not belonging to the ASP: some of them are highly specialized (SSN independent hospital)

--- the private accredited hospitals: they are private providers meeting specific requirements that have applied for becoming eligible for SSN reimbursements.

The same 2009 regulation stated the organizational integration between healthcare providers belonging to different (but close) provinces. This actors, although autonomous, were supposed to be linked one to the other to create a joint platform, called “basin”, useful

²² Every ASP is headed by a general manager, who nominates, for each district, a sanitary coordinator and a administrative coordinator to whom giving specific goals and resources.

for coordinating the overall healthcare activity, common scientific projects and centralized (and less expensive) goods and services purchases. At the same time the integration between all the actors in the same province was aimed to be pursued through the creation of specific and integrated pathways interconnecting the Hospital division and territorial one, by involving the GPs, promoting constant relations between hospital and territorial operators and enhancing continuing care services, in terms of prevention, care and rehabilitation, treatment of chronic diseases²³.

The Law 5/2009 also involves patient in the healthcare management, by instituting a consulting committee made up of patients' representatives, that have the right to express not binding proposals and advises to the general director of each LHA within the activities of planning and verification of the healthcare goals achieved.

The practical application of the above dictations did not find implementation, as witnessed by the regional and local healthcare management interviewed. For example, the LHA manager on the basins: "They do not work, because the integration is already difficult at the provincial level. Even though from 2009 onwards our Healthcare System made some progresses, we still have a strong gap comparing to other regions. It is not easy to recover a 20-year delay in few years. The problem is political, cultural, managerial and of leadership".

All the interviewees agree on the crucial role that the Local Health Authority will play in the future the Sicilian health care and in the contrast of the patients' mobility. The commissioning (purchasing) function of the Local Health Authority has the scope to implement the Regional government policies, including the ones specifically targeting the patients' mobility. This function started to be carried out last year through:

---- a preliminary negotiation among the LHAs and the Regional Healthcare Department, in which the latter plays the role of guarantor and ruler as it is the funding institution ("It still holds the purse strings"). For instance, last year the Region established a reimbursement reduction (final reimburse equal to one-third of the tariff) in case of provision inappropriate DRGs. "In this regard – the LHA manager interviewed commented – the LHA would have had more leverage to propose to each provider either not to

²³ Retrieved from the Regional Law, 14/04/2009 n. 5, Norms for the reorganization of the Regional Health Service, (*Norme per il riordino del Servizio Sanitario Regionale*).

reimburse inappropriate hospitalizations or to negotiate them with the LHA, rather than this cross-cutting that did not produce great results, as we still experience inappropriateness”;

---- a permanent peer table of discussion made up of the representatives of the nine LHAs, who shared goals and made comparisons on the data and scenario analyses. Then the committee presented such findings to the Regional Healthcare Department, which had the role to settle eventual issues in case of different points of view among the managers;

---- elaboration of planning document, shared with the public and private hospital directions, where the LHA set maximum financial and productive limits (called roof) for the DRG production. This measure aimed at incentivizing the hospitals to rationalize their production processes. Otherwise (with *piè di lista* reimbursements) the tendency of the hospitals would be to increase the production of DRGs as it is the source of their revenues. “Putting these limits is crucial – from the LHA manager interview – because if the LHA manages to save quotas of budget, it can promote industrial investment of those resource in the LHA community care territorial medicine, still lacking”.

According to the analysis, the purchasing function of LHA is not mature (1 year) also because it finds budget constraints from the Regional government. The LHA cannot exercise a steering power towards the providers and the “last word” in the policy measures is hold by the Regional Healthcare Administration.

The Sicilian Healthcare System apparently recognizes the importance of the mobility issues, but until the present times it has not put in practice a systematic contrasting strategy. However, it emerges a will to address the problem with a New Public Governance approach. The achievement of this purpose could find obstacles in the intra-governmental and intra-organizational focus, which is typical both of traditional and NPM approaches, emphasizing the economy and efficiency of the service units in producing public services (outputs of the processes). “We are excessively self-referencing” the LHA manager admitted. Although the actors generally declared to call for a more systematic and holistic approach, they often showed conservative attitude to maintain the status quo. The private sector representative gave the explanation: “The actual system brings the advantage to ensure to the Regional Healthcare Administration centralized control, certainty of costs, time savings and easier (and limited) negotiations with the providers. At the same time it

attributes funds anyone-anywhere, thus reduces the motivation of the private providers to undertake public-loyal behaviors rather than opportunistic ones”.

It looks the New Public Management season struggled to start in Sicily later than in other Italian regions: only recently (2009) some germs of health packages negotiation were put in practice. The private sector claimed a more incentivizing strategy, holding the conviction that the mere application of certain sets of contracts and money allocation will bring benefits to contrast the mobility.

On the other side, the regional and local management emphasize the role of communication, negotiation and cooperation. These statements conflict with what was done in the practice: the policies are not tailored to contrast the problem and do not look at the entire system but to limited portions of it. In addition, the researcher perceives a discrepancy between what is established and reported in the regulations and in the planning documents and the dynamics taking place in the reality. LHA is the formal purchaser designed from the top of the Healthcare System, but the authority still lays on the top, the Regional Healthcare Department, which is the ruler, the coordinator and the commissioner-purchaser *de facto*.

Regarding this point, the Regional Healthcare Administration is actually ready to make a step back pursuing a model of governance with an empowered role of LHAs and the promotion of the a more diffuse communication among the different actors of the Healthcare system. “The system does not have to be based on the competition: it can work only if each actor plays his role. The reaction of the LHAs seems to be favorable to this new architecture, whose practical application is still lacking: we need a cultural change”. In addition, the regional manager remarked as a critical point the inhomogeneity of the negotiation skills among the nine provincial LHAs. “We try to force the homogeneity of LHAs’ behaviors – He explains - by providing draft contracts where the requests of budget assignments go in pace with desired healthcare packages. Anyway the purchasing decision is discretionary to the single LHA according to lacks of the provincial offer, the presence of significant waiting lists, relevant intra-regional mobility, etc..”²⁴.

²⁴ The regional manager interviewed also illustrated that the system is built in order to avoid that the movement of patients put excessive pressure on the destination provinces: all the provinces are uniformly provided with a medium-low complexity offer, while high specialty is concentrated on three main poles, due to the cost’s economies and the accumulated clinical records in relevant casuistic.

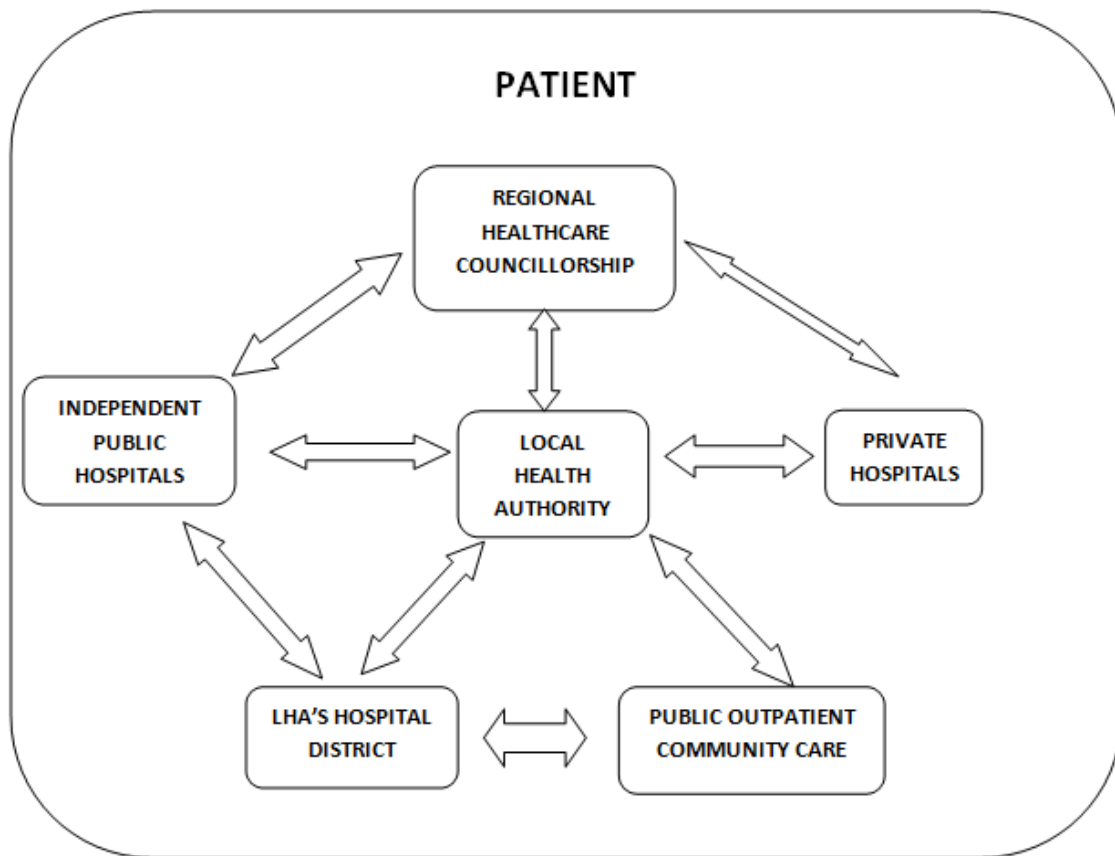


Figure 12. The reticular governance model that the Regional and Local Healthcare Administrations of Sicily declare to pursue (source: own elaboration based on interviews insights).

The LHA manager interviewed highlighted that in order to translate these good intentions into practice it is crucial to work on the leadership “...which means the shift from the hierarchical structures of government, towards multi-centered systems of leaders among leaders. Adopting this governance perspective through networked decisional structures is not easy, because it requires the acceptance of the centrality of the other leaders”.

The above discourse raises the possible transition from a traditional bureaucratic administration towards a public value based and networked model. For each actor it postulates the “inter-organizational negotiation (formal or informal, explicit or implicit) of the respective productive vocations” (Fattore, 2006).

According to Longo (2012: 75), the inter-LHA competitive game can become destructive for the single LHA and for the system as a whole, thus it is necessary that the competition does not create an hypertrophy of the available productive capacities, redundancies, mechanisms of inappropriateness proliferation and situations of partial saturation of productive capacity that in the health care sector, characterized prevalently by fixed costs, will produce relevant inefficiencies”.

Thus, in order to govern the mobility the challenge is to recognize the interdependence of the organizations and to find new ways to collaborate, being open to learn from the other actors. To this aim, public governance can be defined as the steering of the complex horizontal and vertical relationships of the system, characterized by interdependent actors of different types, which are influenced and directed in various ways to obtain the shared objectives of public interest (Kickert, 1997: 737; Rhodes, 2000).

Adopting models of public governance and network management surfaces the need for new managerial tools and skills to be developed, such as governing the interdependencies creation, design and management of network of public interest, mapping, listening and involvement of stakeholders (Bertocchi & Mazzoleni, 2007; Borgonovi, 2000; Bonaretti, 2005) .

In line with this challenges, the System Dynamics has proven an effective method to make explicit mental models as a way to identify discrepancies and to induce a fruitful dialogue between parties, such as the actors in the public sector, and between them and those in the private sphere (Bianchi, 2010). The next chapter presents the steps of application of such method to address the patients’ mobility phenomenon.

Chapter 3.

Linking System Dynamics And Performance Management To Address The Patients' Mobility: The Dynamic Performance Management Framework

1. The need of new managerial tools to represent the complexity of the patients' mobility

The analysis reported in the previous chapter on key stakeholders interviews, highlighted the need of new tools able to capture the growing complexity of the patients mobility phenomenon. For both politicians and public managers this means to find a pragmatic way to “unpack the complex processes of the policy implementation’s black box” (Osborne, 2006), taking into consideration the challenges of public value management and networked governances that the Regional Healthcare Administration declares to pursue.

Nevertheless the performance culture cannot be underestimated as a fundamental element of the public value management ethos to be adopted by all providers of public services (Aldridge and Stoker, 2002). In the public sector, the a-critical adoption of formal performance management systems proved to lead to unintended consequences, such as: an increase of bureaucratization; a myopic definition of goals and indicators; a lack of coordination between the political and managerial level, as well as among different institutions involved in the delivery of a public services; a prevailing view on the player rather than on the all system and an unfocussed communication to the community of the outcomes associated to undertaken policies (Bianchi, 2010).

The public value management, in order to achieve efficiency, accountability, and equity indicates motivational forces others than rule compliance or incentives. Managers are tasked with steering networks of deliberation and delivery and maintaining the overall health of the system (Stoker, 2006). At the level of practice, as Kettl (2002) argues, “Public managers need to rely on interpersonal and inter-organizational processes as complements to—and sometimes as substitutes for—authority” (p. 168).

To get a definition of public value, it is worth recalling Moore (1995: 57), according to whom the underlying philosophy of public managers should be to create public value: “Public managers create public value. The problem is that they cannot know for sure what that is. . . . It is not enough to say that public managers create results that are valued; they must be able to show that the results obtained are worth the cost of private consumption and unrestrained liberty forgone in producing the desirable results. Only then can we be sure that some public value has been created”.

Thus it becomes decisive the ability to represent and to properly measure the public interest, especially in the design of the borders and the missions of the public networks and in the performance of planning and purchasing (Longo, 2005: 76). In this respect, the decision makers need to adopt new approaches and tools to foster a common shared view among different involved actors about the causes underlying experienced phenomena on which they are expected to intervene (Bianchi, 2010).

The Sicilian policy makers and public managers seem to be aware of such requirements. Indeed, during the field research, the necessity of a systemic logic was remarked several times by the interviewees: “... to contrast the mobility we need a serious strategic planning with investments connecting the hospitals together, and the hospitals’ network with the Local Health Authorities and the outpatients community care”, as well as the “ ...need to gain awareness of what is going on in the entire system”.

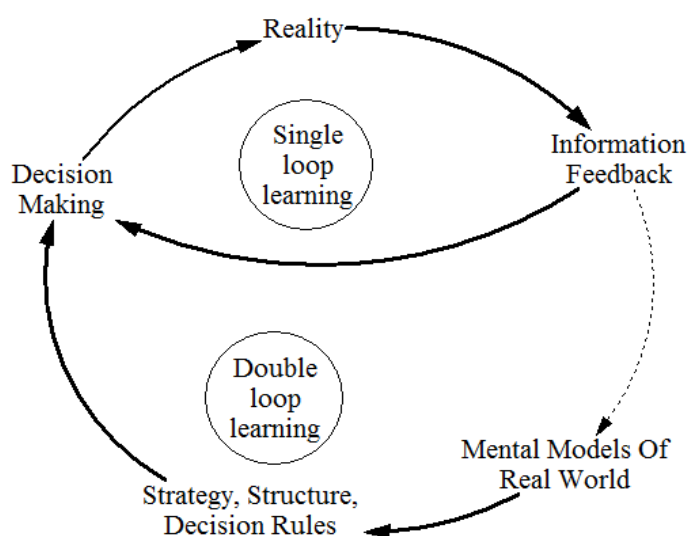


Figure 13. Single and Double loop learning mechanisms. Adapted from (Sterman, 2000: 19)

It was argued (Bianchi, 2009: 45) that System Dynamics can aid the Planning & Control and the Human Resources systems in the change management and in the promotion of learning organizations. These processes have to be conceived as the result of a continuous activity of mental models elicitation rather than of discrete events such as the drawing up of a plan or the mere *ex-post* control. Figure 13 shows the double loop learning (Argyris, 1985) that the SD is claimed to be able to foster: the information feedback about the real world not only alters decision within the context of existing frames of decision rules (single loop learning) but also feeds back to alter the mental models. “Thus we replace a reductionist, narrow, short-run static view of the world with a holistic, broad, long-term dynamic view and then redesign our policy and institutions accordingly” (Sterman, 2000: 18).

In the next headings of this chapter it is presented an example of how a learning-based approach driven by System Dynamics can be useful to make a first step towards the creation of factual (not just “desired”) networks and partnerships for the delivery of sustainable and performance driven public services.

2. Using System Dynamics to address the patients’ mobility phenomenon

System Dynamics is a computer-aided methodology for policy analysis and design. It applies to dynamic problems (e.g. problems that involve change over time) arising in complex social, managerial, economic, or ecological systems, literally any dynamic systems characterized by interdependence, mutual interaction, information feedback, and circular causality (Richardson, 1991).

The foundation of SD can be attributed to Jay Forrester from the MIT Boston (1961, 1969) who firstly addressed urban and industrial dynamics. As reported by Meadows (1980), bringing together ideas from control engineering, cybernetics and organizational theory, he developed a guiding philosophy and a set of representational techniques for simulating complex, nonlinear, multi-loop feedback systems. The fundamental principle of SD, is that the structure of the system (group of functionally interrelated elements forming a complex whole), gives rise to its behavior (Sterman 2000).

In the present work the System Dynamics modeling is used to support public decision makers (politicians and officials) to frame the cause-and-effect tissue underlying the performance of the Sicilian Healthcare System and to identify alternative strategies to contrast the patients' mobility phenomenon. For the purpose, the System Dynamics approach is combined with the basic elements of performance management, in order to design a dynamic performance management system (Bianchi and Montemaggiore 2008; Bianchi, 2010; Bianchi, 2012; Bivona, 2013).

The dynamic performance management system here proposed is built with a learning-oriented approach and aims at giving a practical content to the challenges of public value management mentioned above. It is also meant to enhance the formal and static performance systems in use, based from time to time on norms compliance or responsiveness to incentives. In the proposed framework, the relevant actors of the Sicilian Healthcare System, each of them holding different mental models, take part to the model building and develop ownership of the entire health care process. This way they are encouraged to adopt a shared vision about what determined the patients' mobility flows at an inter-organizational level, why some decisions have been taken, and which contribution to overall system performance is expected from each responsibility area.

In *System Dynamics*, the main tools to conceptualize the structure of a complex system and for communicating model-based insights are the stock-and-flow diagrams and the causal loop diagrams.

The stock-and-flow structures are diagrams representing the physical structure of a system, tracking accumulations of material, money and information as they move through the system itself (Sterman, 2000). Two kinds of building blocks constitute this diagrams: stocks or accumulations (levels, identified with certain units), and flows (rates, identified with units per time period).

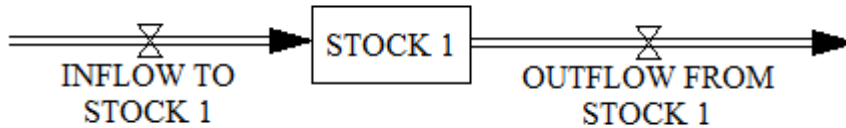


Figure 14: Simplified Stock-and-Flow structure.

System therefore consist of network of stocks and flows linked by information feedbacks from the stocks to the rates. As stock accumulates their inflows less their outflow, thus a stock and flow structure quantitatively can be represented as a system of integrals and differential equations²⁵. The only way the stocks change is through their flows. In turn, the stocks determine the flows, together with constants and exogenous variables²⁶.

The causal loops are diagrams representing closed chains of causes and effects depicting the interactions between the model variables, able to explain the dynamics of the investigated systems. The feedback loops reflects the endogenous point of view (Richardson, 2011), according to which the main causes of the problematic behavior arise within the internal structure of the model. Thus it is possible to distinguish in a model endogenous variables, taking part of at least one loop (variables X and Y in figure 15, for example), exogenous variables, not directly involved in a loop but still part of the model (e.g. variable Z), and variable excluded from the model (variable B).

In a causal loop a positive link (denoted with the “+” sign) means that if the independent variable increases, *ceteris paribus* (assuming all the other variables constant), the dependent variable increases above what it would otherwise have been, and if the cause decreases, the effect decreases below what it would otherwise have been. On the other way around, a negative link (indicated by the “-“ sign) means that if the independent variable

²⁵ Mathematically, the basic structure of a formal system dynamics computer simulation model is a system of coupled, nonlinear, first-order differential (or integral) equations like the following: $dX(t)/dt=f(x,p)$, where X is a vector of levels (stocks or state variables), p is a set of parameters, and f is a nonlinear vector-valued function. Simulation of such systems is easily accomplished by partitioning simulated time into discrete intervals of length dt and stepping the system through time one dt at a time. Each state variable is computed from its previous value (the general equation is $Stock_t = Stock_{(t-dt)} + Inflow * dt - Outflow * dt$) while its net rate of change is the difference between the inflow and the outflow respectively feeding and draining the stock in the chosen time step (Richardson 1991).

²⁶ Which are stock too: constants are state variables that change so slowly that they are considered to be constant over the time horizon of interest of the model (Sterman, 2000).

increases, the effect decreases, while if the cause decreases, the effect increases (Sterman, 2000).

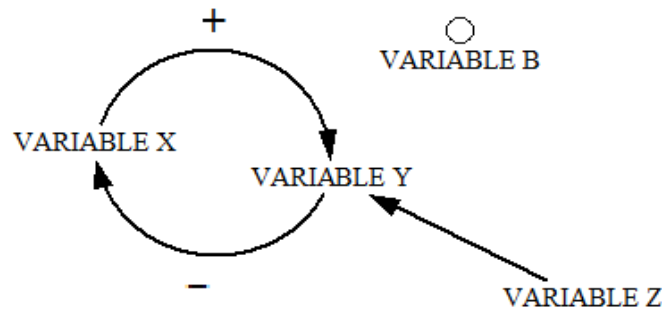


Figure 15: Causal loop diagram.

A dynamics performance management system (Bianchi, 2012) is characterized by the interplay between three interconnected views briefly described below.

1) The object view defines “what” is the object of the performance management system. It first identify the client(s)/user(s) with whom an organization interacts and the desired products/services to be delivered. Based on such analysis, it is then possible to make explicit the main objects (or end-results) the organization should plan and the proper indicators to estimate its performance. Such a view also requires that management processes and related activities leading to the above end-results must be made explicit.

2) The instrumental view identifies “how” to affect the defined object makes and explicit the means able to drive the performance of the investigated system. Such perspective include the identification of:

a) the relevant strategic resources, tangible and intangible, that the organization is able to accumulate/deplete over the time through external acquisition/disposal or internal building/depletion processes. They are modeled using the SD stock notation, which varies as result of the accumulation and depletion processes. The strategic resources are able to influence the acquisition of other resources and the capacity of the organization to pursue economic, competitive and social objectives through critical success factors;

b) the performance drivers, modeled as calculating variables, refer to the critical success factors and outline the capability of an organization, in relationship with the performance of external counterparts, to influence the end-results;

c) the end-results, modeled as inflows and outflows, can be expressed in economic, competitive or social objectives and are able to affect the processes of accumulation and depletion of the strategic resources over the time.

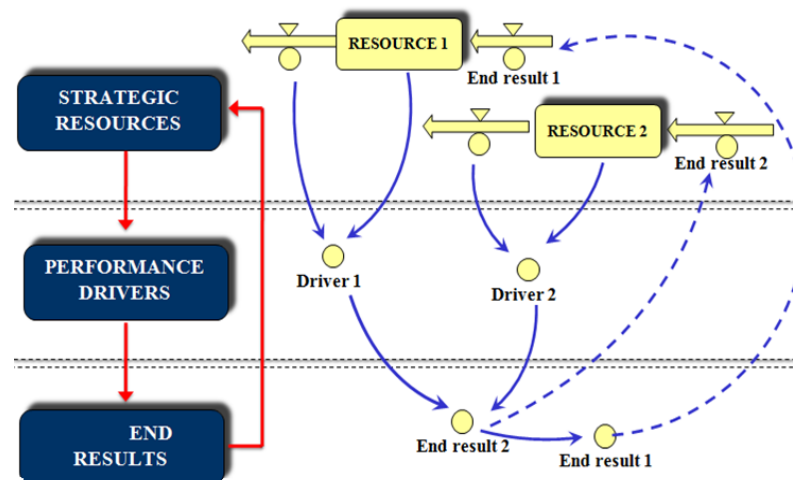


Figure 16. The dynamic performance management framework (Adapted from Bianchi, 2009)

3) The subjective view focuses on “who” is responsible for the achievement of the goals in the involved organizations. It makes a link between the previous dimensions, as it identifies for each responsibility area the objectives/performance targets to plan and the related activities to carry out.

The next heading of the chapter describe the phases of research undertaken in order to attempt to give an answer to the following research questions:

RQ. 2) Should the phenomenon of patients’ mobility be addressed in general terms or would it be more appropriate to focus only on certain diagnostic groups?

RQ. 3) What are the key-actors’ levels of integration providing health care in Sicily? How can a system dynamic approach support their coordination for the design and implementation of effective patients’ mobility policies?

3. Application of the Dynamic Performance Management approach to the patients mobility

The first phase of the research was the problem definition. Starting from the clinical records data available from the Regional Healthcare informative system, it was undertaken an analysis of the most common *Diagnosis-Related-Groups* provided to Sicilian patients out of the residential region. The output of such analysis, combined with in-depth interviews to the Regional and Local Health Authorities Strategic Management and to staff of the Epidemiological Observatory Regional Department, was the identification of the cohort of patients' affected by "thyroid cancer and related diseases" to focus the analysis on.

Afterwards, a process mapping activity, carried on with the cooperation of physicians belonging to the public hospital system, identified the main steps of the diagnostic and therapeutic path and the key-actors responsible for each phase.

Finally, in-depth interviews to Regional and Local Healthcare Authorities' management and hospital management, together with the distribution of a questionnaire to a sample of patients belonging to the same diagnostic group, allowed the selection of the key-variables and their links according to the perception of the interviewed people.

Such findings have converged to the gradual building of a dynamic performance management system (also translated into a simulation System Dynamics model) consisting of a stock-and-flow structure representing the most relevant causal relationships between strategic resources, end-results and mobility performance drivers.

3.1. The problem definition

The quantitative identification of the patients' mobility phenomenon took place from the clinical records data available from the Regional Healthcare informative system for the triennial 2010-2012. It was firstly conducted a descriptive analysis (partially presented in the second chapter) on the active and passive mobility flows in general terms, together with the detection of the Sicilian Hospital care supply and demand.

The outputs of such analysis were then combined with in-depth interviews to the Regional and Local Health Authorities Strategic Management and to staff of the Epidemiological Observatory Regional Department (DASOE).

It emerged that given the purpose of the project to carry out an explanatory study, facing the patients mobility in general terms would have been too generic and misleading, not able to effectively contribute to the reconstruction of the causal structure underlying the mobility.

In order to define a specific pathology to focus, the analysis of the phenomenon was done according to the first 20 more frequent *Diagnosis-Related-Groups* provided to Sicilian patients out of Sicily, as in the triennial 2010-2012 their cumulative represented more than the 25% of the total DRGs treated out Sicily, both in terms of frequency and financial value (figure 17).

First 20 Drg treated out of Sicily	2010	2011	2012
Cumulated Frequency of the first 20 DRGs treated out of Sicily	11.922	10.520	10.846
% Cumulated Frequency of the first 20 DRGs over the total DRGs treated out of Sicily	27,27%	24,96%	27,95%
Financial value of the first 20 DRGs treated out of Sicily (euro)	52.339.745	51.861.896	47.641.254
% Financial value of the first 20 DRGs over the total financial value of DRG treated out Sicily	27,06%	27,22%	26,09%
Cumulated Orthopedic Surgery Drgs' frequency within the top 20	5.115	4.982	4.280
% Cumulated Orthopedic Surgery DRGs' frequency over the frequency of the first 20 Drg treated out of Sicily	42,90%	47,36%	39,46%
Financial value of the Orthopedic Surgery DRGs within the first 20 DRGs treated out of Sicily (euro)	25.238.434	25.381.016	23.295.460
% Orthopedic Surgery DRGs' financial value over the financial value of the first 20	48,22%	48,94%	48,90%

Figure 17. Cumulated frequency and financial value of the first 20 most frequent DRGs provided out of Sicily (Source: elaboration from data provided by the Sicilian Healthcare Administration).

The DRGs were then grouped and positioned in a bi-dimensional matrix (figure 18) according to frequency and complexity of the treatment, taking as a proxy for the complexity the average DRG weight, conventionally defined as “high” or “low” when respectively higher or lower than 1.

For an immediate comprehension of the changes occurred over the time, in the matrix the length of the arrows approximately represents the intensity of the variation registered from 2010 to 2012. Ten DRGs (the ones written in red capital letters) are the surgical orthopedic ones, which represent almost the 50% both in terms of frequency and financial value within the selected list and are characterized by variable frequencies and complexities all over the four quadrants. Seven over the ten orthopedic DRGs decreased in frequency, with rates of change ranging from -3% to -54%, for a 1,942 million of euro of positive financial variation. This fact could be due to the policies that the Sicilian Department of Health activated in the 2009-2012 timeframe to contrast the passive mobility phenomenon, already mentioned in the previous chapter.

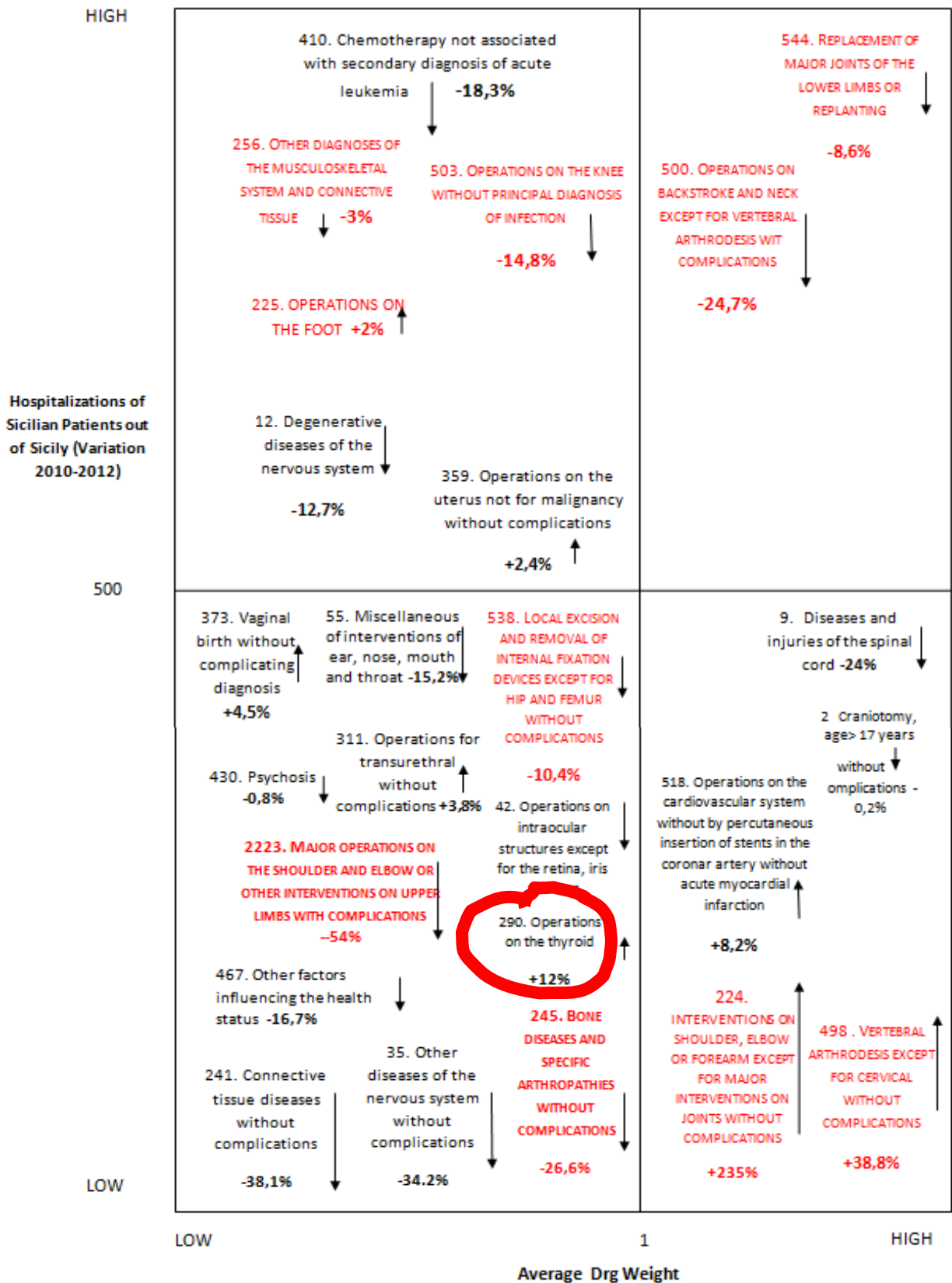


Figure 18. Variation 2010-2012 of the most frequent DRGs provided out of Sicily, grouped according to frequency and complexity.

Carrying out interviews to the Regional and Local Health Authorities Strategic Management and to staff of the DASOE, it was decided to deepen the analysis on the DRG n. 290 “Interventions on Thyroid”, located in the bottom-left quadrant. The reasons of such focalization are the following:

1) this DRG is characterized by an unfavorable increasing trend: in 2010 it was placed at the 18th place of the most frequent DRGs treated out (407 hospitalizations for a 1.073.406 euro financial value), in 2011 at the 9th raking (460 hospitalizations, 1.004.693 euro) and in the 2012 at the 8th (456 hospitalizations, 1.177.490 euro);

DRG CODE 290	Denomination: Surgical Interventions on Thyroid			
Time horizon (Quarters)	Hospitalizations	Drg Value (€)	Hospitalization's Days	Average Length Of Stay
2010-I Q	108	287.113	390	3,61
2010-II Q	119	315.343	467	3,92
2010-III Q	66	171.732	195	2,95
2010-IV Q	114	299.217	386	3,39
2010-general	407	1.073.405	1.438	3,53
2011-I Q	107	279.506	355	3,32
2011-II Q	120	311.137	347	2,89
2011-III Q	73	190.101	240	3,29
2011-IV Q	140	368.512	459	3,28
2011-general	440	1.149.256	1.401	3,18
2012-I Q	132	347.215	418	3,17
2012-II Q	112	289.870	357	3,19
2012-III Q	88	223.815	254	2,89
2012-IV Q	124	316.590	365	2,94
2012-general	456	1.177.490	1.394	3,06
Total	1.292	3.400.151	4.233	3,25

Figure 19. Main trends about the surgical interventions on thyroid for Sicilian residents out of Sicily (source: elaboration from the Regional Healthcare informative system for the triennial 2010-2012)

2) the DRG 290 was also included in the list of DRG most frequently provided out-of-Region, the so called “DRGs fugue”, whose mobility the Sicilian healthcare management aims to contrast;

3) the mobility for the DRG 290 can be considered “avoidable”, as the complexity of the DRG is relatively low (average weight 0,998) and the service is available in Sicily. The matrix in figure 20 maps the DRGs according to the average tariff (conventionally defined as “high” or “low” when respectively higher or lower than 2.500 euro) and the average weight, while the dimension of the ellipses represents the frequency of mobility. DRG 290 is located in the first quadrant on the left (low complexity, high tariff);

4) interviewing some staff units of the Regional Epidemiologic Observatory and two eminent Endocrinologists of Palermo and Catania, it emerged the opportunity to narrow down the analysis on a specific cohort of patients within the DRG 290, the “affected by thyroid cancer and related diseases”. The System Dynamics model was populated by data about those specific group of patients, tracked through ICD-9-CM diagnoses codes²⁷, which also allowed to bypass the limitations inherent in the use of the DRG system²⁸;

5) according to the last data retrieved from the thyroid cancer register, in Sicily the annual incidence rate of the thyroid cancer is the 0,139‰ (with a marked difference between the male and the female population, respectively registering the 0,054 and the 0,218 ‰), in spite of a lower national average of 0,03‰ per year in males and 0,1‰ per year in females²⁹.

²⁷ The Diagnosis and Intervention Codes ICD9CM related to Drg 290, identified through interviews to Endocrinological Specialist Physicians and some staff units of the Epidemiological Observatory, are the following: 193=Thyroid Cancer, 244.0= Acquired Hypothyroidism; V10.87= Personal anamnesis of thyroid cancer, 064= radioiodine. The data of the hospitalizations was taken considering the cohort of patients in primary and secondary diagnosis, not distinguishing the ordinary and the DH hospitalizations and eliminating the repeated hospitalizations.

²⁸ The DRG system has been developed and used in USA since 1983, with the purpose to determine how much the Government (Medicare) pays the hospital. It is a system to classify hospital cases into one of approximately 500 groups (also each called simply DRGs), expected to have similar hospital resource use. The DRGs are assigned by a software (the Grouper ©) based on a coding system called ICD-9-CM, indicating diagnoses, procedures, age, sex, and the presence of complications or co-morbidities. Since patients within each category are similar clinically and are expected to use the same level of hospital resources, this DRG system is used for both hospital payments and for hospital performance measurements (Bianchi et al. 2010).

Due to the limited number of DRGs, at a given DRG may correspond hospitalizations of different complexity, with use of human resources, equipment and materials (drugs, prostheses etc.) different. In addition, the classification is done with a "black box" (the Grouper) which determines a code, a weight and finally an amount, without a clear method to relate the cost of the resources used with the total amount awarded.

In addition, the DRGs are based on the primary diagnosis (the most resource-absorbing) and do not give any information about the reason why the patients entered into the hospital; thus it was decided to pick the data of the hospitalizations in primary and secondary diagnosis.

²⁹ Sicilian Regional Healthcare Department - Epidemiological Observatory. Note “Sicilian Registry of Thyroid Cancer: data 2002-2006” - Prot./Serv.7/ n. 100610, dated 22.12.2011.

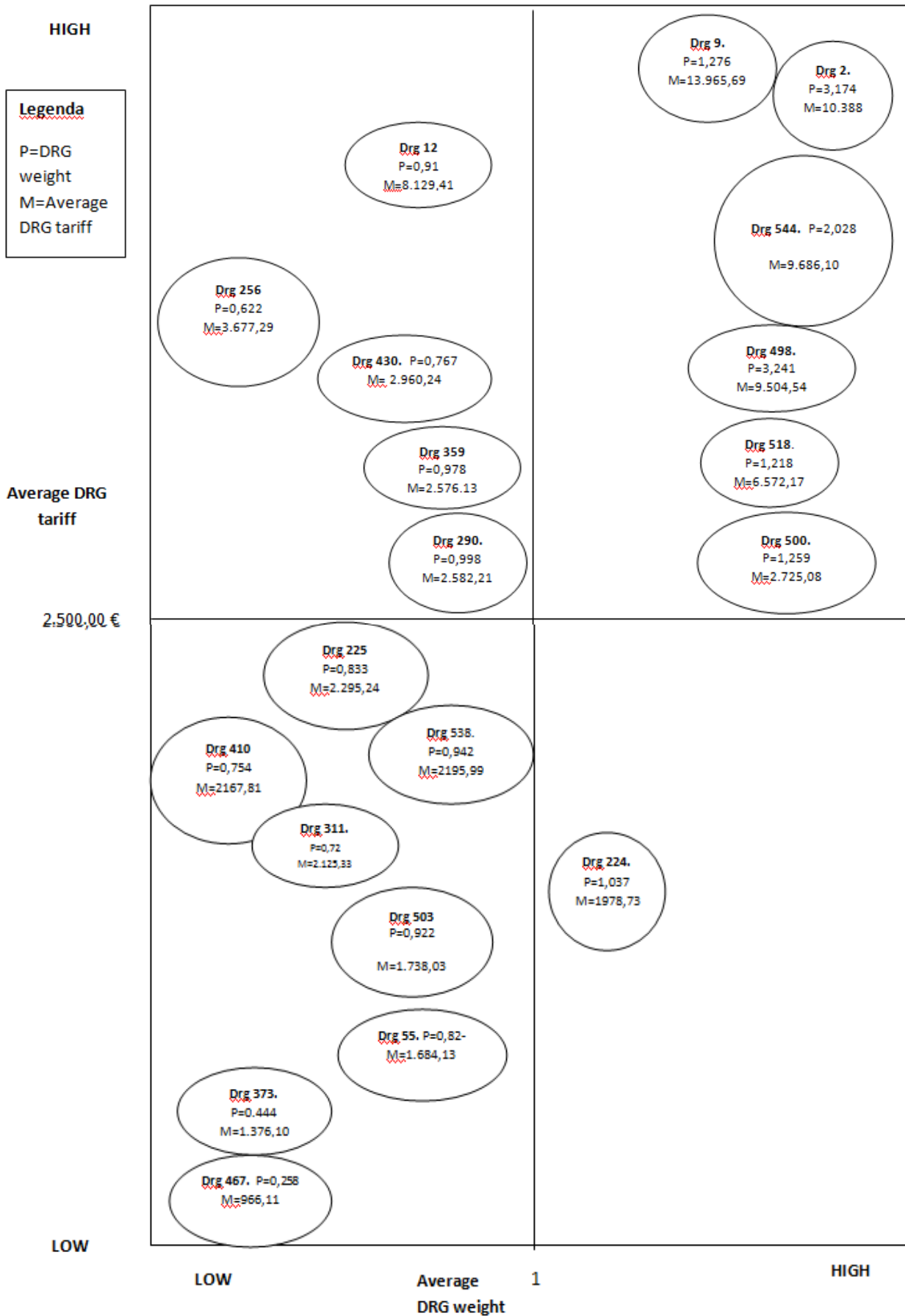


Figure 20. DRGs mapped according to average tariff and weight (average 2010-2012)

3.2. The boundaries of the relevant system

According System Dynamics literature (e.g. Sterman, 2000), in the practice effective learning from System Dynamics models occurs best when the decision makers participate actively in the development of the model. This allows the elicitation of the participants' existing mental models, for structuring the problem, selecting the model boundary and time horizon and mapping the causal structure of the relevant system.

According to Doyle and Ford (1998, 1999), mental models are internal conceptual representations of an external system (historical, existing or projected) whose structure is analogous to the perceived structure of that system. They are non conscious and relatively enduring, i.e. the cognitive structures are stored permanently and in a long term memory rather than temporarily.

In the present research, before starting with the modeling phase, it was made a deep reflection about the boundaries of the investigated system, meaning to discriminate what was relevant according to the purpose of the analysis. In order to represent a simplified picture of main factors concurring to the patients' mobility towards other Regions, the following boundaries were established:

1) the vertical dimension, i.e. the organizational level in the perspective of which the model is developed, is the Regional Healthcare Department as it is the main interlocutor of the one-year project. In spite of this fact, the model proposed later on in this chapter was calibrated according to a Local Health Authority data, the one matching the territory of Palermo's province.

This exemplification was due to the project's limited time and was encouraged by the Regional and Local Health Authorities. In addition "...the LHAs have a similar evaluation's point of view than the SSN as they are responsible for the overall health of their residents according to a fixed budget, while the public hospital organizations have a more productive vocation and the private accredited hospital have other institutional missions" (Longo, 2012:74)³⁰;

³⁰ In the later parts of the work it will be possible to find both references to Sicily and to the Local Healthcare Authority of Palermo.

2) as far the horizontal dimension of the model is concerned, the macro-level application of the System Dynamics approach was coupled with an inter-institutional perspective (Bianchi, 2010). Such view postulates that in presence of multiple decision makers operating in different organizations involved in delivering a public service, to design effective policies, the interrelations between all actors must be investigated and made explicit. The political decision maker (in this case the Regional Healthcare Administration) plays an active role of ruler and coordinator of a wider system affected by the behavior of many other actors, both public (e.g. the Local Health Authorities) and private ones (e.g. accredited hospitals).

By adopting an inter-institutional perspective it is possible to facilitate or invigorate the start of a strategic conversation with the other key-players operating in other institutions of the system, to establish joined-up government initiatives. Actually the initial focus of the model was the mobility for hospitalizations, considering that it constitutes the main part of the total mobility (about the 80%). However, carrying on the project, the model was enlarged to other kinds of mobility, such as the mobility for specialist outpatient services due to the relevant link it has with the mobility for hospitalizations;

3) finally the analytical (also called longitudinal) dimension, consisting of the level of detail in the representation of the variables, was influenced by the limited time horizon of the model (a three year period), and was established considering that “...It is possible to experience a kind of inverse relationship between the two previous dimensions and the analytical one. In fact, as we proceed to the construction of models from the top decisional levels perspective with an inter-functional view³¹, the more you will have to “accept” a synthetic perspective about the phenomena...” (Bianchi, 2010: 87).

So far, the policy to contrast the mobility was limited to the creation of financial incentives for the private sector. On the contrary, it was not designed a systematic strategy involving both the public and the private sector according to a governance and reticular logic. For this reason, in this version of the model the mobility flows are considered at an aggregated level, with no distinction between public and private providers. Considering the Regional and Local healthcare management positions presented in the previous chapter, the

³¹ In this case, as we are talking about the Regional political decision maker, the term “inter-functional” needs to be substituted by the word “inter-institutional”.

modeling activity aimed at depicting the “overall system taking in charge the patient”. The model built is the synthesis of the entire research efforts; however, in order to specifically address the mobility for the thyroid cancer treatment, the researcher found it useful to purposefully investigate two complementary views: the professionals’ and the patients’ ones.

This way the model attempts to combine the map of “hard variables” indicated by the technical-professional lenses of the physicians, and the map of the “soft variables” playing an active role in the patients perception³².

3.3. The process of health care delivery according to the professionals’ view

Once the problem was defined, a process mapping was carried out with the cooperation of physicians belonging to the public hospital system and led to the identification of the main steps of the diagnostic and therapeutic path and the key-actors responsible for each phase.

The first step was the identification of the “products” of the health care and the “clients” to whom the products are designed for. To this aim the concept of product refers to the so called “product’s system”, the mix of tangible and intangible factors defining the supply package on which an organization aims to achieve a sustainable competitive advantage based on critical success factors (Coda, 1988). Furthermore, the concept of product was not limited to the only “external client” but also to the “internal clients” beneficiary of intermediate products.

Moving backwards from the “final” products (treatment’s completion) delivered to the “external” client (the patient) at the end of the relevant value chain, it was progressively framed the performance cycle upstream.

Keeping in mind the patient’s health aim (outcome) along with the entire chain, figure 21 identifies two “internal clients”:

³² Actually, beyond the interviews to the involved healthcare actors (officials and professionals) and the questionnaire administered to the patients, another kind of inputs to the modeling creative process was the literature about previous studies, also undertaken with other methodological approaches than System Dynamics.

1) the outpatients units: located both in the hospital structures and in the community care, they are beneficiary of (and use as input) the instrumental product “suspect of pathology” from the General Practitioner (GP) and produce the instrumental product “diagnosis of pathology”;

2) the hospital: takes as input the “diagnosis of pathology” intermediate product and provides the treatment completion final product to the benefit of the external client’s health outcome.

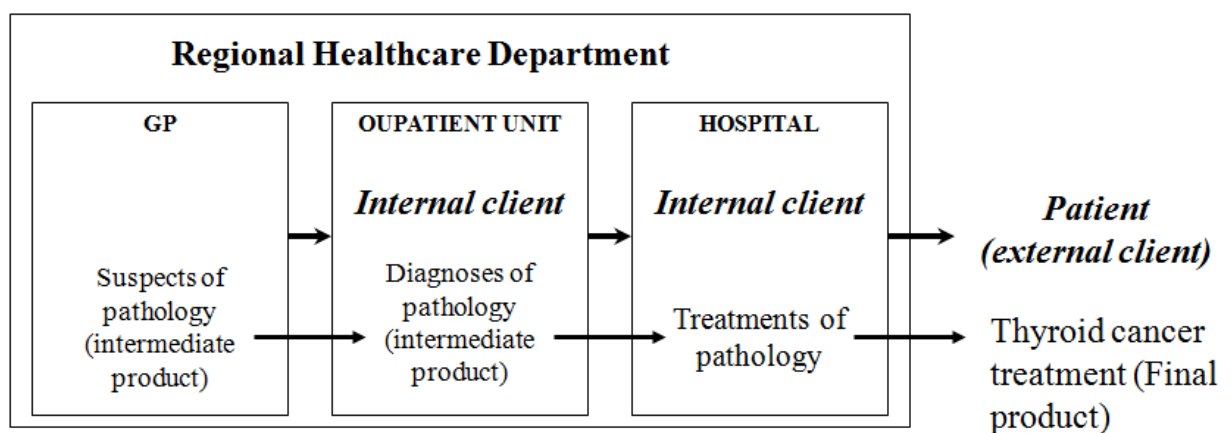


Figure 21. The identification of “clients” and “products” within the Thyroid cancer treatment value chain

The diagnostic and therapeutic path was further broken down in elementary tasks. This mapping activity was carried out with the collaboration of two eminent Endocrinologist physicians from Palermo and Catania, representing the key reference poles for the rest of Sicilian provinces regarding the investigated pathology.

The experts were interviewed separately and both asked to identify the main diagnostic and therapeutic steps for the thyroid cancer management and the “ideal maximum waiting times” for each phase.

They agreed on the main diagnostic and therapeutic steps, which indeed are coherent with the international guidelines on thyroid cancer management (Cooper et al., 2009) but they were very prudent in the waiting times definition, due to the difficulties to “generalize

the various clinical occurrences”. The output of the two interviews is resumed in the diagnostic therapeutic flow chart in figure 22.

The thyroid cancer requires a short term management, involving diagnostic-therapeutic activities to be provided at last in a semester, and a long term management, consisting of periodical checks (to be done once or twice per year).

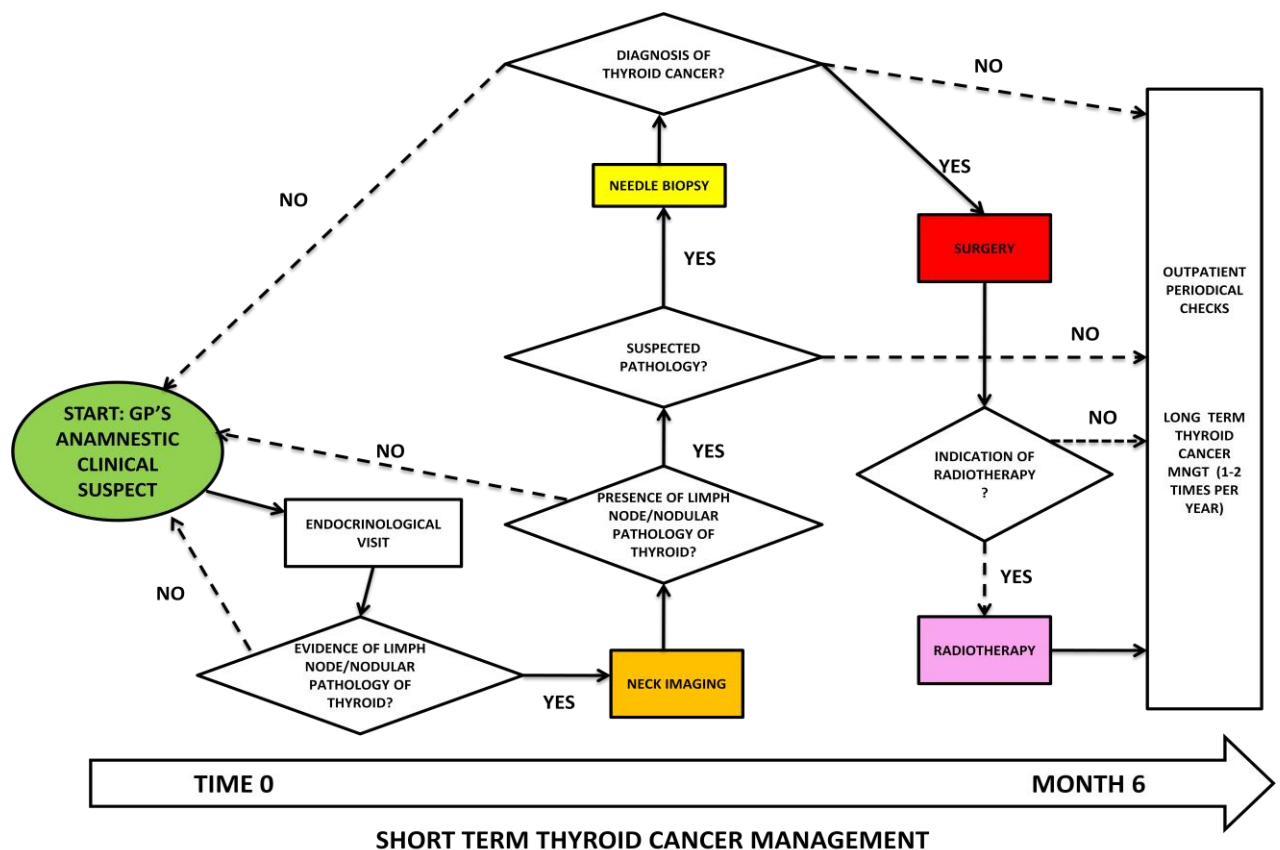


Figure 22. Main diagnostic and therapeutic steps of the thyroid cancer management according to the experts interviewed.

The route starts with the general practitioner’s anamnestic clinical suspect. Under GP prescription, the patient is directed to the first diagnostic step, the endocrinological visit, which corresponds to the time zero.

If the visit does not evidence a limph node or a nodular pathology of the thyroid, the patient is re-directed to the GP’s care, otherwise the diagnostic path goes ahead with the neck imaging. If the latter does not confirm the presence of pathology, the patients is re-routed to the GP, otherwise continues with the needle biopsy.

When the needle biopsy confirms the diagnosis of thyroid cancer, the surgical treatment for the removal of the thyroid and the metastases will take place forthwith. The surgery can be followed by one or more radiotherapy treatments, if the clinical postoperative requires them. In any case the patients affected by thyroid cancer are supposed to receive a lifelong follow up: 1) for monitoring eventual recidivisms; 2) because the removal of the thyroid gland implies for them an “acquired hypothyroidism” condition, so that they need thyroid hormones’ substitutive therapy.

3.4. Analysis of the factors impacting on the mobility according to the patients’ perspective.

In line with a public value management approach, it was considered that the public officials should take into account the people needs and preference, as well as the issues related to the other institutions, thus developing an attitude to the complex dialogue, learning exchange and mutual search for solutions

Thus the diagnostic-therapeutic path described in the previous heading was combined with a qualitative analysis aided by questionnaires, administered to a panel of thyroid cancer patients resident in Sicily. The involvement of patients in modeling a highly professionalized area such as health care was motivated by the considerations summarized herewith.

1) The patients deal with the disease for the all their lives: the cohort of patients affected by thyroid cancer, after the surgical treatment get into chronic (they need lifelong follow up). Although not bringing clinical knowledge, they can become “experts in their own conditions and are the only people who are present at all stages during the provision of care: from diagnosis to recovery” (Rathert et al. 2011). Especially in chronic and rare diseases, users or patients know things that many professionals may not know (Bovaird, 2007), so it was evaluated the usefulness of their contribution to the System Dynamics modeling.

2) There is a patients community active in the third sector: the Sicilian patients affected by thyroid cancer and related disease have spontaneously created a no-profit organization made up of patients assisting other patients along the diagnostic and

therapeutic path.³³ During the research it was observed the active role played by the volunteers in the hospital lane and ambulatories, for example for the patients' welcoming and bureaucratic assistance. Those activities, supposed to be carried out by hospital rather than voluntary staffs, contributed to fill the gaps due to the progressive reduction of public budgets assignments, in some cases allowing the medical staffs to maintain adequate level of service towards the patients.

In this patients' initiative the researcher envisaged a sort of "feeling of loneliness": it is like if the patients do not perceive to be at the center of a system supposed to satisfy their needs, so they decide to "do it themselves". This fact finds confirmation in some phone interviews to the patients³⁴: one of the interviewees ironically talked about "a crisis of abandonment, when you don't know whether someone is taking care about you". Another person more seriously declared: "I gave up to look for cures because of the long waiting lists. Five years have passed since my last check up".

The questionnaire was built looking at previous Italian patients surveys reported by Collicelli (2012): 1) the 2009 the Forum Censis on Biomedical research about the perceived quality of health in Italy, who pointed out the waiting time as the major downside of the Italian health care; 2) the 2005 Censis panel analysis on the inter-regional mobility of seven regions (Sicily not included), which identified three main areas of motivation for patients' "migration": quality area (looking for higher quality standards), practical- logistic area (presence of family or medical ties in the destination region a panel) and necessity area (absence of the health care services in the home region or too long waiting times).

In addition, interviews to staff units of the DASOE helped in the recognition of the model used in Sicily to assess the perceived quality of care and provided some elements to be included in the questionnaire.

The thyroid patients' association collaborated in the questionnaire administration, which took place in the waiting hall of the "Thyroid cancer and related diseases"

³³ It is the ATTA ONLUS– Associazione per la lotta al tumore tiroideo ed affini, founded in 1992. Alongside the doctors, it assists the patients within the hospital lanes and ambulatories, also creating events out of the hospital for the health care information and prevention.

http://www.unionenoprofit.it/index.php?option=com_content&view=article&id=12&Itemid=32&lang=en

³⁴ Among the patients who filled the questionnaire, ten people made themselves available for unstructured interviews about their experience.

ambulatory within the Operative Unit “Endocrinology” of a public hospital in Palermo (Azienda Ospedaliera Ospedali Riuniti Villa Sofia-Cervello)³⁵.

The questionnaire was filled in by 56 respondents: the sample was chosen purposefully, so that the half was made up of the people who received a thyroid cancer treatments in the home region, the remaining ones having travelled to other Italian regions for it³⁶.

Looking at System Dynamics Literature (Vennix, 2003) the contribution of questionnaires to the modeling consisted of: identifying key variables of the model (through item ranking from 0 to 5); identify key relationships between the variable of the model (through open-answers); parameter estimations.

The questionnaire consisted of 17 questions, ideally divided into four logical sections³⁷, not distinguishable by the user, aiming at:

1) identification of type of user: to provide general and socio-economic information about the patient. The internal composition of the sample is reported in figure 23;

2) identification of the key factors that could impact on the choice of the health care of health care facilities;

3) assessment of the perceived quality of the local offer. To this aim every patient was asked to express an evaluation from 0 to 5 to some quality factors;

4) assessment of the health care experience received out of Sicily: it is composed of questions designed to obtain information on the medical treatment received out of Sicily, the factors that led the patient to seek treatment out of Sicily, the monetary costs of health mobility for the patient and his companions. In addition, who received health care treatment out of region had assigned the task to assess the same quality dimensions in Sicily and out of Sicily.

³⁵ Before starting the delivery, questionnaire drafts were submitted to the attention of physicians and volunteers of the association, in order to be sure about the intelligibility of the contents. In appendixes 1 you will find the text of the questionnaire administered to the patients.

³⁶ The tracking of the patients treated out of Sicily could take place as they referred at least once to healthcare providers in the jurisdiction of Palermo Local Health Authority.

³⁷ At the heading of the questionnaire it is reported information about the research project and about the data disclosure according to the Italian regulation on privacy.

The following table summarizes the cognitive objectives and targets, the questions designed to reach them as well as the explanation of the rationale of the some questions.

General Cognitive Goals	Specific Cognitive Goals	Questions	Note On the Ratio Of Some Questions
Identification of the patient's typology	Personal information Socio-economic status of the patient	1) Name and Surname 2) Date Of Birth 3) Gender 4) Place Of Birth 5) Place Of Residence 6) Fiscal Code 7) Phone nr. 8) Qualification 9) Occupation	The fiscal code was inserted for the tracking of the patients diagnostic and therapeutic path.
Identification of general factors of choice	Verification of generic selection criteria for health facility	10) How important do you consider the elements in the table below in the choice of health care facility? Give a rating from 0 to 5 to each element (Acceptable waiting time to access care, etc..)	Question 10 asks the patient to express, in a scale from 0 to 5, the weight of each factor potentially influencing his/her choice of an health facility.
Assessment of the health care experience in Sicily	Assessment of the health care experience in Sicily	11) How do you assess the health care received within this structure? Give a rating from 0 to 5 to each element in the table (Welcoming department staff, quality of personnel, etc...)	Question 11 asks the patient to express, in a scale from 0 to 5, an assessment of the health care in Sicily according to factors such as the quality and kindness of the personnel, etc....
Evaluation of the experience of health care received outside Sicily (section to be completed only if the interviewee had received a surgery/ treatment outside the region).	Verification if the patient has traveled to other regions to get health care	12) Have you ever had the need to move to another region to receive health care?	The 12 th is a switch question to check if the patients have ever experienced healthcare mobility. If the answer is "no", he/she will be done with the questionnaire since the remaining questions are not relevant to him/her.
	Information on the types of medical treatment received outside the region	13) What kind of health care you received outside the region?	With Question 13 the patient is asked to indicate one or more option among outpatient service, surgery, radioiodine, etc., together with year of mobility and destination region.
	Verification of the factors pushing the patient to seek treatment out of Sicily	14) Why have you traveled to another region for care? Give a rating from 0 to 5 to each element in the table	Question 14 gives the patient the possibility to express the reasons for his/her mobility. It lists a number of possible factors, for each of which the respondent is required to express a preference from 0 to 5.
	Monetary and non-monetary costs of health mobility for the patient and his/her companions	15) How much are the annual additional (not refunded) travel expenditures incurred by you and your carer? (tick the type of expenditure and indicate the approximate amount) 16) How do you rate the discomfort of receiving medical treatment outside your region of residence for you and your companion?	Questions 15 and 16 assess the nature and extent of both monetary and non-monetary costs (to be understood in terms of discomfort) of patient mobility.
Assessment of the health care experience Out-Of-Sicily	17) How do you assess the health care received outside Sicily? Give a rating from 0 to 5 to each element in the table	Question 17 asks the patient to express, in a scale from 0 to 5, an assessment of the health care out of Sicily according to factors such as the quality and kindness of the personnel, etc.... (the same factors of question 11)	

Figure 23. Questions' general and specific goals and categorization

The internal composition of the patients' sample is reported in figure 24. Despite the survey targeted patients referring to the healthcare territorial jurisdiction of the LHA of Palermo, about the 76% of the respondents are actually resident in other provinces. Such figure captures the relevance of the intra-regional mobility phenomenon (mentioned at the beginning of the second chapter) for the province of Palermo.

The 67,86% of the respondents were female and this data is in line with the Sicilian epidemiologic data³⁸.

Residential Area	From The Province of Palermo 23,21%	From Other Sicilian Provinces 76,79%
Age	Young-Middle aged (18-44) 75,00%	Elderly 25,00%
Gender	Female 67,86%	Male 32,14%
Employment	Working Population 62,50%	Not Working Population * 37,50%
Level of education	Low (primary school) 33,93%	Medium-high (high school, degree, 6%) 66,07%
Year Of Surgery For Thyroid Cancer	Before 2009 (excluded) 50,00%	After 2009 50,00%
Moved Out Of Sicily for treatment/visit/surgery?	Yes 50,00%	No 50,00%

**(retired people, unemployed and housewives)*

Figure 24. Internal composition of the sample of patients participating to the qualitative study

The 50% of the panel received the surgical treatment before 2009, when the Sicilian Healthcare Administration started to contrast the phenomenon, thus some patients' responses do not incorporate the effect of the policy activated. The half of the respondents moved out of the Sicilian jurisdiction for receiving a treatment and/or a visit and/or a surgery. This fraction is not surprising, as the patients population to investigate was deliberately chosen with this characteristic.

The responses to the question 13 ("What kind of health care you received outside the region?) are reported in the table below. The totality of the respondents who experienced mobility for health care were motivated by receiving a surgical treatment, the 77% also moved for outpatient services and a slightly lower percentage (66,07%) seek for radioiodine treatments out of region.

³⁸ According to the last data from the Sicilian thyroid cancer record, the annual incidence rate of the thyroid cancer (0,139‰) registers a marked difference between the male and the female population, respectively registering the 0,054 and the 0,218 ‰.

Motivation of mobility	yes	no
Mobility For Ambulatory Services	77%	23%
Mobility For Surgery	100%	///
Mobility For Radioiodine	66,07%	33,93%

Figure 25. Internal composition of the sample of patients participating to the qualitative study

Ten out of the 28 patients who received health care out of Region accepted to participate to phone unstructured interview, whose findings also converged to the modeling activity.

3.5. The Dynamic Performance Management Framework

The finding from the qualitative analyses described in the previous headings have converged in the building of a cause-and-effect framework, built according to a performance management view (figure 26) and relating strategic resources, performance drivers and end-results. Among the strategic resources included in the model:

- beds: as this kind of resources are not dedicated just to the thyroid cancer management, it was calculated the proportion of hospitalization days for the thyroid cancer treatment in Sicily over the available hospitalization days (total number of bed*360 days);

- endocrinologists: in order to identify the specialist physician human resources devoted to the thyroid cancer management diagnosis and follow up it was made a proportion between the number of outpatient services specifically related to the thyroid cancer (identified with the diagnosis code ICD-9-CM) and the total outpatient services provided by the Endocrinology in the territory;

- soft variables: the perceived quality of the Sicilian Healthcare System and the other ones was detected through the questionnaire administered to the panel of patients, who were asked to express an evaluation on quality dimensions in Sicily and Out Of Sicily (quality of personnel, comfort of the structures, acceptability of waiting time);

- patients stocks: as the patients proceed in the diagnostic-therapeutic path, several stocks are respectively fed and drained. A complete map of such stocks and the related in- and outflow is provided in figure 28.

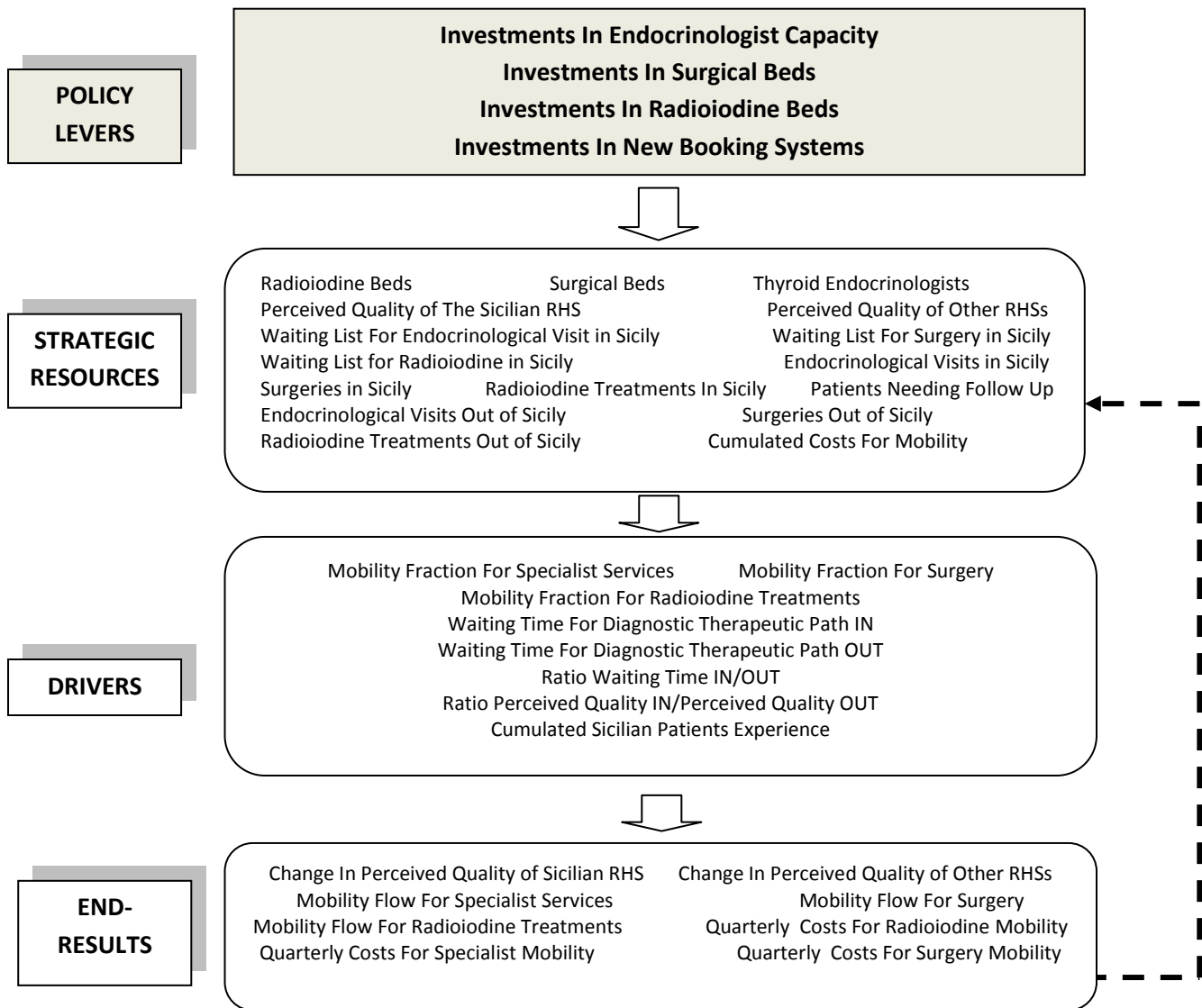


Figure 26. Dynamic Performance Management Framework

Regarding the performance drivers are concerned, they were identified:

-- mobility fractions: according to the model hypothesis, the flows of patients spilling over the residential region towards other ones are regulated by quarterly fractions of the patients inside the waiting lists' stocks (Mobility Fraction For Specialist Services, Mobility Fraction For Surgery and Mobility Fraction For Radioiodine Treatments);

-- waiting times for the diagnostic and therapeutic path: the bed and human resources' capacities impact on the waiting times for each step of the diagnostic-therapeutic path. The ratio between the total waiting time in Sicily and the desired waiting time (benchmark waiting times previously identified through the experts interviews) impact on the perceived quality of the Sicilian Healthcare System;

-- ratio perceived quality IN and OUT: this performance driver affects the mobility fractions previously described;

-- cumulated patients experience IN and OUT of Sicily: it results from the sum of the treated patients' stocks and it was conceived as the vehicle of word-of-mouth mechanisms, to be described in later parts of the chapter.

The performance drivers are able to influence the end-results (flows) of the model (end results), which in turns feed back to the stocks. The most relevant *end-results* are:

-- changes in perceived quality of Sicilian Regional Healthcare System and Other Regional Healthcare Systems;

-- mobility flows for specialist services, for surgery and for radioiodine treatments;

-- quarterly costs of the mobility flows.

3.6. The System Dynamics model

The dynamic performance management framework presented above was translated into a System Dynamics model: the stock notation was used to represent the strategic resources, able to impact on performance drivers (calculating variables) thereby affecting the end-results (flows), that feed back into the stocks.

This gradual approach was privileged because considered a valid way to improving the comprehension of the structure of the problem, capturing its multidimensional facets and the possible relationships between relevant variables.

The formalization of the model was done by using the simulation software Ithink ® by Stella, through which the stock and flow structures were quantitatively specified and

defined by a list of equations (representative of decision rules and behavioral relationships), complemented by the estimation of the parameters and the initial conditions³⁹.

Modeling was “as a part of a learning process, an iterative process of formulating hypotheses, testing and revision” (Sterman, 2000). The time horizon of the model is the triennial 2010-2012, chosen because the institutional interlocutor only made available those data⁴⁰. Anyway, this timeframe is supposed to enclose the effects of the ongoing policies (promoted since 2009) to contrast the mobility phenomenon, hypothesizing a one-year lag for those measures to start disclosing effects.

In order to have more data points, all the data and calculation on an annual basis were re-conducted to quarters’ units.

The resulting model is made up of four inter-related sub-models, each of them divided into sectors: 1) the productive capacity; 2) the costs of mobility; 3) the diagnostic and therapeutic paths; 4) the patients perceived quality.

The productive capacity is made up of the core productive factors for the short term and long term management, such as the thyroid beds, the thyroid endocrinologists and the radioiodine beds. As mentioned before, we did not have available data about the resources dedicated to the typology of patients affected by thyroid cancer and related diseases, since we are not talking about a specific branch of medicine. Anyway, the estimation of the proportion of resources absorbed (bed, endocrinologists, etc...) to treat this typology of patients, was made equal to the average weight of the cases of thyroid cancer⁴¹ over the total endocrinological activity.

In the costs of mobility portion of the model it was made a distinction between the public and the private costs of the mobility. The first type of costs were calculated referring to the DRG and specialist tariffs, the second type of cost (in turn distinguished into

³⁹ The stocks have been initialized with average historical data when available. The length of the time step chosen for the model (i.e. the measure of how frequent the computer updates the value of the stock) is 0.1, chosen because it is lower than the shortest time constant of the model, equal to 1 (Sterman, 2000).

⁴⁰ Actually the initial idea was to consider the ten-years period 2003-2012, but for the Regional Healthcare Authority IT was not possible to promptly provide the data. Indeed, the DRG classification system used in the last triennial is different from the ones adopted before; for this reason, making the data series homogeneous and comparable would have required an analytic effort transcending the one-year project duration.

⁴¹ The patients were traced through diagnosis and intervention codes related to the thyroid cancer, grouped by staff of Regional Epidemiological Observatory.

monetary and non-monetary) was assessed by referring to the question n.16 of the questionnaire delivered to the sample of patients (appendix 1).

According to the questionnaire answers, the average monetary costs accounted for 700 euro on an annual basis. However, the relative weight of such costs is lower than the other kinds of private discomforts related to the mobility, represented in figure 27.

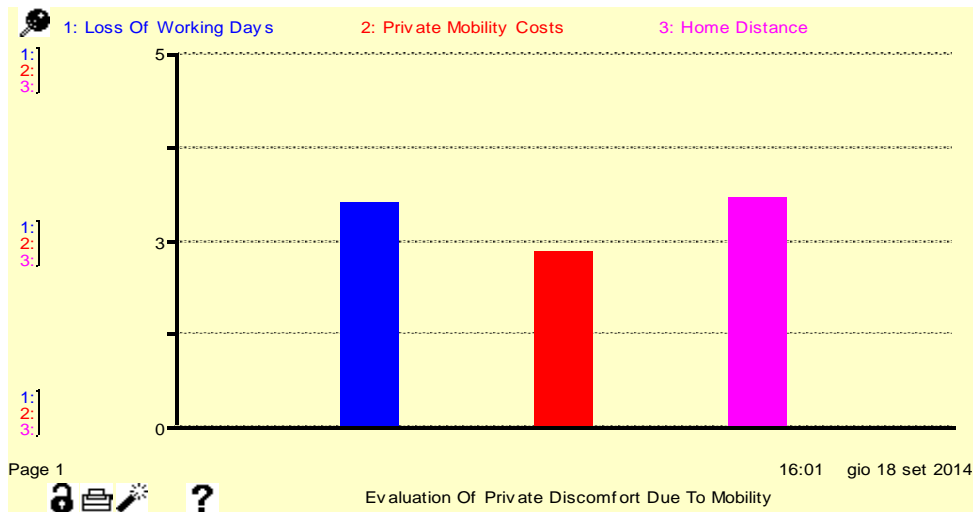


Figure 27. Average evaluation of private discomforts related to mobility (source: patients’ survey) .

Within the panel of patients participating to the study (asking to rank from 0 to 5 each item), the loss of working days and psychological discomfort due to the home distance appear to be more relevant than the travelling cost. “After the surgery – this is the story of a volunteer - I got up alone in a bed hospital, not in my native city. I felt very fragile: exactly in that moment I decided that once coming back home I would have supported other people passing through the same difficulties”

The diagnostic and therapeutic paths identifies the healthcare routes of patients flowing through five major sectors (whose stock and flow structure is represented in figure 28):

- SECTOR 1 Diagnosis IN: it summarizes the diagnostic path (from the endocrinological visit to the needle biopsy) taking place in the residential region. The inflow to the system is the “GP referrals for endocrinological visit”, which in turn was modeled as

depending on the population (treated as a constant) and the average quarterly specialist fractional rate available for the triennial 2010-2012⁴².

The people accumulate in the stock “Waiting List For Endocrinological Visit”, which is drained by the outflow “To endocrinological Visit IN” and again accumulate in the “Patients In Endocrinological Visit IN”.

- SECTOR 2 Therapy IN: people with a thyroid cancer diagnosis confirmed are addressed to the surgical waiting list and, when required, treated with radioiodine;

- SECTOR 3 Follow up IN: people discharged from surgery and from radioiodine treatments need periodical outpatient follow up and converge to the waiting list for endocrinological visit;

- SECTOR 4 Diagnosis OUT: this sector include the mobility flow of resident requiring outpatient specialist services out of Sicily;

- SECTOR 5 Therapy OUT: the stock “Surgery Out” is the result of the accumulation of two distinct flows of people:

1) the inflow called “To surgery from out” , referring to people that previously moved out of Sicily for the endocrinological check up;

2) the inflow called “Travelling for surgery”, consisting of the movements of people that have started the diagnostic-therapeutic path in Sicily.

⁴² This rate was calculated as the ratio between the specialist outpatient services per quarter (on 2011-2012 data) and the average population of the province in the triennial under consideration. The specialist outpatients services considered for this calculation were the ones strictly related to the thyroid cancer diagnostic and therapeutic path identified with the following codes: 0601=extraction in the thyroid region, 91481= thyroid biopsy; 92011= thyroid capitation, 92013= thyroid scintigraphy; 92014= thyroid scintigraphy with positive indicators; 92183= search of thyroid cancer metastases.

The input demand for the entire diagnostic and therapeutic path could have been populated by:

1) using the incidence rate for the thyroid cancer: this option was not chosen because of lacking of recent data;

2) using the prevalence rate for the thyroid cancer: according to the staff of the Epidemiologic Observatory (DASOE) a proxy variable for the prevalence is represented by the hospitalization rate (hospitalizations/population) adjusted for epidemiologic parameters such as gender, ages, etc...

Anyway, none of the options above were chosen because the purpose of the model was to capture the possible patients routes from the pathology’s suspect to the therapy and follow up. In this regard, not all the suspects give light to a cancer diagnosis and not all the surgeries are followed by radioiodine therapy.

Similar dynamics take place for the stock of people treated with radioiodine out, fed by the inflows “To radioiodine from out” (Sicilian people that have already crossed the diagnostic-therapeutic steps out of Sicily) and “Travelling for radioiodine” (Sicilian people that have already completed the previous steps in Sicily).

Then mobility flow for surgery and the mobility flow for radioiodine treatments are the results of two components. Respectively:

$$\text{Mobility Flow For Surgery} = (\text{Travelling For Surgery} + \text{To Surgery From OUT})$$

$$\text{Mobility Flow For Radioiodine} = (\text{Travelling For Radioiodine} + \text{To Radioiodine From OUT})$$

For hypothesis in the paths there are not recurrences of the disease. People are “directed” down various routes at a branching point: a percentage is sent one way or another (e.g. only the 8% of the patients checked up in Sicily were supposed to need surgery, and the 5% of people surgically treated was set as needing radioiodine). They only flow through the routes when there is sufficient capacity.

The general equation for these flows is to take the minimum of demand at that point or spare capacity; for deciding spare capacity the equation takes current capacity less capacity in use. This formula is used for all resource types (e. g surgical beds, physicians etc).

In order to avoid that the stock variables go negative, hence overcoming their physical limits, there are first order control loops, imposing for each outflow that if the value of the stock upstream is negative or equal to zero, then the outflow will be zero.

For example, the equation for the flow of patients directed “To Surgeries” is:

$$\text{IF}(\text{Waiting List For Surgery} \leq 0) \text{ THEN}(0) \text{ ELSE}(\text{MIN}(\text{Waiting List For Surgery}, \\ \text{Spare Bed Surgical Capacity}))$$

Once the patient starts the diagnostic and therapeutic route out of Sicily, in most of the cases he will continue that route out of residential area. By the way, there is also a certain percentage of “healthcare emigrant patients” who return to the home region for the follow up activities. This version of the model does not capture such dynamics.

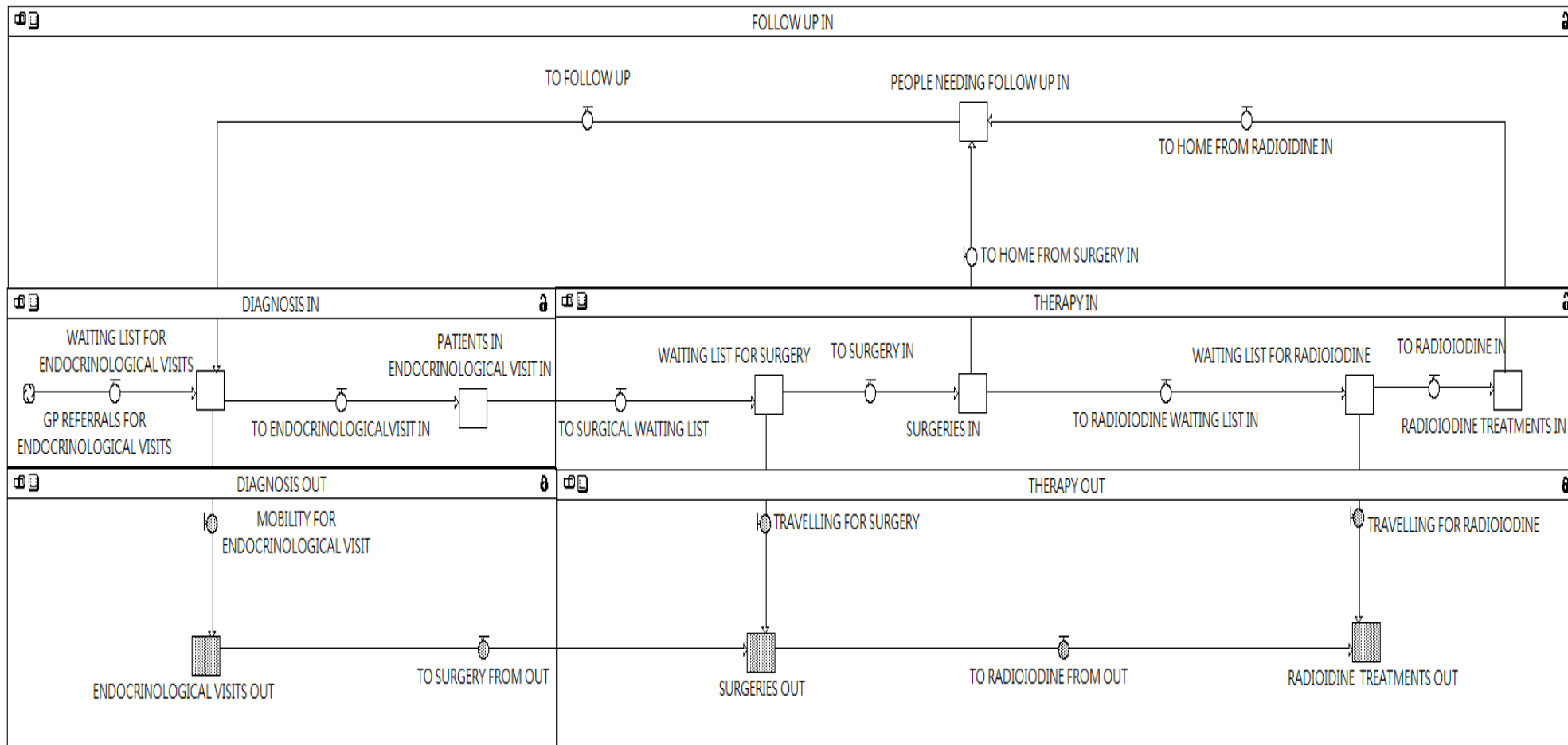


Figure 28. Simplified stock and flow structure of the patients' routes.

As far as the patients' perceived quality sub-model is concerned, it is represented by the stock of perceived quality in Sicily and the stock of perceived quality out of Sicily (figure 29).

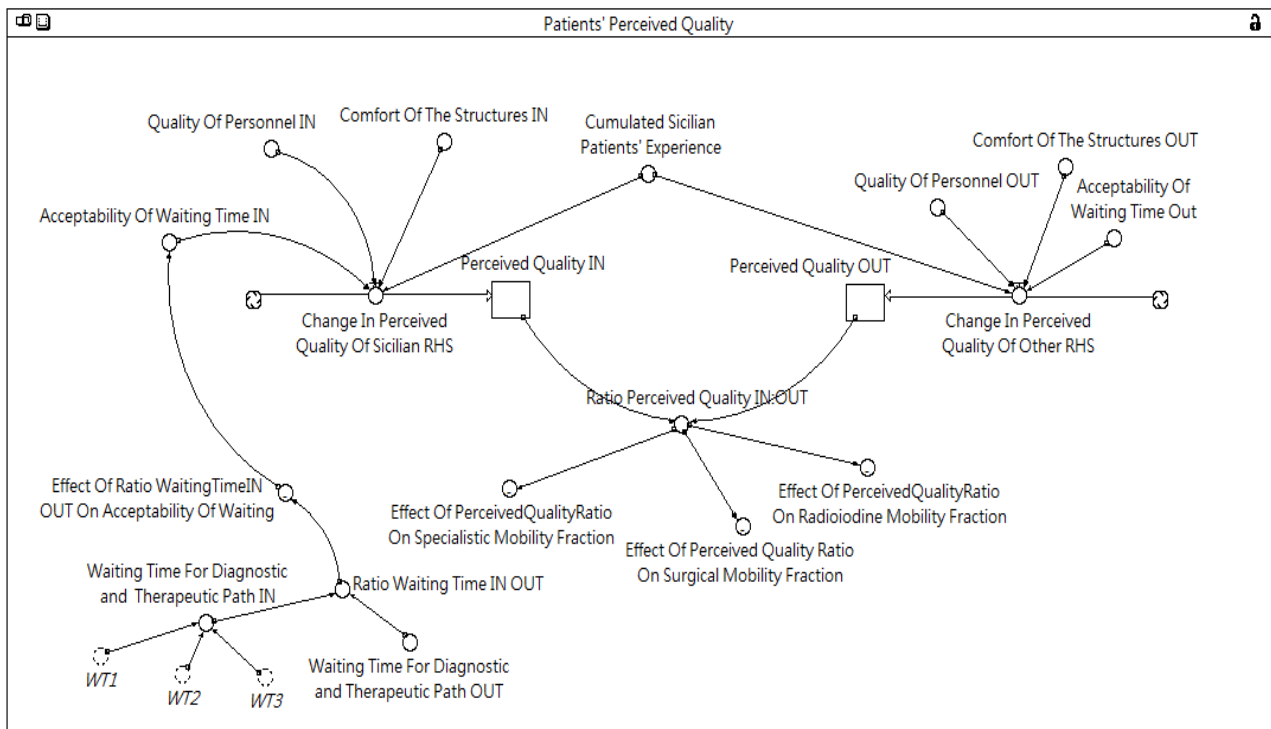


Figure 29. The patients' perceived quality sub-model.

The inflows feeding these stocks depend upon the cumulated Sicilian patients' experience: it is the sum of the Sicilian healthcare demand for specialist services, surgeries and radioiodine provided in and out of Sicily. This driver is introduced in order to capture the "word-of-mouth effect", meaning that the interactions between people experiencing the Sicilian and the other regional healthcare systems allow the exchange of information about the main factors influencing the quality of the healthcare systems.

Such factors are: the "quality of personnel", the "comfort of the healthcare facilities" and the "acceptability of waiting times". As far as the "quality of personnel" and the "comfort of the of the healthcare facilities", their change was presumed to take place slowly, so they were considered to be constant over the time horizon of interest in the model. In particular, changing such factors in the Sicilian context is supposed to require new investments not recognizable in the current Sicilian healthcare policy makers' programs. In any case, eventual improvements in those spheres would require time to be perceived by the citizens. The parameter estimation was done into two steps: firstly, by aggregating

homogeneous items within the questions 11 and 17 of the survey (figure 30), which assessed the healthcare experience respectively IN and OUT of Sicily. Then it was calculated the average of the rankings given in the questionnaires (figures 31, 32& 33).

ITEMS ASSESSED BY THE PATIENTS IN & OUT OF SICILY	VARIABLES IN THE MODEL
Welcoming department staff	PERCEIVED QUALITY OF PERSONNEL
Quality of personnel	
Clarity of information received from the medical and nurse personnel	
Cleanness of the structures	COMFORT OF THE HEALTHCARE FACILITIES
Comfort of the structures	
Easiness to book the treatments	
Acceptable waiting time to access care	ACCEPTABILITY OF WAITING TIME

Figure 30. Transposition of questionnaire items into model variables.

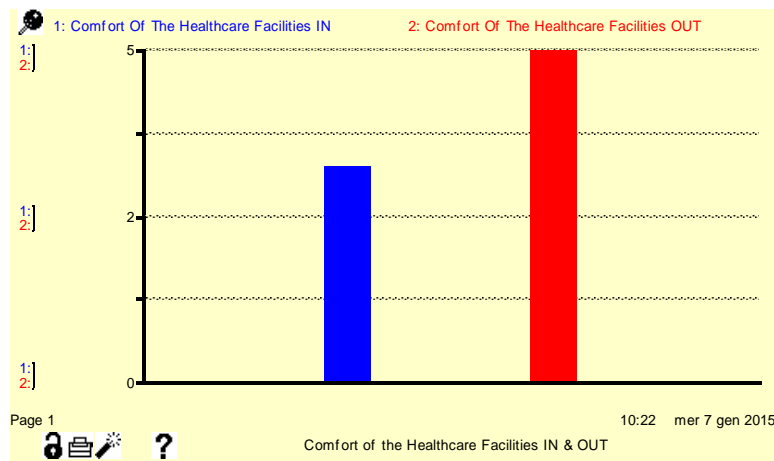


Figure 31. Average comfort of the healthcare facilities IN (blue color) & OUT (of Sicily red color). Source: patients' survey.

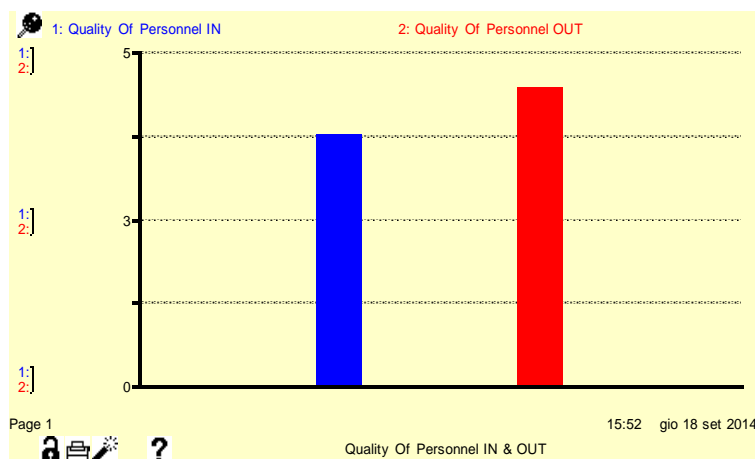


Figure 32. Average perceived quality of personnel IN (blue color) & OUT of Sicily (red color). Source: patients' survey.

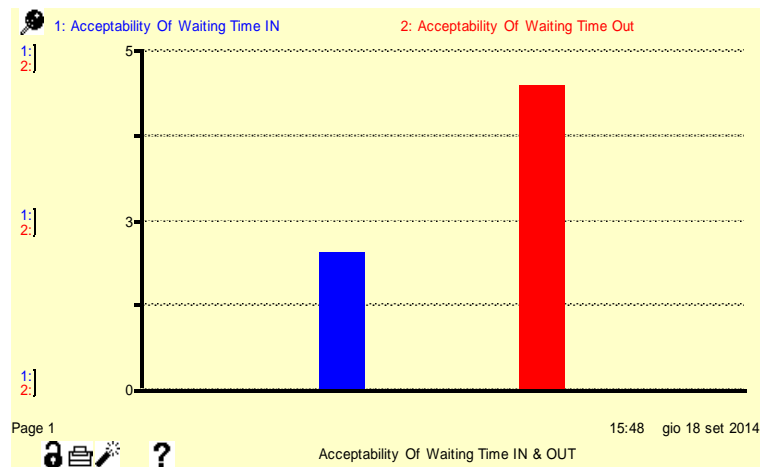


Figure 33. Average Acceptability of waiting times IN (blue color) & OUT of Sicily (red color). Source: patients' survey.

The general “change of perceived quality” formula is the following:

$$(\text{Comfort_Of_The_Structures} + \text{Quality_Of_Personnel} + \text{Acceptability_Of_Waiting_Time}) * \text{Cumulated_Sicilian_Patients' Experience}$$

The decision to model the word-of-mouth effect was taken considering the questionnaire analysis. Indeed, among the factors impacting on the choice of the healthcare facilities (question 10, see appendix 1), the word-of-mouth (of other patients, GPs and specialist physicians) had a 60% weight. This result confirms some studies (Ha & Lauer, 2008; Harris, 2003; Collicelli, 2012) pointing the word-of-mouth's recommendations from family and friends and physicians among the main factors that drive the patients in the healthcare provider choices.

The “acceptability of the waiting time in Sicily” has a 2-points initial value established through the patients survey (figure 33), and its floating depends upon the performance driver “ratio between the total waiting time in and out of Sicily”. The waiting time here intended is the total amount of time required to complete the diagnostic and therapeutic path, in turn the sum of WT1 (waiting time for specialist visit), WT2 (waiting time for surgery) and WT3 (waiting time for radioiodine). Such waiting times are endogenous variables calculated as the ratio between the stocks of patients in waiting lists and the outflow draining them (see figure 34).

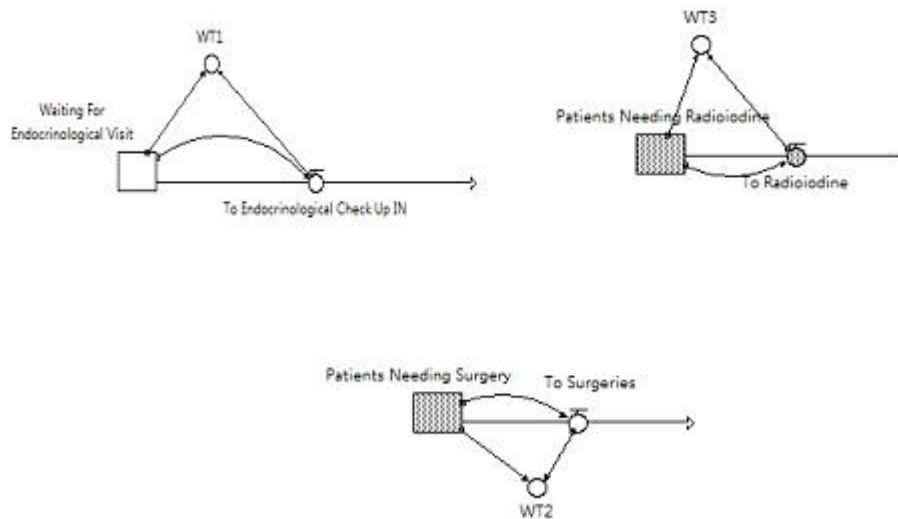
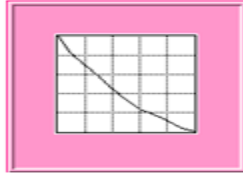


Figure 34. Waiting lists and waiting times (WT1, WT2 and WT3) for each step of the diagnostic and therapeutic path.

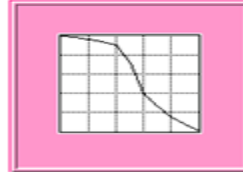
The waiting times are modeled as endogenous variables because they are part of the Regional Healthcare Administration planning. With the Healthcare Councillorship 1220/2011 “*Piano della Regione Sicilia per il governo dei tempi di attesa 2011-2013*” (Sicilian Regional planning for the waiting times management 2011-2013), it is pursued the goal of “guarantee maximum waiting times according to adequate criteria of clinical appropriateness”. According to such regional plan, the waiting time starts to be accounted from the first contact of the patients with the Regional Healthcare System. For the thyroid cancer management the time starts with the first endocrinological visit and entire procedure is expected to last maximum 6 months (alias 2 quarters).

The performance driver “ratio between the perceived quality in Sicily and out of Sicily” has a nonlinear negative effect on each mobility fraction (for specialist services, for surgery, for radioiodine). As observable in figure 35, the effect is more accentuated when the patients’ mobility takes place for receiving the surgical treatment, because it was taken into consideration the complexity of this therapeutic stage in comparison with the previous and the next ones.

Effect Of PerceivedQualityRatio On Specialistic Mobility Fraction



Effect Of Perceived Quality Ratio On Surgical Mobility Fraction



Effect Of PerceivedQualityRatio On Radioiodine Mobility Fraction

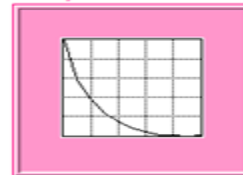


Figure 35. Nonlinear effects of the “Ratio of perceived quality IN and OUT of Sicily” on the patients’ mobility fractions.

Regarding the other two mobility fractions, the curve has the same shape, albeit the influence of the driver is more emphatic in the case of specialist mobility fraction. This assumption was taken hypothesizing that at the beginning of the healthcare path the patient is more physically and psychologically fragile due to the disease’s suspect.

In addition, he/she does not have any direct experience about the thyroid cancer management, so that the relative weight of word-of-mouth factors in the mobility decision is higher than at the end of the healthcare path.

All the sectors of the System Dynamics model are inter-related (figure 36) and looking at the whole system instead of its parts gives the opportunity to re-think the totality of the Sicilian patients experience.

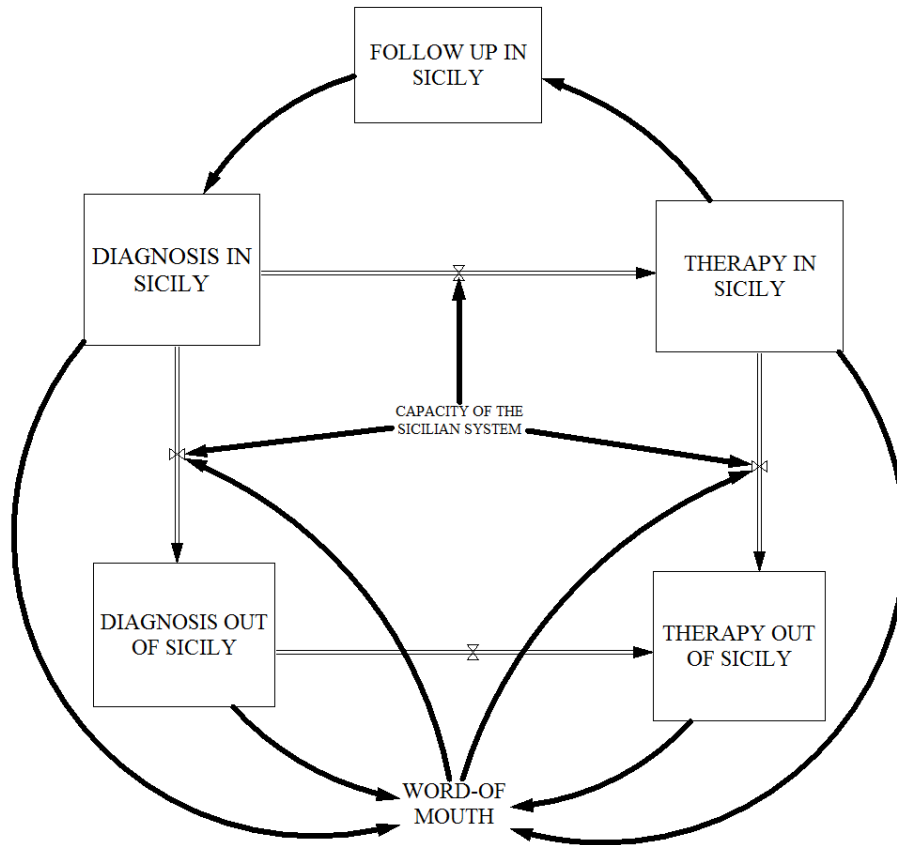


Figure 36. Interrelationships between sectors in the System Dynamics model

The scheme above represents how the mobility phenomenon cannot be analyzed separately from the local healthcare service delivery. Two main forces, the system capacity and the word-of-mouth, lead the patients decision about the place to receive the treatments.

The structure of the relevant system will be now described through selected feedback loops⁴³.

⁴³In a System Dynamics model, the patterns of the variables are the result of interactions between feedback loops, which are characterized by polarities. The polarity of a loop can be positive (and then the loop is called reinforcing) or negative (and the loop is rather balancing or counteracting), while the terms positive or negative do not express any judgment of favorability for the decision maker. The reinforcing loops destabilizing and have the tendency to provoke exponential growth or decay of the initial conditions. The balancing loops have rather the tendency to equilibrate and stabilize the initial dynamics. A rule of thumb to establish the loop polarity is check the number of negative links: if they are odd, then the loop is balancing, otherwise reinforcing.

The math to determine the loop polarity (Sterman, 2000), requires to calculate the open loop gain, e.g. the strengths of the signal returned by the loop. Choosing any variable participating in a loop, for example X_1 within a loop made up of the variables X_1, X_2, X_3, X_4 , the variable X_1 is split in an input X_1^1 , and an output X_1^0 . Then the open loop gain is the partial derivative of X_1^0 with respect to X_1^1 , that is the feedback effect of a small change in the variable as it returns to itself. The polarity of the loop is the sign of the open loop gain.

Polarity of loop = $\text{SGN}(\delta X_1^0 / \delta X_1^1)$ where $\text{SGN}()$ is the sign function, returning +1 if its argument is positive and -1 if its argument is negative. Thus the open loop gain is the chain rule from the gains of the individual links $\delta X_i / \delta X_{i-1}$:

Figure 37 portrays two major reinforcing loops connecting the diagnostic and therapeutic steps of the thyroid cancer management in Sicily.

Ceteris paribus, the more the waiting list for endocrinological visits is, the more will be the endocrinological visits in Sicily, thereby stimulating the surgical and the radioiodine sectors. Once the therapy is completed, the people needing follow up feed back into the waiting list for endocrinological visit in Sicily.

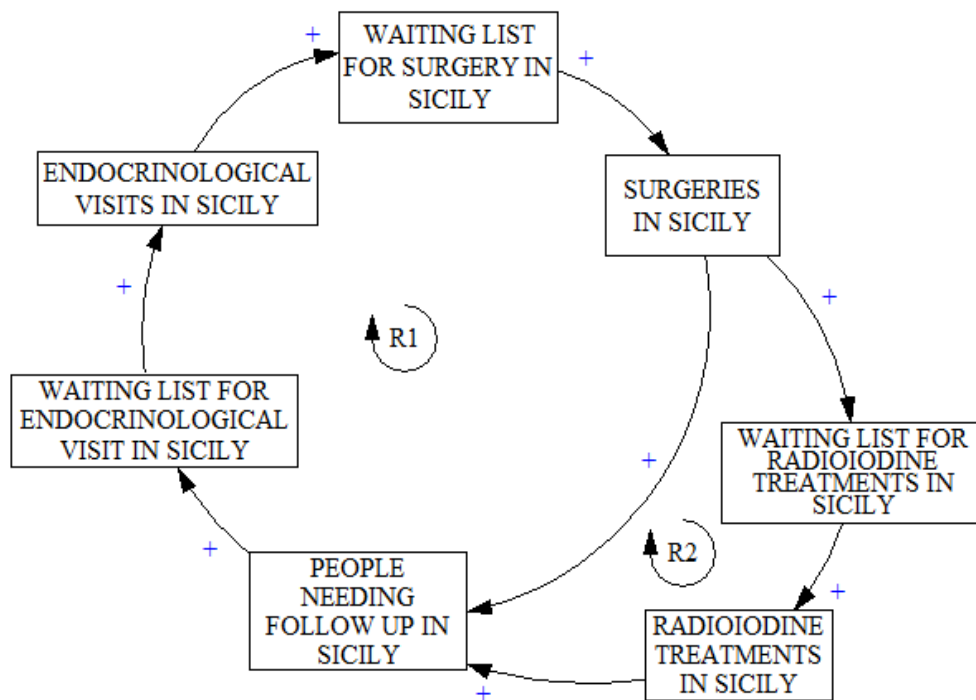


Figure 37. Causal loop diagram relating the diagnostic and therapeutic steps.

Each type of mobility (for specialist services, for surgeries and for radioiodine) depends on the combination of the ratio between the perceived quality in Sicily and out of Sicily, and the system's carrying capacity.

Regarding the mobility flows indicated by capacities, the counteracting loops C1, C2, C3 (figure 38) depict the mobility flows as physiological mechanisms due to the

$SGN(\delta X_1^0 / \delta X_1^1) = SGN[(\delta X_1^0 / \delta X_4) (\delta X_4 / \delta X_3) (\delta X_3 / \delta X_2) (\delta X_2 / \delta X_1^1)]$. Since the sign of a product is the product of the signs, loop polarity is also given by $SGN(\delta X_1^0 / \delta X_1^1) = SGN(\delta X_1^0 / \delta X_4) * SGN(\delta X_4 / \delta X_3) * SGN(\delta X_3 / \delta X_2) * SGN(\delta X_2 / \delta X_1^1)$

adjustments of temporary imbalances between the healthcare demand and supply. A lack of supply causes the waiting times to increase and stimulates the mobility, which in turn relieves pressure on the internal supply, freeing up new capacity and discouraging the mobility.

According to this representation, for each diagnostic and therapeutic stage a rise in the mobility flow depletes the waiting list, thereby reducing the services provided in Sicily. This improves the waiting time to access the health care, thereby causing a reduction of the mobility fraction ascribable to capacity constraints.

Once the capacity will be saturated again, the mobility is likely to show up again. If these loops were the only working, the patients flows behavior would have been characterized by oscillations, not envisaged in the Sicilian case. This fact may be due to the combined effects of the word-of-mouth within the diagnostic and therapeutic path, which tend to uniform the people behaviors.

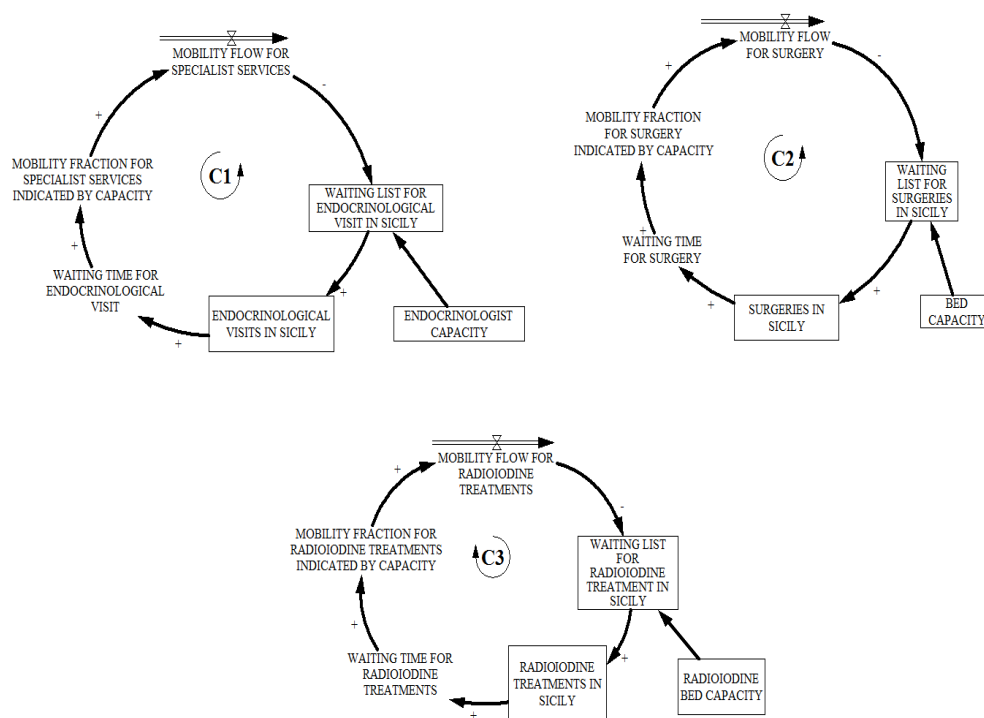


Figure 38. Counteracting loops regarding the patients mobility flows indicated by internal capacity of the healthcare system.

Similar dynamics of demand/supply adjustments can be envisaged in the in the counteracting major loop C4 (figure 39), which depicts the links between the diagnostic and therapeutic sectors (for simplicity the radioiodine was not represented herewith). An increase in the stock of surgeries in Sicily causes the people needing follow up to grow, thereby delaying the start of the healthcare path in Sicily. The latter stimulates the mobility for specialist services and the mobility for surgery, by this way depleting the surgeries in Sicily.

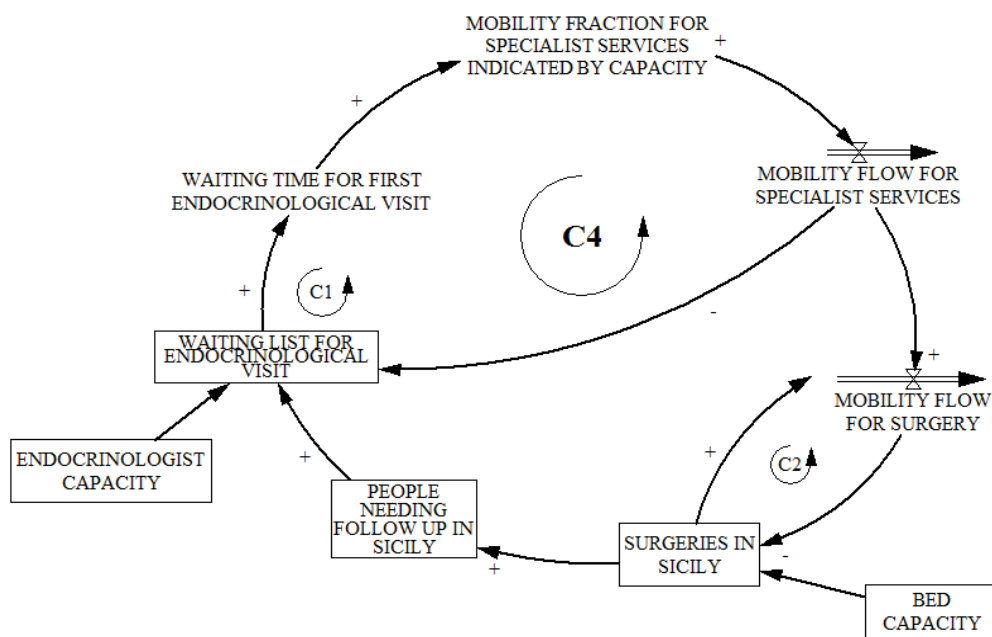


Figure 39. Feedback loops linking capacity constraints and steps of the diagnostic and therapeutic path

The feedback structure previously presented participate in a wider loop, relating capacity constraints, diagnostic-therapeutic steps and perceived quality of the Sicilian Healthcare System. In figure 40 it is noticeable that the sum of the waiting times to access respectively the endocrinological visit, the surgery and the radioiodine treatment has a negative impact (i.e. going in the opposite direction) on the perceived quality of the Sicilian Healthcare System, reducing the ratio between the perceived quality of the Sicilian and other RHSs. This fact provokes a rise in the mobility fractions indicated by word-of-mouth,

which after some time concur to release pressure from the patients' waiting lists and by this way reduce the waiting times to access the healthcare services.

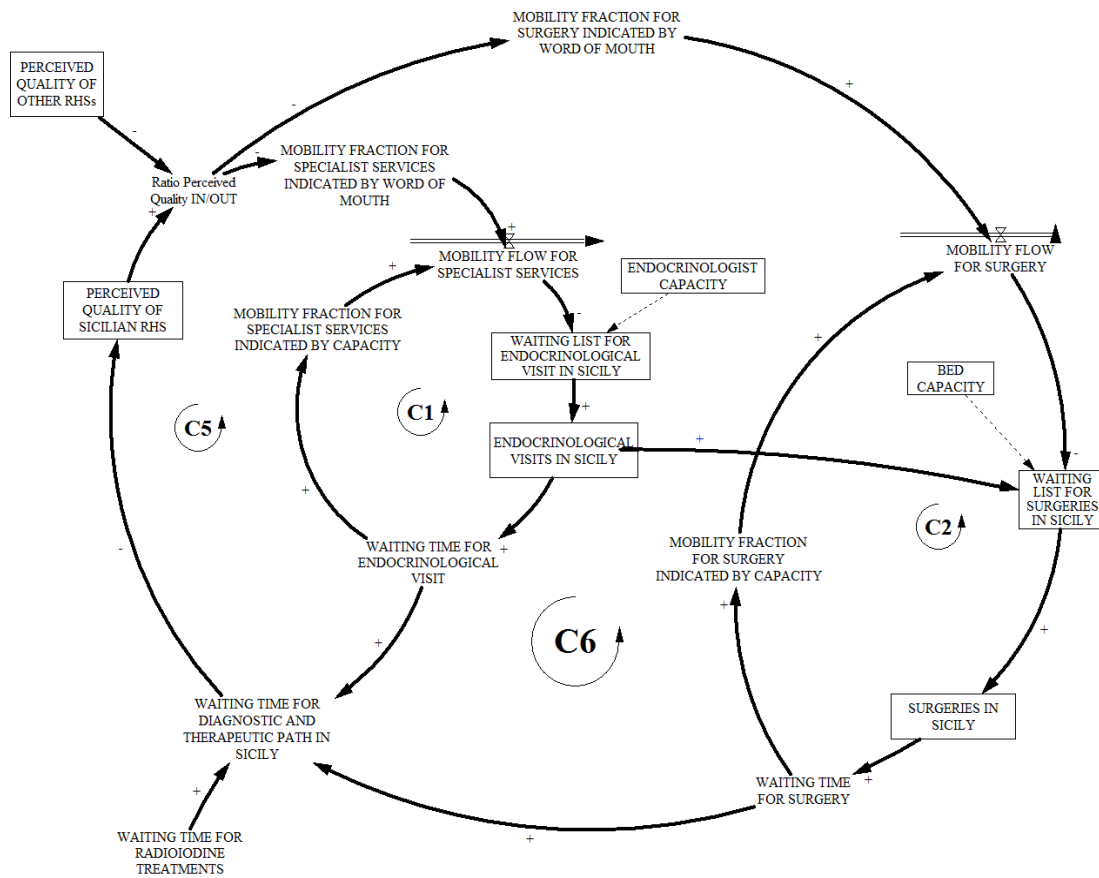


Figure 40. Feedback structure connecting capacity constraints, diagnostic-therapeutic steps and perceived quality of the Sicilian Healthcare System.

Together with the counteracting loops just presented, the dynamics of the diagnostic and therapeutic paths provided to Sicilian patients out of the residential region are influenced by the reinforcing loop in figure 41.

The loop R3 depicts the word-of-mouth mechanisms regarding the endocrinological specialist mobility. The mobility for specialist services is the result of the interaction between the mobility fraction indicated by resource capacity and the mobility fraction indicated by the word of mouth. The increase in the mobility flows provokes the accumulated experience out of Region to increase, then lowering the “ratio perceived

quality IN/OUT”. A reduction of such performance driver makes the mobility flows to increase again.

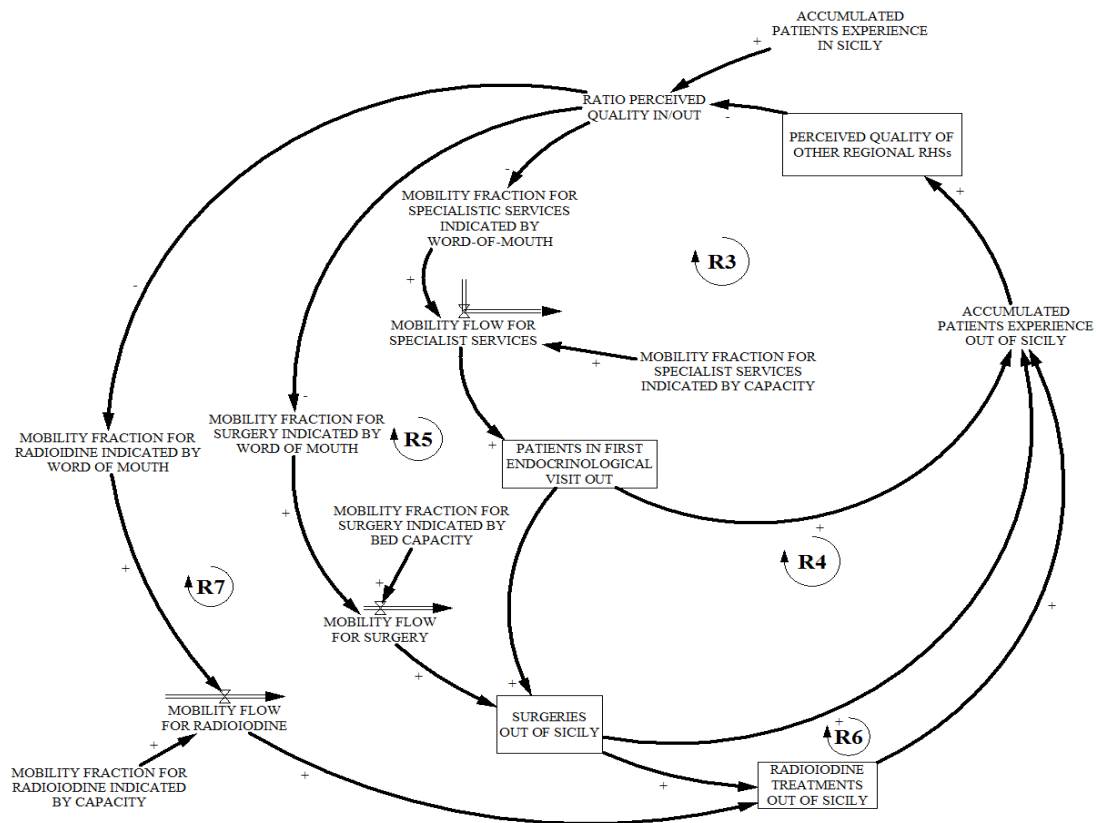


Figure 41. Reinforcing loops regarding diagnoses and therapies provided to Sicilian patients out of Sicily

The loop R4 is strictly related to the previous one and it represents the mobility for surgery due the path dependence. When the patient starts the diagnostic and therapeutic path in another Region, mechanisms of fidelity are triggered, so that He/She will also undertake the other therapeutic steps out of the residential Region.

The loop R5 shows the dynamics occurring when the patients start the diagnostic path in Sicily and then move for the surgical step. Again, the mobility fraction results from the interactions between surgical beds capacity and the word-of-mouth about the relative perceived quality of the Sicilian health care.

The loops R6 and R7 present similar mechanisms as the ones referred to the other stages of the diagnostic and therapeutic path: R6 takes place for the mobility for radioiodine

for the patients who have already made the previous stages of the health path in Sicily; R7 occurs in case of mobility depending on the pathways started in other Regions.

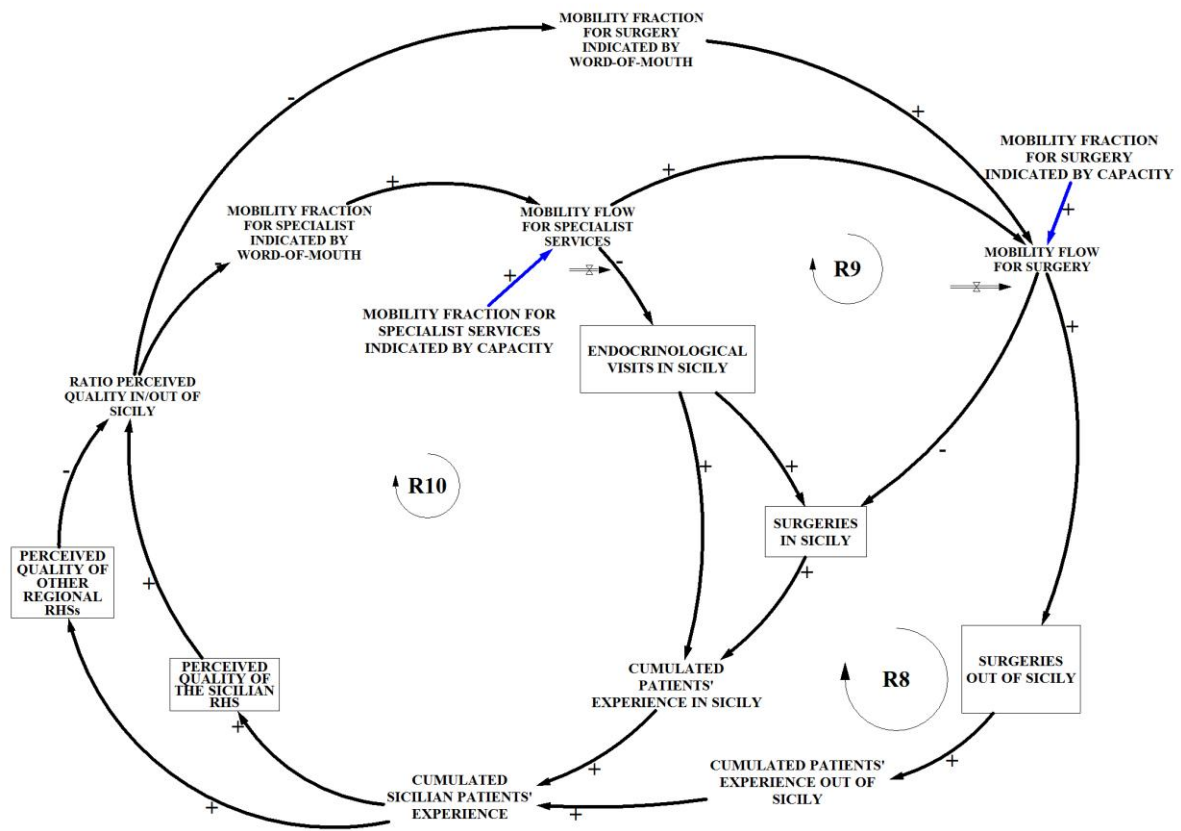


Figure 42. Causal loop diagram relating perceived quality in and out of Sicily

Finally, the feedback structure in figure 42 resumes perceived-quality related dynamics. A reduction of the ratio between perceived quality in and out of Sicily stimulates the mobility fractions indicated by word-of-mouth, thereby reducing the cumulated patients experience. *Ceteris paribus*, the perceived quality of the Sicilian RHS will be depleted, as well as the perceived qualities' ratio.

3.7. Model validation

The System Dynamics model built for the present research formulates a complex hypothesis about the causal structure underlying the investigated phenomenon; the validation consisted on the progressive accumulation of evidences to justify confidence in it. This is an iterative process faced with a holistic approach, aiming at verifying the usefulness of the model's "big picture".

“Because all models are wrong, we reject the notion that models can be validated in the dictionary definition sense of ‘establishing truthfulness’, instead focusing on creating models that are useful, on the process of testing, on the ongoing comparison of the model against all data of all types, and on the continual iteration between experiments with the virtual world of the model and experiments in the real world” (Sterman, 2002: 521).

“Models are not validated after they are completed nor by any one test such as their ability to fit historical data. Clients (and modelers) build confidence in the utility of a model gradually, by constantly confronting the model with data and expert opinion-their own and others’ (Sterman, 2000: 81).

“The system dynamicists are generally unconcerned with specific values of system variables in specific years. They are much more interested in general dynamic tendencies, whether the system as a whole is stable or unstable, oscillating, growing, declining or in equilibrium” (Meadows, 1980). The tests performed up to now are presented here below.

Test 1: Unit consistency

Such test consists of verifying that the right side of each model equation matches the left side “so you aren’t adding apples and oranges” (Sterman, 2000: 103). For example, the surgical capacity was considered in terms of number of patients that can be potentially treated in a quarter, and it was calculated as follows:

$$\begin{aligned} \text{Quarterly Surgical Patients Capacity} &= \\ \text{Quarterly Surgical Days Capacity/Average Length of Stay For Surgery hospitalization} & \\ \text{UNITS: patient/quarter} &= \\ \text{(Days/Quarter)/(Days/Patient)} & \end{aligned}$$

The unit consistency was checked every time a new equation was added to the model by using the “Check the unit” command available in the formulation box of the Ithink package, which also provides full documentation of unit consistency.

Test 2: Face validity

Along the research process, the unit consistency test was paired with a face validity test, serving the scope to reply to the following questions: “Does the model structure looks like the real system? Is it a recognizable representation of the real system? Does a

reasonable fit exist between the feedback structure of the model and the essential characteristics of the real system?” (Forrester & Senge, 1980). This task was fulfilled by sharing the model structure progresses with actors belonging to the Sicilian Healthcare System and involving them in the model building. The test provided to the modeler a reality check in some cases where the units were consistent but the equations initially formulated were judged un-correct or misleading.

Test 3: Reference mode comparison

This test aims at understanding if the model is able to reproduce the dynamic problem. i.e. the historical behavior of the key concepts and variables (Sterman, 2000: 85).

The variable chosen to represent the dynamic problem are the following: the mobility flow for surgery, the mobility flow for radioiodine treatments and the mobility flow for specialist endocrinological services. All of them correspond to end-results within the dynamic performance management framework previously presented.

The reference modes were built considering that the data available only referred to a triennial: in order to get more data points, it was chosen to pick the quarter as time unit. In addition, due to the project’s limited time, under the encouragement of the Regional and Local Health Authorities, the model refers to a Local Health Authority data.

Time (quarters)	Mobility For Hospitalizations (except Radioiodine)	Mobility For Radioiodine
2010-1	51	12
2010-2	49	9
2010-3	33	6
2010-4	49	10
general 2010	182	37
2011-1	47	10
2011-2	49	9
2011-3	32	8
2011-4	58	8
general 2011	186	35
2012-1	53	14
2012-2	50	12
2012-3	36	4
2012-4	50	12
general 2012	189	42

Figure 43. Patients mobility data from the Local Health Authority (source: ICD9CM diagnoses and intervention codes).

Figure 43 shows a synthesis of the patients mobility flows data, with separated indication of the hospitalizations for radioiodine treatments, where it is possible to notice a rising trend in spite of seasonal oscillations in the third quarter of each year⁴⁴.

Looking at the simulations⁴⁵, as far as the mobility flows for surgeries and for radioiodine (and the related stocks) are concerned (figures 44, 45, 47 & 48), after initial transients, the model behaviors match the reference modes, with a better fitting in the radioiodine case.

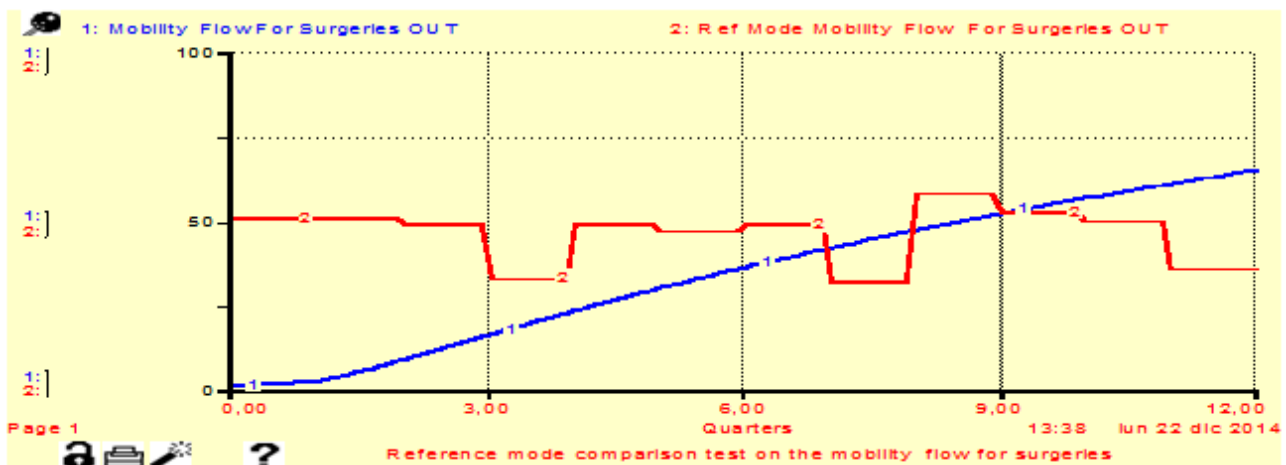


Figure 44. Reference mode comparison test on the mobility flow for surgeries (line1 = simulation; blue line= reference mode)

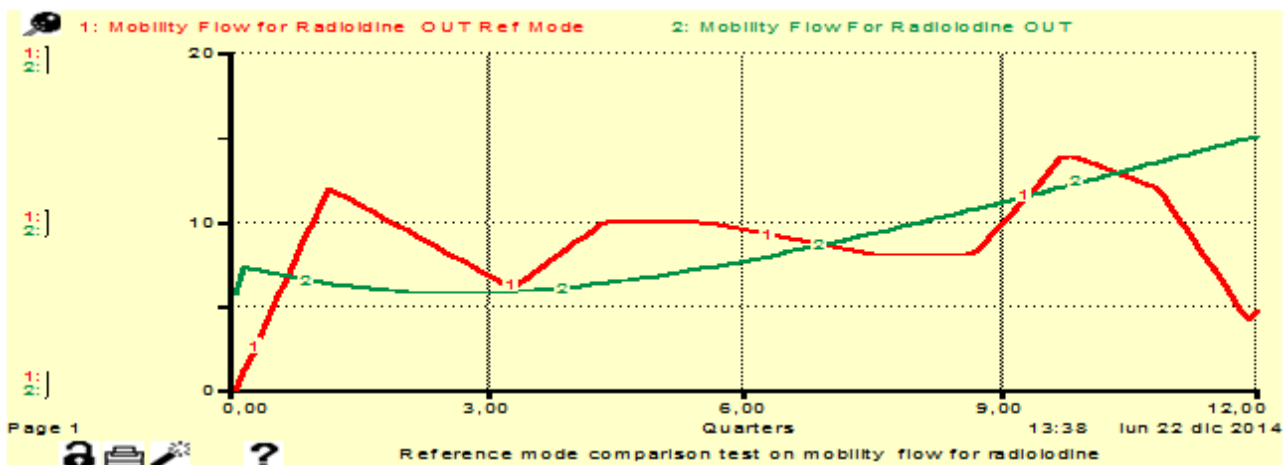


Figure 45. Reference mode comparison test on mobility flow for radioiodine (line 1= reference mode; line 2= simulation).

⁴⁴ Data gathered from the clinical records data available from the Regional Healthcare informative system. The mobility for surgery flow includes the Diagnosis Code ICD9CM related to Drg 290, identified through interviews to Endocrinological Specialist Physicians and some staff units of the Epidemiological Observatory (193=Thyroid Cancer, 244.0= Acquired Hypothyroidism; V10.87= Personal anamnesis of thyroid cancer). The mobility for radioiodine flow was identified through the Intervention Code ICD9CM 064= radioiodine. The data of the hospitalizations was taken considering the cohort of patients, in primary and secondary diagnosis and eliminating the repeated hospitalizations.

⁴⁵ The simulations refer to a period of 12 quarters, corresponding to a 3-years timeframe.

It is worth remarking that this test compares simulations about the surgeries and reference modes about the hospitalizations, assuming this way that all the hospitalizations (excluded the ones for radioiodine treatments which were unequivocally identified by a specific ICD9CM intervention code) took place for surgeries.

Regarding the mobility for specialist services, the data was on annual basis and only two points were available. Due to this lack of data, the reference mode was built with average values per quarter and the test had the scope to verify whether the model is able to simulate realistic values⁴⁶. In figures 46 and 49 it is noticeable that the simulation undergoes the reference behavior (even considering a longer timeframe of 24 quarters).

Notwithstanding, the fact is not believed to undermine the trustworthiness of the model: in this case the model reproduce the problematic behavior adequately for the mentioned purpose.

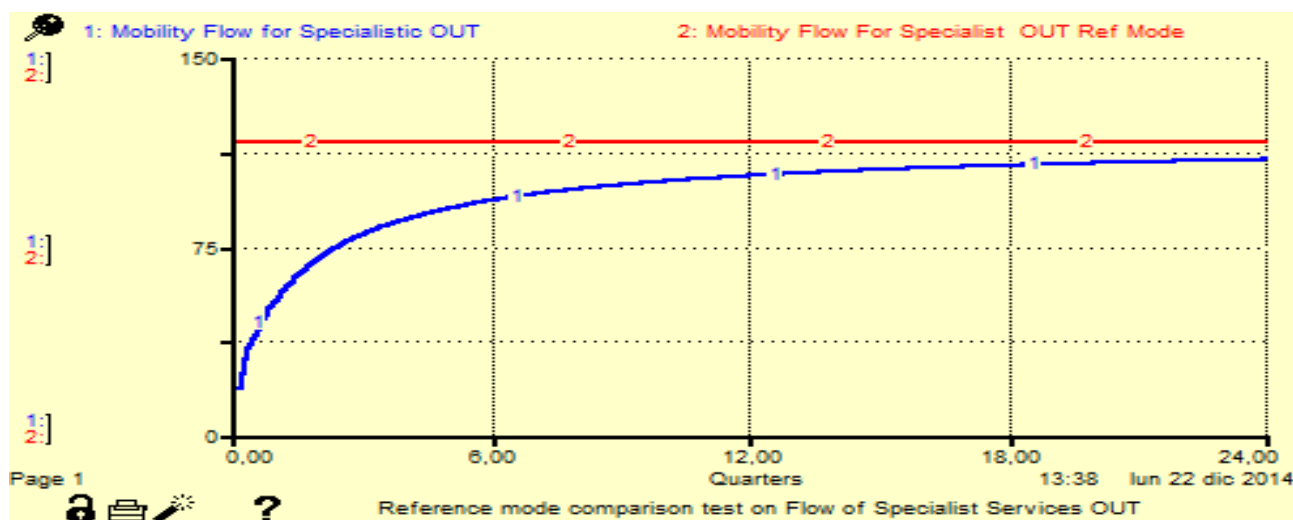


Figure 46. Reference mode comparison test on flow of specialist services out (line 1= simulation; line2= reference mode)

⁴⁶ This data refer to the specialist outpatients services strictly related to the thyroid cancer diagnostic and therapeutic path, identified with the following codes: 0601=extraction in the thyroid region, 91481= thyroid biopsy; 92011= thyroid capitation, 92013= thyroid scintigraphy; 92014= thyroid scintigraphy with positive indicators; 92183= search of thyroid cancer metastases.

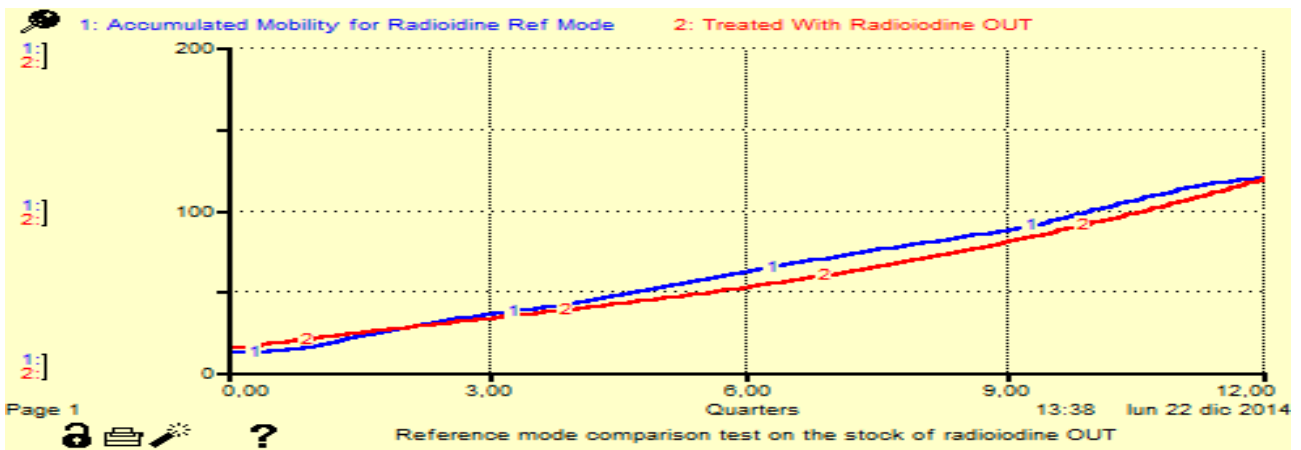


Figure 47. Reference mode comparison test on stock of radioiodine treatments out (line 1= reference mode; line 2= simulation)

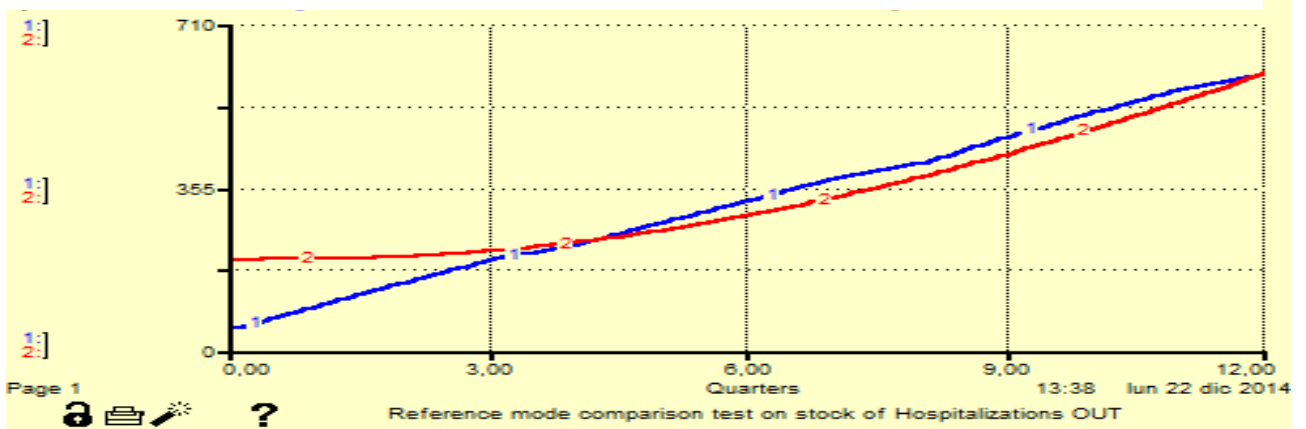


Figure 48. Reference mode comparison test on stock of surgeries out (line 1= reference mode; line 2= simulation)

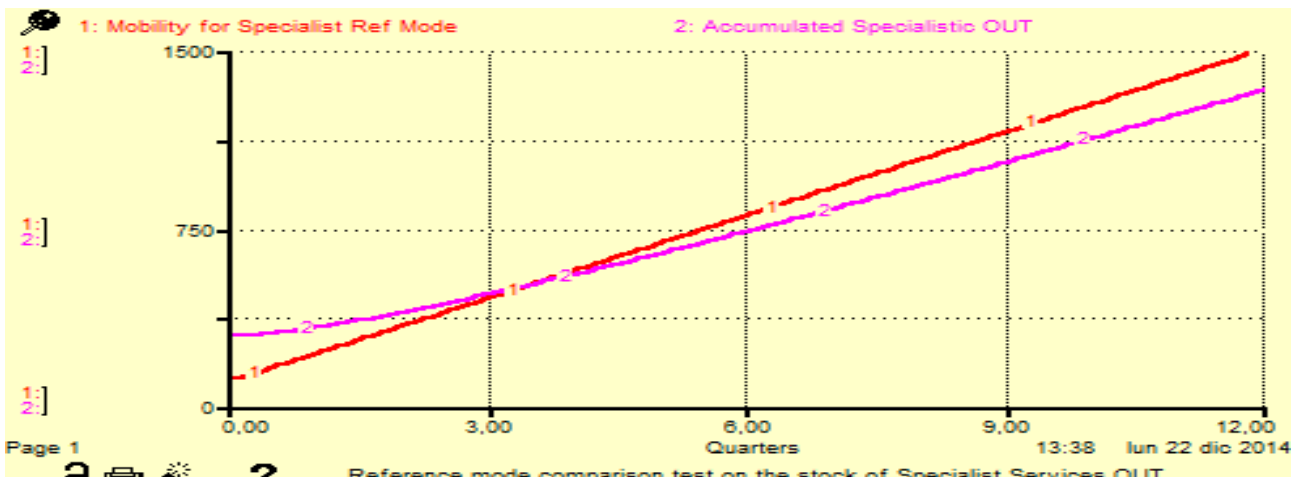


Figure 49. Reference mode comparison test on stock of specialist services out (line 1= reference mode; line 2= simulation)

On the other side, the model underestimate the internal supply of hospitalizations and radioiodine treatments⁴⁷ (figure 50 & 51). The flows feeding those stocks are governed by the estimated spare bed capacities⁴⁸ to face the demand respectively for thyroid cancer hospitalizations and radioiodine. The next versions of the model will try to fix the shortcoming, in order to give a better explanation of these behavior patterns, not fully captured by the variables' interconnection identified in the model building up to now.

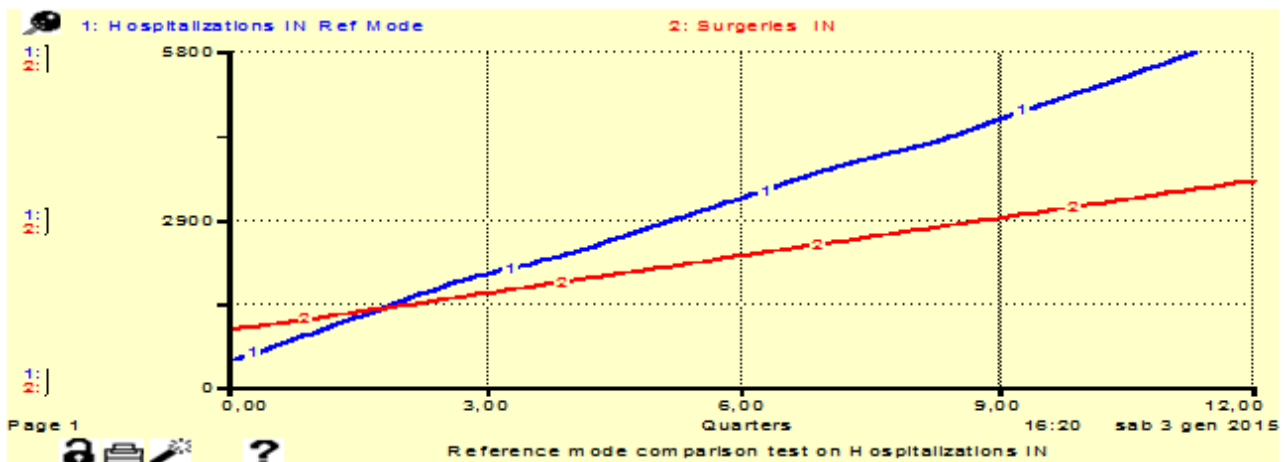


Figure 50. Reference mode comparison test on stock of Hospitalization in Sicily (line 1= reference mode; line 2= simulation).

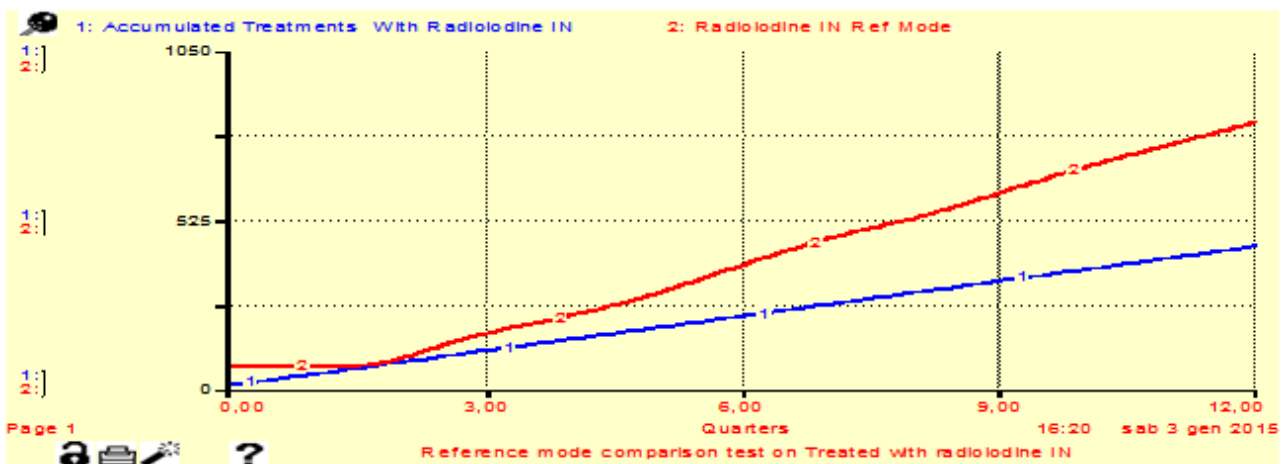


Figure 51. Reference mode comparison test on stock of treatments of radioiodine in Sicily (line 1= simulation; line= reference mode)

⁴⁷ The reference modes for the internal supply were built referring to the hospitalizations and the radioiodine treatments provided in the province, regardless of the residence of the patients. Thus the internal demand of the Palermo LHA also took into account the patients' intra-regional mobility from the other Sicilian provinces who referred to the health care of Palermo.

⁴⁸ As previously reported, since the bed resources are not dedicated just to the thyroid cancer management, the capacity was calculated through the proportion of hospitalization days for the thyroid cancer treatment in Sicily over the available hospitalization days.

Test 4: Extreme condition test

This test consists of assigning extreme values to selected parameters and comparing the model-generated behavior to the observed (“or anticipated”) behavior of the real system, under the same extreme condition (Barlas, 1989).

As extreme assumption the specialist fractional rate, which represents the initial input to the entire diagnostic and therapeutic path, was posed at zero without changing the other initial conditions. The expected behavior was the zeroing of the mobility flows.

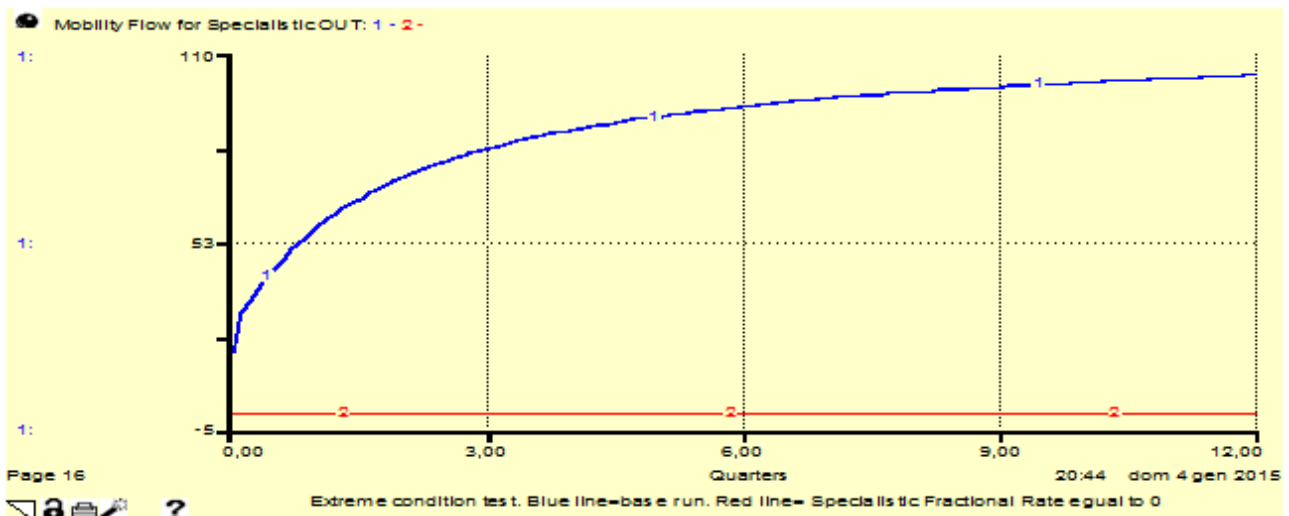


Figure 52. Extreme condition test on mobility flow for specialist services. Line 1=base run. Line 2= Simulation with Specialist Fractional Rate equal to 0.

The simulations confirm this prediction in the cases of mobility for specialist services and for surgeries (figure 52 and 53). Notwithstanding, the mobility flow for radioiodine services (figure 54) presents a reduced trend but the anticipated behavior does not find confirmation. In this case the positive results of reference mode comparison test revealed some weaknesses. Future structural changes are required for the portion of the model regarding the radioiodine services provision.

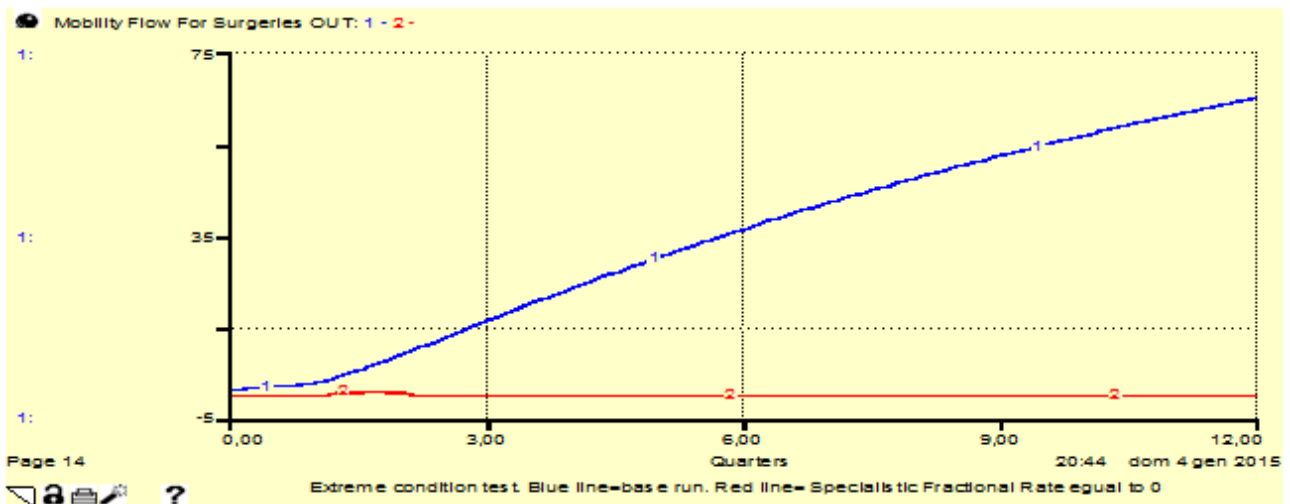


Figure 53. Extreme condition test on the mobility flow for surgeries. Line 1=base run. Line 2= Simulation with Specialist Fractional Rate equal to 0

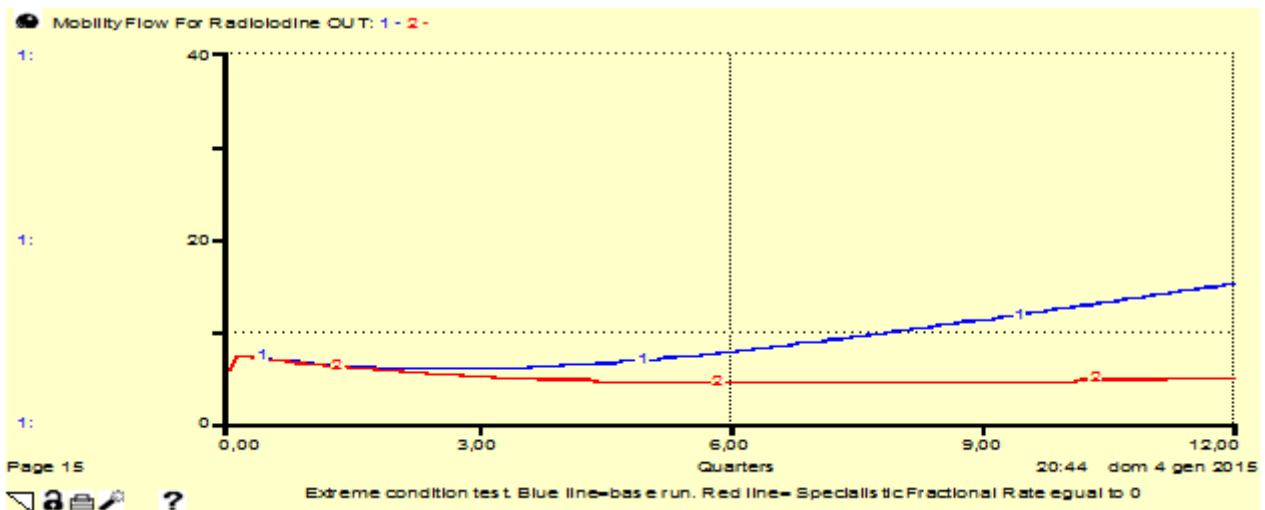


Figure 54. Extreme condition test on the mobility flow for radioiodine services out. Line 1=base run. Line 2= Simulation with Specialist Fractional Rate equal to 0

Test 5: Parameter sensitivity test

These tests “determine those parameters to which the model behavior displays high sensitivity, and ask if the real system would exhibit a similar high sensitivity” (Barlas, 1989). The ultimate scope of such analysis was to identify “leverage points” in the system, i.e. understanding if changes in one parameter are able to affect the fundamental pattern of behavior or just numerical differences can be envisaged.

The outputs of the tests were useful to acquire awareness about the effects of the uncertainties within the model and to set the priorities for further data researches and parameter estimations.

To this aim, some uncertain parameter were selected and for each of them four simulations with alternative values were made.

The parameters under test were the specialist fractional rate, the fraction of people needing surgery, the fraction of people needing radioiodine and the comfort of the healthcare facilities.

The table in figure 55 summarizes the tests carried out on the model. They were undertaken *ceteris paribus*: for example, after testing the sensitivity of the model to the parameter Specialist Fractional Rate, this parameter was re-set at its initial value, and then carried out the sensitivity test to the Fraction of People Needing Surgery, and so on.

	Specialist Fractional Rate	Fraction of People Needing Surgery	Fraction of People Needing Radioiodine	Comfort of the Healthcare Facilities
Initial value	0.0075	0.08	0.05	2.9
Test 1	0.01	0.04	0.025	3.6
Test 2	0.0125	0.10	0.075	4.3
Test 3	0.015	0.12	0.01	5

Figure 55. Summary of the sensitivity tests undertaken on the model.

Regarding the Specialist Fractional Rate, the simulations (please see appendix 2) show that all the mobility flows present numerical differences, still maintaining the fundamental behaviour patterns. The numerical gaps are more relevant for the curve of mobility flow for specialist services, and this is not surprising as the fraction directly affects the demand for specialist endocrinological services.

Changes to the Fraction of People Needing Surgery dramatically affect the behavior pattern of the mobility flows for surgeries and for radioiodine treatments, in spite of the non remarkable effects of the parameter alteration on the mobility for specialist services (appendix 3).

The sensitivity tests on the parameter Fraction of People Needing Radioiodine are not showing any difference in the simulations regarding the mobility flows for specialist services and for surgeries, while the mobility flow for radioiodine services presents appreciable differences, still maintaining the same behavior pattern (appendix 4).

The sensitivity test assigned to the parameter “comfort of healthcare facilities” (appendix 5) higher values than the initial one (2.9, average resulting from the patients’ survey) up to the maximum achievable, equal to 5 (highest available score). In this case all the mobility flows are sensitive to the parameter’s variations, and it is possible to envisage a policy potential. Indeed, the “comfort of healthcare facility” can be shaped by the decision makers, i.e. it could be a lever to activate for the improvement of the general patterns of behavior, in spite of the relative uncontrollability of the other parameters under test.

4. Alternative policies design

The model presented in this work was developed to support the concerns about the patients’ mobility of the Sicilian Healthcare Administration, and it mapped the flows of people accessing the health care services in Sicily and in other Italian regions.

Notwithstanding, the SD model is not only an useful instrument to visualize and analyze the complex processes involving the Sicilian patients’ flows from the diagnosis to the therapy and follow up sector, but it also allows to run simulations highlighting potential issues and opportunities for improvement. This can enable different actors to develop more robust plans and strategies and test them (together with possible trade-offs) in a relatively risk free environment, i.e. before proceeding with strategies implementations.

For instance, the desired effect of a policy undertaken in a certain section of the system, could be compensated by other dynamics happening elsewhere in the system, not immediately recognizable (Sterman, 2000).

The model is based on several assumptions, and other limitations have been highlighted along the iterative process of model validation. These issues will not be disregarded in the next researches and will constitute the premises for new model building activities, data/information requirements and more accurate estimations.

In spite of the room for future improvements, it is possible to explore the policy making implications of the SD model constructed up to now, which is then intended to have both descriptive and normative valence. Given the complexity of the whole system's management, its usefulness can lie on exploring aspects of demand, supply and service configuration as well as understanding if/how/where to move organizational resources such as beds and physicians.

Each sector in which the health care operates is characterized by distinct concerns and may be relatively unaware of the inputs provided by other portions of the system, thus the use of simulations can be useful to support decision making and scenario analyses. This issue is particularly crucial at the present times of spending review and/or healthcare expenditure rationalizations.

Bearing in mind that the entire "system taking in charge the patient" would imply not to focus on the mere hospital borders, but also to make a coordination effort between the hospital care and the sectors upstream and downstream, six policy options were identified and simulated for a 5-years period (corresponding to 20 quarters) starting from time 13 (i.e. immediately after the reference mode's timeframe).

All the policies were conceived according to the instrumental view (Bianchi, 2009: 121) which make explicit how to improve the objects of the performance management system. In order to affect the end-results (mobility flows), it is necessary to identify the intermediate performance drivers, for example, the ratio between the perceived quality in and out of Sicily.

The latter cannot be directly influenced by the policy makers, thus the concrete decisions would imply to intervene on those levers able to govern the processes of accumulation and depletion of the strategic resources. Acting on the strategic resources is likely to disclose effects on the chain of feedback relations linking different levels of performance drivers, end-results and (again) strategic resources towards the desired direction.

Option 1: No policy

The first possibility is not to undertake any policy and maintaining the *status quo*. The decision not to contrast the inter-regional mobility is not necessarily related to a problem underestimation and it may actually correspond to a precise internal strategy of patients' exports. It was reported that in some cases the Regional and Local Healthcare Administration empower GPs and pediatricians capacity of gate-keeping to increase the spillovers to other Regions (Longo, 2012:75). In the present work this policy option is not considered neither desirable nor feasible because the pathology analyzed is particularly diffuse in the region and the regional and local health care systems are supposed to give a local answer to the needs of the citizens.

Option 2: Bed policy

The second option consists of an increase of the endocrinological surgical beds by 5 units. This policy frees up some capacity in the hospital sector, so that the surgeries in Sicily increase and the incentive to the mobility for surgery is reduced, with subsequent reduction of the total mobility costs. On the contrary, it has no effect on the rising waiting list for endocrinological visits. In the long term it puts some pressure on the upstream sector: more people complete the diagnostic and therapeutic path in Sicily, so that (due to the increase in the follow ups) the waiting time for specialist visits rises up, together with the patients' mobility to receive those services in other regions.



Figure 56. Policy 2 scenario analysis about the mobility flow for surgery out of Sicily.

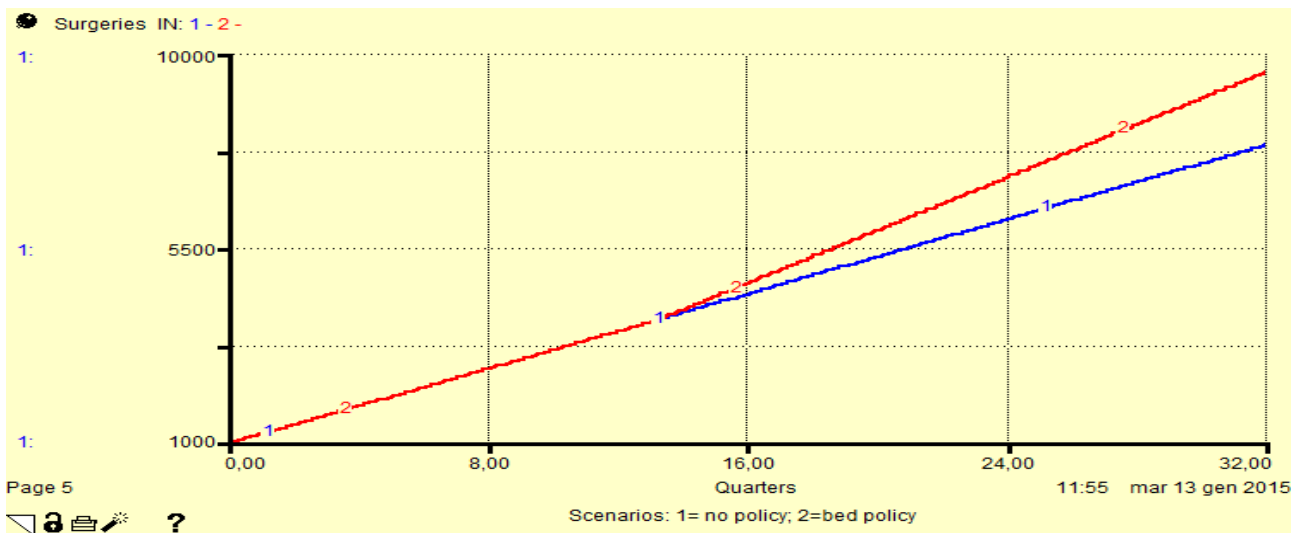


Figure 57. Policy 2 scenario analysis about the stock of surgeries in Sicily.

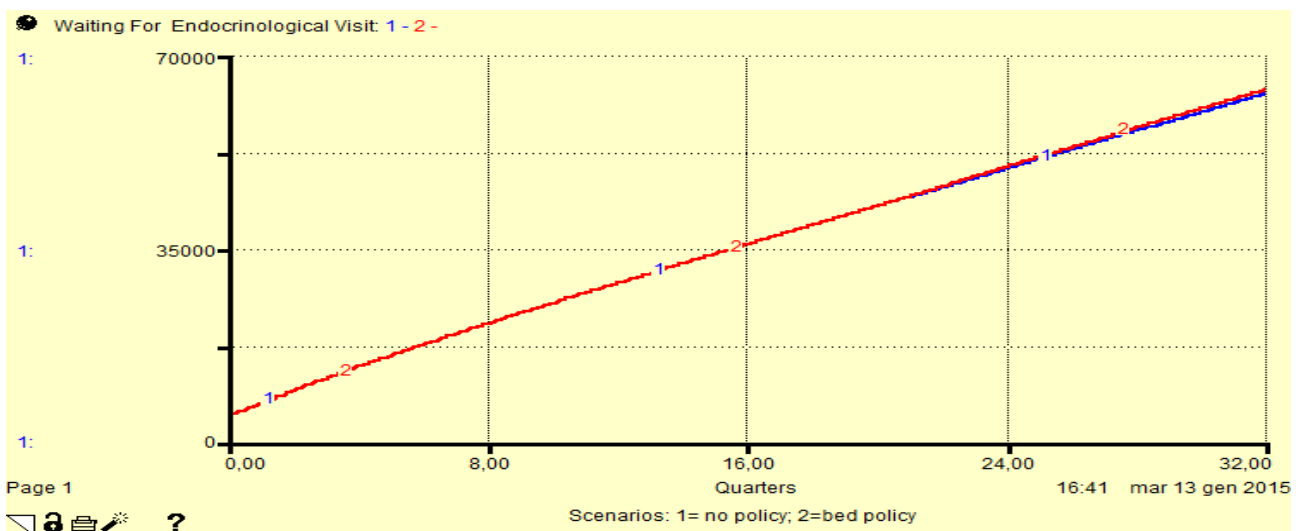


Figure 58. Policy 2 scenario analysis about the waiting list for endocrinological visits.

Option 3: Outpatient policy

Another possibility is to shift the balance of care through an enhancement of the human resources within the outpatients service sector (increase in the number of thyroid endocrinologists, e.g. hiring 1 physician). So far the policy option has a sensible effect on the waiting lists for endocrinological visit, as well as on the patients' mobility for specialist services; but alone it is ineffective in the reduction of the surgical and radioiodine mobility. It rather has the unintended consequence to stimulates the Sicilian demand for surgeries and

for radioiodine treatments, whose increase cannot be satisfied by the current capacity of the system, then the mobility flows augment for the sectors downstream.

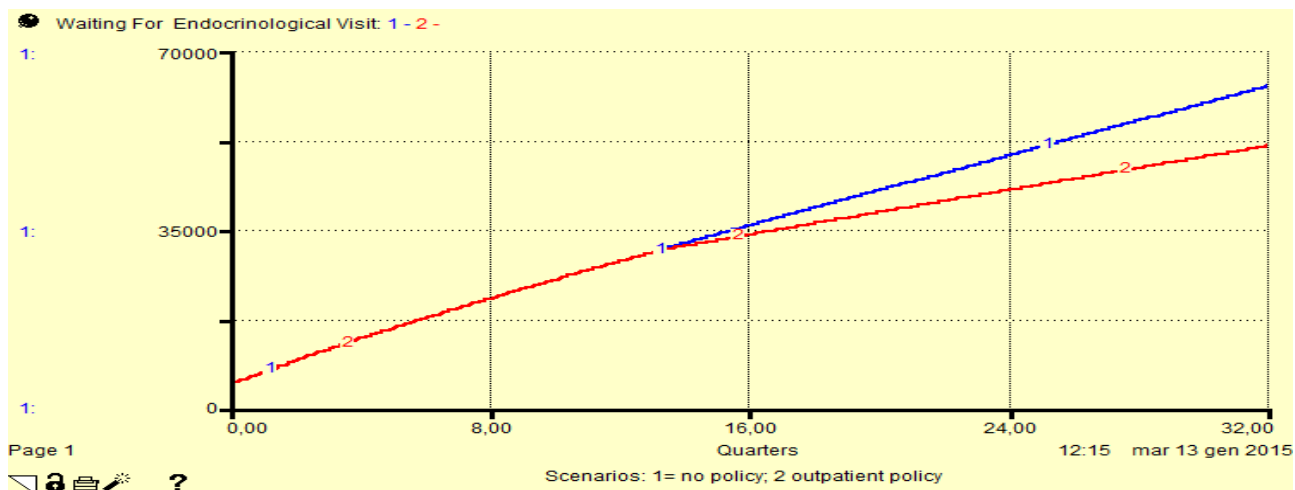


Figure 59. Policy 3 scenario analysis about the waiting list in Sicily for endocrinological visit.



Figure 60. Policy 3 scenario analysis about the mobility flow for surgery.



Figure 61. Policy 3 scenario analysis about the mobility for radioiodine.

Option 4: Radioiodine policy

The fourth possible policy focuses on the last part of the diagnostic and therapeutic path and increases the number of radioiodine beds by the 50% (i.e. adding 1 more radioiodine bed). The simulations show a reduction in the mobility for radioiodine but no dramatic effects on the other sectors can be envisaged.

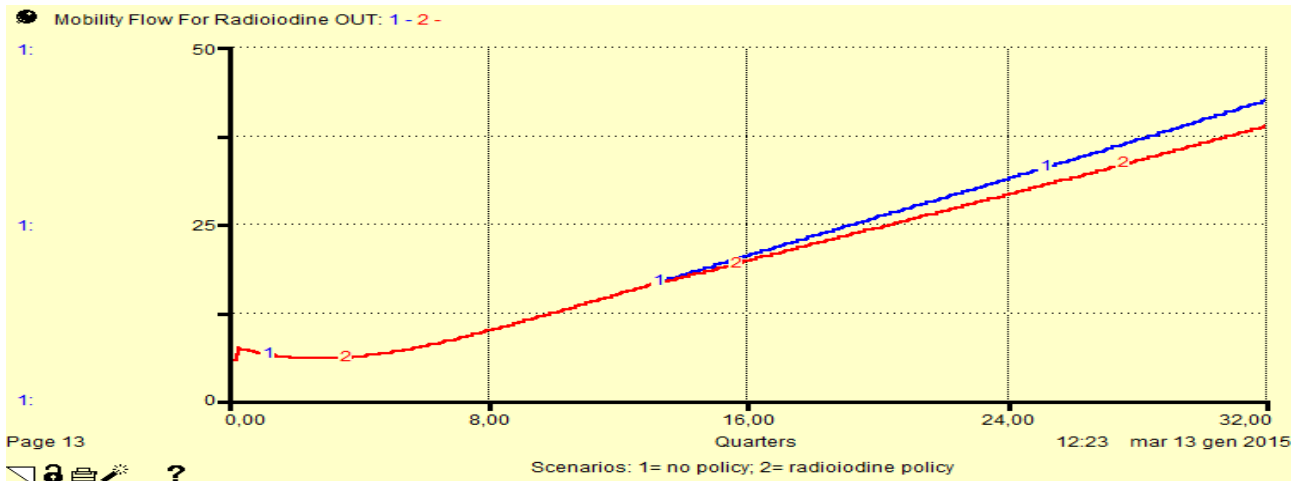


Figure 62. Policy 4 scenario analysis about the mobility flow for radioiodine treatments

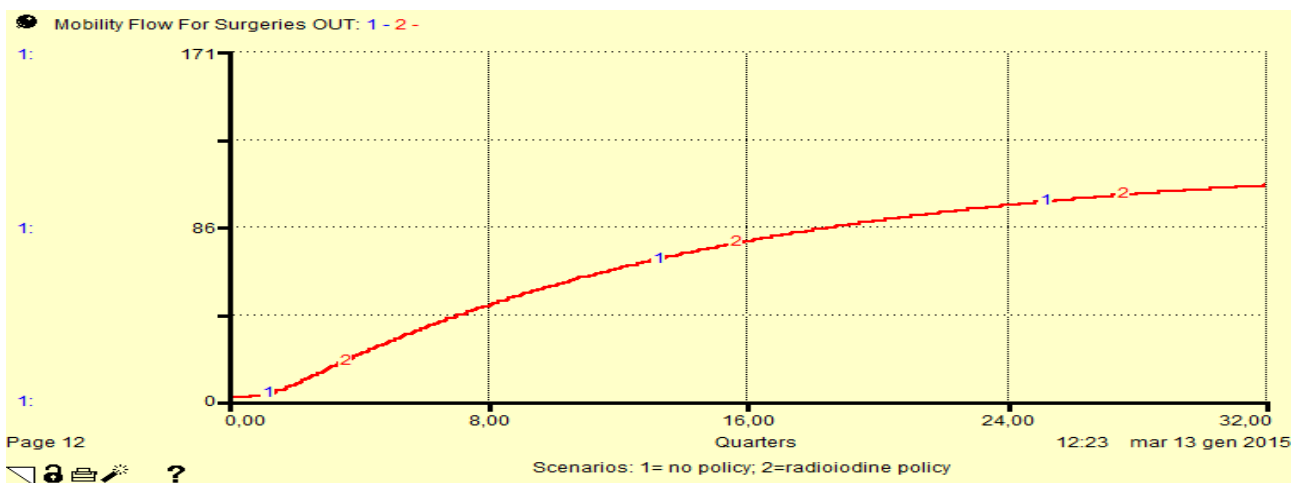


Figure 63. Policy 4 scenario analysis about the mobility flow for radioiodine treatments.

Option 5: Combination of bed policy and outpatient policy

This option reduces the patients' mobility for specialist services, surgeries and radioiodine more than the other policies, and also brings the benefit to address the local demand for specialist services due to the follow ups.

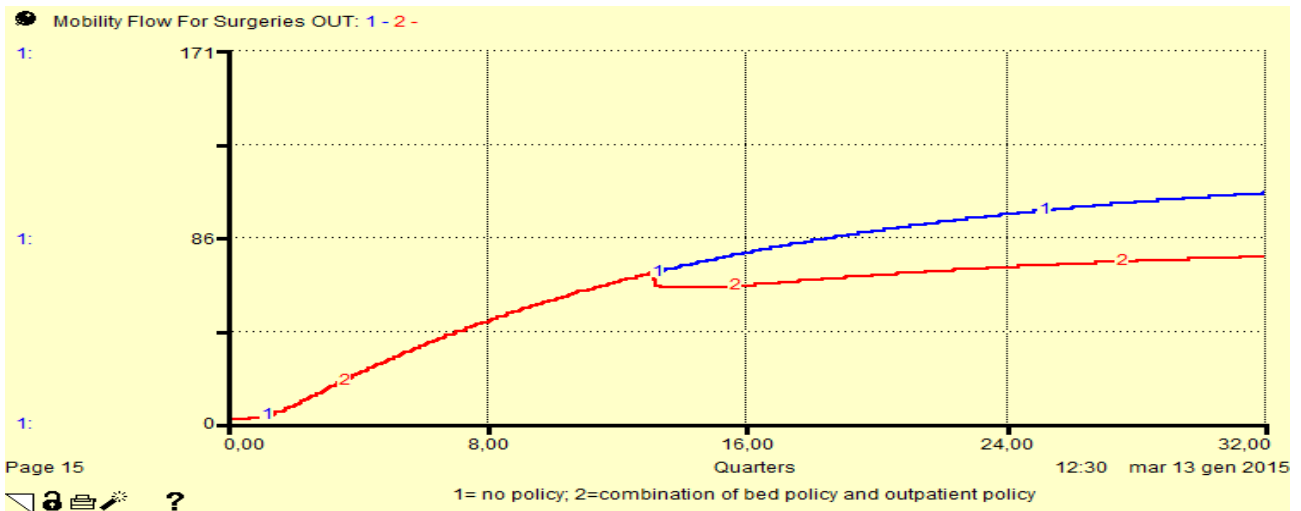


Figure 64. Policy 5 scenario analysis about the mobility flow for surgeries

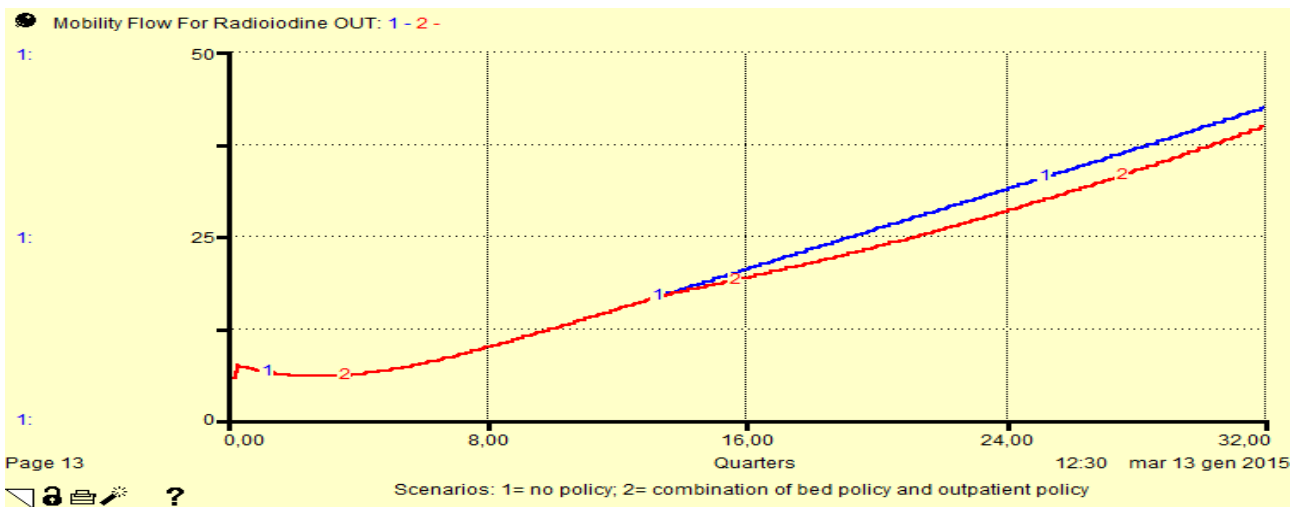


Figure 65. Policy 4 scenario analysis about the mobility flow for radioiodine.

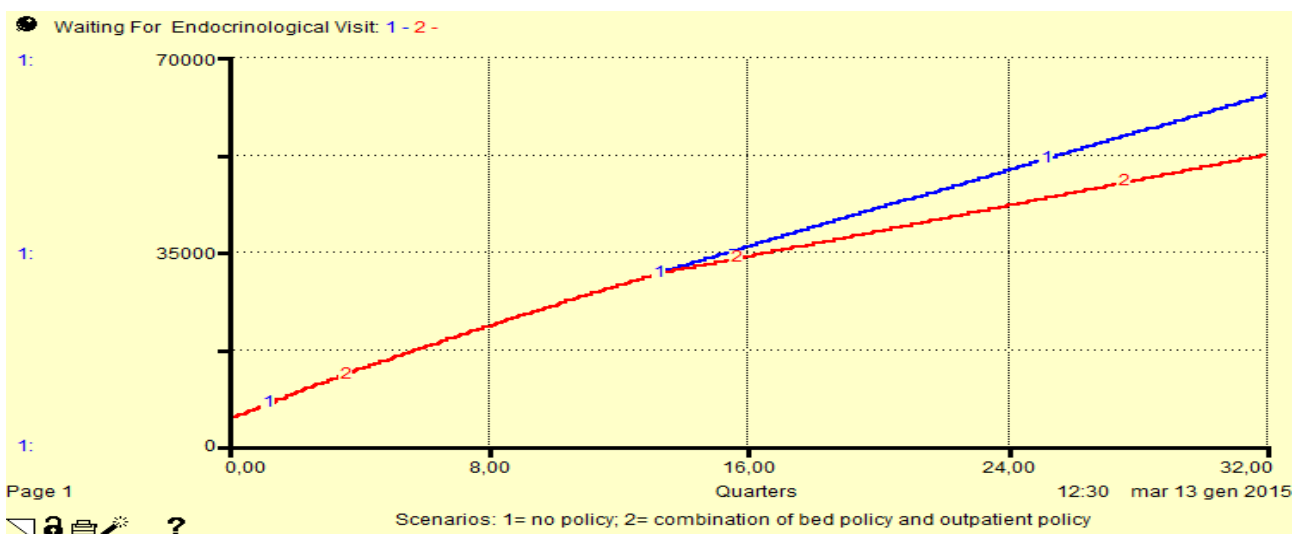


Figure 66. Policy 4 scenario analysis about the waiting list for endocrinological visits.

Looking at figure 67, it is possible to appreciate the location of the policy options investigate up to now on the model’s feedback structure. All the policies act primarily on one component of the patients mobility fraction, the mobility indicated by the system’s capacity.

Among the possibilities, the combination of bed and outpatient policy is desirable because it takes into consideration the system dynamics flow perspective of health service (Wolstenholme, 1999: 254) and does not solely apply leverage at the point at which the symptoms of the issues show themselves (the hospital sector).

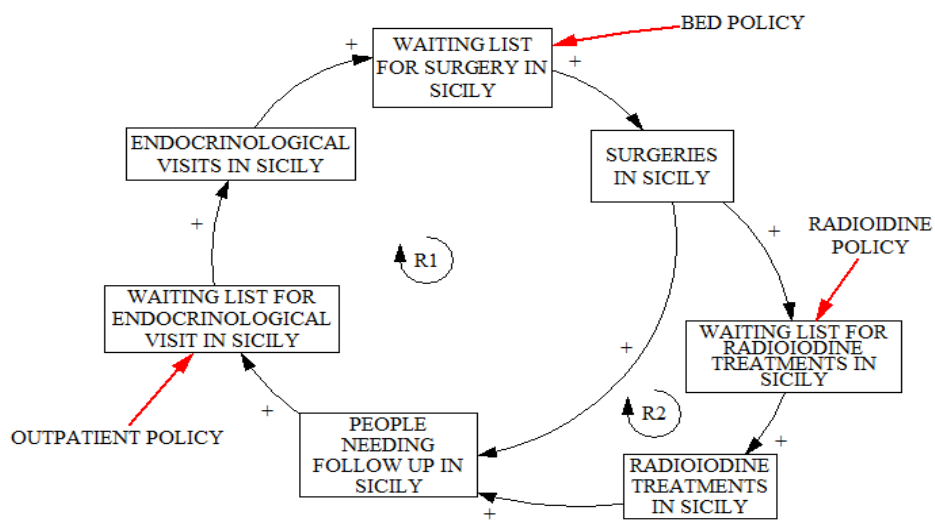


Figure 67. Location of policies 2, 3, 4, 5 in the model’s feedback structure.

Option 6: Booking system policy

The policy consists of creating a new booking system integrating the different hospital and community care facilities. This measure impacts on the variable “comfort of the healthcare facilities”, indicated as a policy parameter during the model’s sensitivity tests.

This time the policy does not rely on the alternative to increase the capacity of the system, but it rather crosses the organizational boundaries and wishes to foster a more collaborative approach among the professionals operating in different areas of the healthcare

system, in order to provide an integrated healthcare package in line to the purpose of public value provision to the patient.

The measure is assumed to bring a 1-point increment in the parameter, which causes the perceived quality of the Sicilian healthcare system to raise, thereby discouraging the mobility fraction indicated by word-of-mouth.

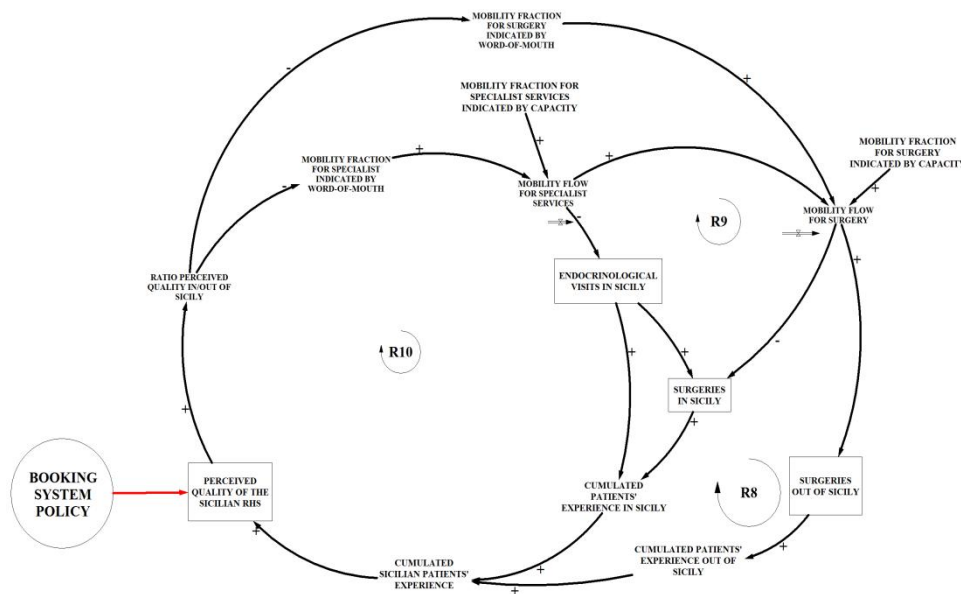


Figure 68. Location of the booking system policy in the model's feedback structure.

So far, compared to the combined bed-outpatient option, the booking system policy leads to similar simulation results for the mobility flow for surgeries (figure 69) and for the cumulated costs for mobility, and better results for the mobility flow for specialist services (figure 70) and for radioiodine (figure 71).

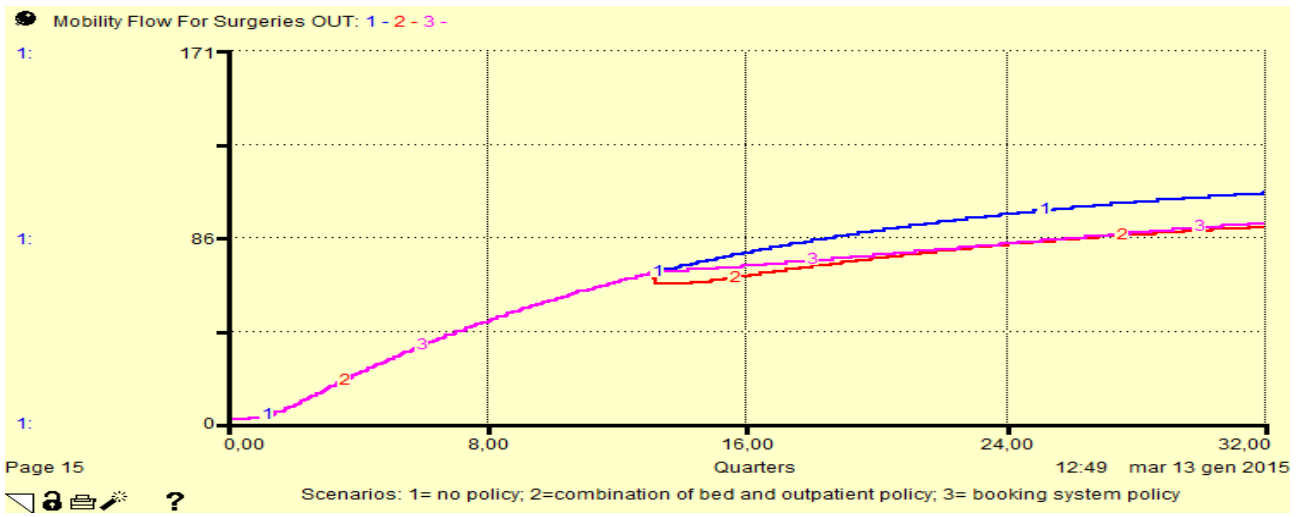


Figure 69. Comparison of policy results for the mobility flow for surgery.

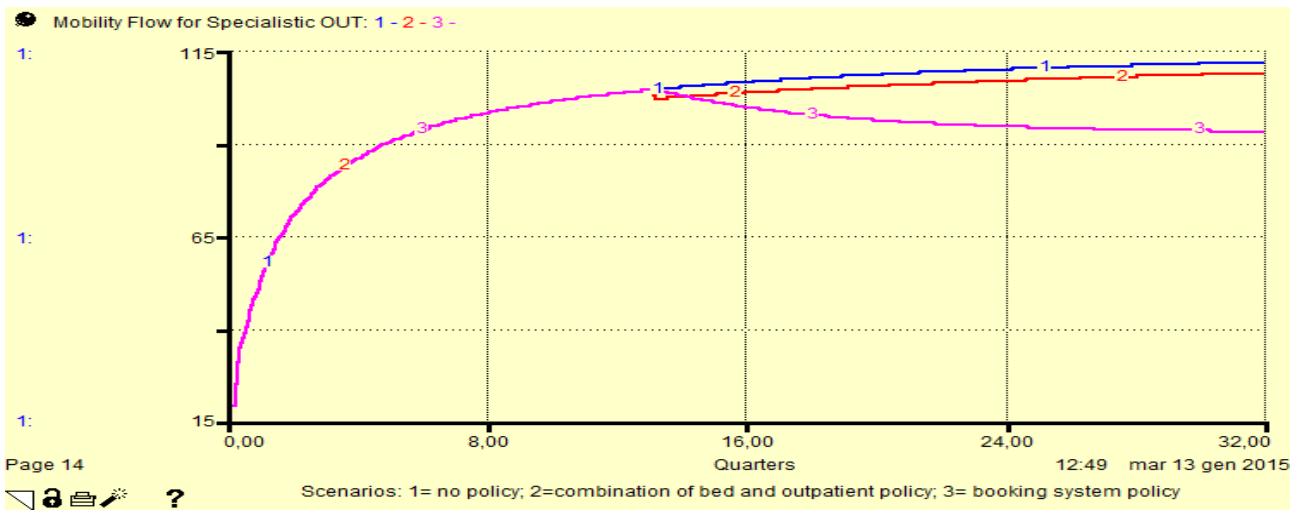


Figure 70. Comparison of policy results for the mobility flow for specialist services.

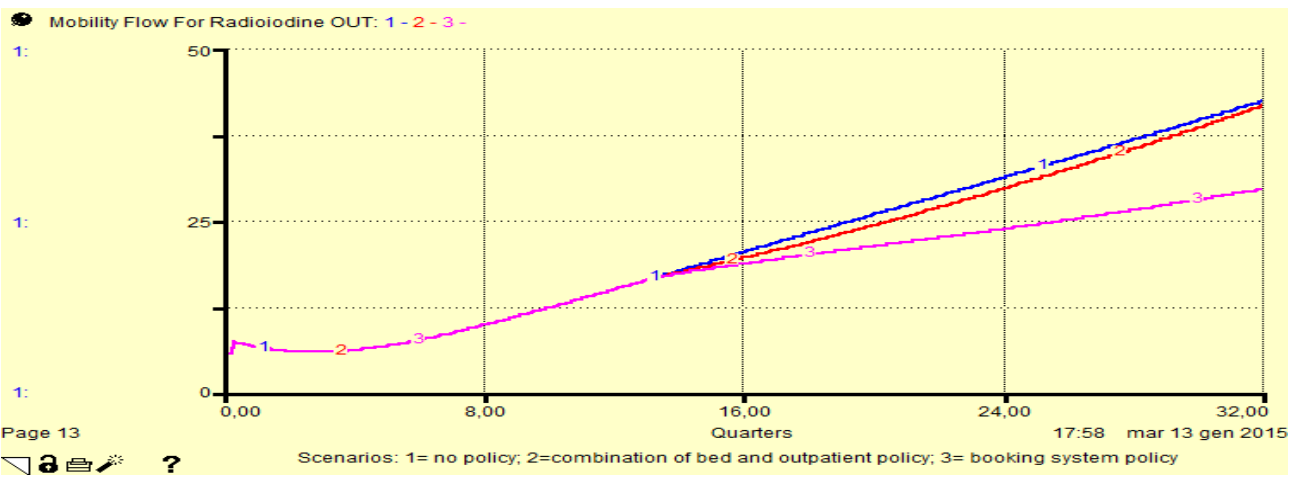


Figure 71. Comparison of policy results for the mobility flow for radioiodine treatments.

Conclusions and future researches

This thesis presented the main findings of a one-year research project on the inter-regional patients' mobility, conducted in collaboration with the Sicilian Healthcare Administration. The aim was to address the phenomenon making at the same time a theoretical and a practical contribution. To reach this scope, the qualitative study relied on public management and administration theory and purposefully mixed several approaches and methods for problem definition and analysis, data gathering, alternative policies design. Those activities have converged to the gradual building of a Dynamic Performance Management System, also translated into a simulation System Dynamics model, consisting of a stock-and-flow structure representing the most relevant causal relationships between strategic resources, end-results and mobility performance drivers.

The model is based on several assumptions (boundaries of the relevant system, initial conditions of the stocks, equations' formulation, sensitivity to uncertain parameters, estimation of nonlinear effects). These issues will not be disregarded in the next researches and will constitute the premises for new model building activities, data/information requirements and more accurate parameter estimations.

With the opportune adjustments underlined during the iterative process of validation, such model can represent a evaluative and predictive tool to analyze the sustainability and effectiveness of the regional healthcare policies. Its usefulness is expected to be appreciated by the strategic management, planning and control, and hospital planning management areas. Despite the model was developed with a regional perspective, it was populated with Local Health Authority data. This fact is not believed to compromise the model's purpose (due to the similarities of the local and regional healthcare authorities' points of view) and future adaptations at the national and supranational level will be taken into consideration.

Notwithstanding, the model built was not the only outcome of the study. Since the beginning of the project, it was experienced the parceling of data and information about the healthcare process. In an inter-institutional and public governance-based perspective, the research framework itself can be intended as a analytic tool putting together the relevant

actors of the Sicilian Healthcare System, people with different disciplinary and methodological backgrounds, holding partial views about the phenomena.

The findings of the interviews, aided by the iterative System Dynamics approach, are wished to induce a strategic dialogue between parties in the public sector, which is a prerequisite for building mutual understanding, confidence and trust, and to establish a foundation for organizational learning, a key component in organizational development (Bianchi, 2010).

Indeed, the interacting with the key actors of the system was useful to elicit their mental models. The information gathered was analyzed in light of the public management theoretical frameworks, retrieving deep insights about the different visions of the problem and identifying discrepancies. The dissertation did not mean to exhaust the entire thematic about the public management and administration paradigms. It rather used them as reference archetypes leading pragmatically the research. The analysis conducted, progressively revealed that the inter-regional mobility phenomenon is at the top of a hidden iceberg. The Italian healthcare legislation of the last thirty years describes an architecture based on two main pillars, planning and evaluation, finding a lacking application in the Sicilian case.

The combination of public value management and performance management is considered useful for driving the policy making in the investigated context: both approaches put emphasis on change and dynamism, counteracting the traditional administrative attributes of stability and permanence, still envisaged in some aspects of the Sicilian Healthcare System.

The public value ethos provided the *leitmotiv* basic principles leading the research activity, in particular for the recognition of the need to work in partnership across the public, private, and voluntary sectors to contribute to the promotion of community well-being and to meet the needs of individuals. On the other side, the performance management approach, aided by the System Dynamics method, helped in giving a practical content to the challenges posed by the public value management and networked governance, which would otherwise remain mere statements of principle, observable in the dictation of laws and planning documents.

Looking at the patients' mobility problem from a Public Value Management perspective does not mean to simplistically omit or overpass the New Public Management lessons. The philosophy underlying the research is pragmatic (Alford and Hughes, 2008), so it contemplates the possibility to combine features from the public value management and from the previous archetypes. A similar position could be accepted in the public healthcare services planning: some parts of the system are likely to be governed by reticular cooperative logics, in other parts competitive and incentivizing mechanisms are worth to be triggered.

The application of NPM principles in the Italian public healthcare sector has not been uniform across the 21 regions. Emerging from the interviews to key-actors of the Sicilian Healthcare System, there is a 20 years gap comparing to other virtuous regions, and only in the last 5 years some attempts were done to promote changes and leave behind the traditional bureaucratic logics.

Moreover, the governance model that the Sicilian Healthcare System pursues (described in chapter 2) holds hybrid characteristics of public value management (and networked governance) and NPM; but in order to put it in practice, it will be worth for both politicians and officials to develop the aptitude to frame the dynamic complexity of the context. To this aim the decision makers are requested to abandon the limited focus on the efficiency of individual organizations, switching to the wider focus of the efficiency and effectiveness of the entire healthcare system, continuously asking themselves if their action is actually bringing a net benefit to the society. Another important issue raised during the interview phase was the role of the Local Health Authorities, designed with formal powers of healthcare purchasing, while the effective authority still lays on the Regional Healthcare Department, which in the facts is the ruler, the coordinator and the commissioner-purchaser.

The above processes of change can be fostered and motivated by the start/enhancement of systematic collaborations and continuous involvement of the key-actors of the system (public and private) about the decision making and service delivery implementation. In this regard, as evidenced in the first chapter, many SD scholars and practitioners (Vennix *et al*, 1994; Ackermann *et al*, 2010; Merrill *et al*, 2012) addressed public value-related issues through group model building sessions. This was not the case.

Although it is not deniable the validity of multi-actors modeling sections, here it was privileged a traditional case study enclosing the progressive involvement of the stakeholders in the modeling activity.

The reason of such decision was that the specific research problem was not clear from the beginning, and its focalization took some time and several iterations. It may be argued that the group model building could have been used also for the problem definition. Anyway, the researcher considered that a “collective problem definition” would have been confusing and misleading, not fitting the limited project’s time. Furthermore, it was considered that one-to-one meetings would have allowed more room for detail and depth.

For these reasons it was preferred to investigate the “mental model” of each key-actor separately in first place. Then, as much the qualitative research and modeling progresses were visible, it was registered a growing interest of the key-actors met during the research period, that expressed themselves the intention to take part to a “meeting to compare my opinion with others’ about what is going on”: this propensity to share is itself a practical advancement fostered by the SD modeling.

Therefore, the model built up to now is susceptible of improvements and it will be object of model building sessions with the relevant stakeholders for further validation, improvements and adaptations. Future versions of the model can be tailored to address the mobility flows for other diagnostic groups, envisaging for them other dynamics such as the accumulation of experience in relevant clinical records for the more complex pathologies. The new model may also include enlargements to other aspects of the mobility issue, strictly related to the quality of the health care, such as the inappropriateness of the health packages provided. Then the SD model boundaries will necessary change, e.g. the modeler may be required to make a distinction between the ordinary and day-hospital regimes for hospitalizations, to capture when less complex cases are provided in ordinary rather than DH or community care regimes. In this direction, it would be interesting to verify the links between elective hospitalizations and emergencies and their impact on waiting lists and perceived quality.

The present research used the questionnaire tool to enforce the qualitative analysis on the patients’ dimension. The sample was chosen purposefully in order that at least the half

of the respondents had travelled for health care at least once in the life. Anyway, some patients have experienced mobility before the start of the policies to contrast the mobility (2009), thus their responses do not incorporate the effect of these measures. To overcome this temporal inhomogeneity, the sample should have been built considering only patients who experienced mobility after that time. In addition, future researches may contemplate more robust analyses on the patients' dimension, enlarging the size of the sample within the same province or making comparisons among two or more provinces within the Sicilian territory.

The model-based policies designed in this work actually represent a wishful thinking to be complemented by studies of feasibility. In a more realistic perspective, the actual model is likely to be aided by new sectors, depicting the operational structure necessary for the implementation of the identified policies. This would also imply to extend the relevant system's boundaries (challenging new "clouds"), giving wider space to the economic and financial aspects, whose analysis was limited to the costs of health care packages up to now. New portions of the model could capture budget assignments, tariff reimbursements and new investment mechanisms, even distinguishing between the public and the private accredited sectors, and the hospital and community care operators.

The SD model proposed herewith did not capture the dynamics of the "returning fraction" of patients to access the Sicilian Healthcare services after having experienced the mobility. In addition, the word-of-mouth effect as modeled in here is based on nonlinear assumptions about the different complexities of the treatments to be provided. The modeling of such mechanism would actually benefit from psychological studies' inputs about how the patients (and in general the user) form their opinion about the quality of a certain service, the effects of the medical prescriptions and the inter-relationships among GPs and specialist physicians. So far the model developed, albeit capturing some aspect of the perceived quality of the regional healthcare system, does not contain any indicators of health outcome, which would be particularly relevant in order to capture the gap between perceived and effective quality of the healthcare supply in Sicily.

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Appendix 1: questionnaire administered to the panel of patients



Dear User,

We kindly ask you to take a few minutes to fill in this questionnaire, conducted as part of a research project sponsored by the University of Palermo in collaboration with the Regional Healthcare Councillorship (note Councillor Prot.14956 of 02/14/2014).

In compliance with the Law 196/2003 on privacy, sensitive data concerning your person will not be disclosed except in aggregated and anonymous form and will be used only for purposes related to this research.

Thanks for your cooperation

- 1) Name and Surname _____ 2) Date Of Birth _____
- 3) Gender F M 4) Place Of Birth _____
- 5) Place Of Residence _____ 6) Fiscal Code _____
- 7) Phone nr. _____
- 8) Qualification _____ 9) Occupation _____

10) How important do you consider the elements in the table below in the choice of health care facility? Give a rating from 0 to 5 to each element (where 0 = NOT AT ALL IMPORTANT 5= VERY IMPORTANT)	0	1	2	3	4	5
Acceptable waiting time to access care						
Proximity to home						
Positive opinion of family members and friends						
Indication of the GP						
Indications of specialist physician						
Other (please specify)						

11) How do you assess the health care received within this structure? Give a rating from 0 to 5 to each element in the table (where 0 = NOT AT ALL VERY SATISFACTORY 5=SATISFACTORY)	0	1	2	3	4	5
Welcoming department staff						
Quality of personnel						
Clarity of information received from the medical and nurse personnel						
Cleanness of the structures						
Comfort of the structure						
Easiness to book the treatments						
Acceptable waiting time to access care						
Other (please specify)						

12) Have you ever had the need to move to another region to receive health care?

- YES NO

13) What kind of health care you received outside the region (it is possible to tick more than one option)?

- Outpatient services (no hospitalization) year _____ destination place _____
- Surgery year _____ destination place _____
- Radioiodine treatment year _____ destination place _____
- Other (please specify) year _____ destination place _____

14) Why have you traveled to another region for care? Give a rating from 0 to 5 to each element in the table (where 0 = not at all important 5 = very important)	0	1	2	3	4	5
Indications of GP						
Indications of Specialist Physician						
Family members and friends' advise						
Presence of friends and / or family in the city where I received care						
I had no trust in the Sicilian Healthcare System						
Outside Sicily I expected a better quality of hospital						
Outside Sicily I expected a better quality of doctors						
I knew a doctor or a nurse in the hospital extra-region						
The waiting times were shorter outside Sicily						
Other (please specify)						

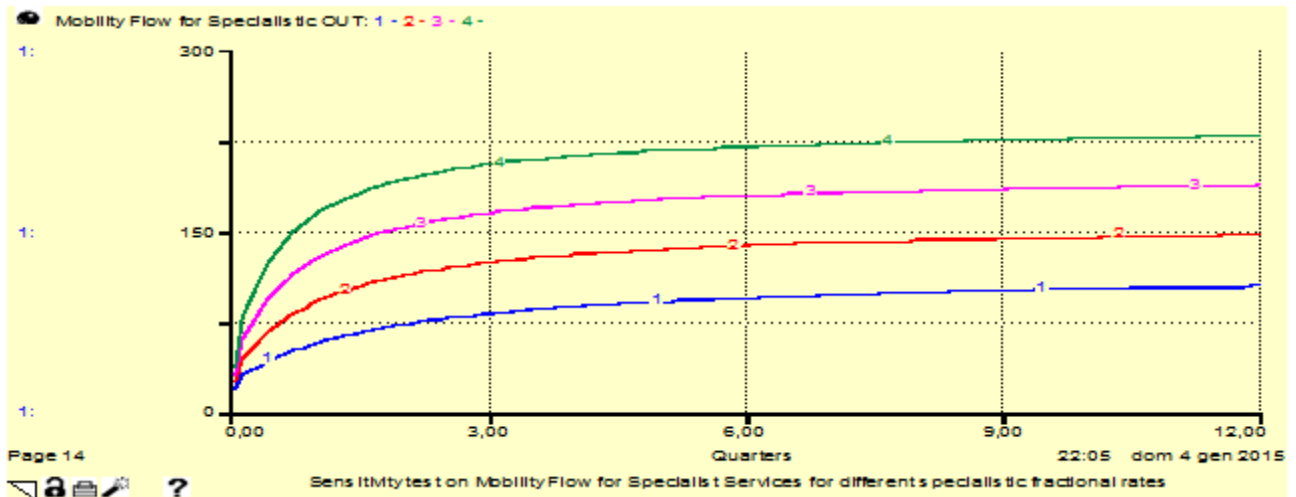
15) How much are the annual additional (not refunded) travel expenditures incurred by you and your carer? (tick the type of expenditure and indicate the approximate amount)

- Flight ticket euro _____ Hotel euro _____
- Public Transportation euro _____ Other (please specify) _____ euro _____

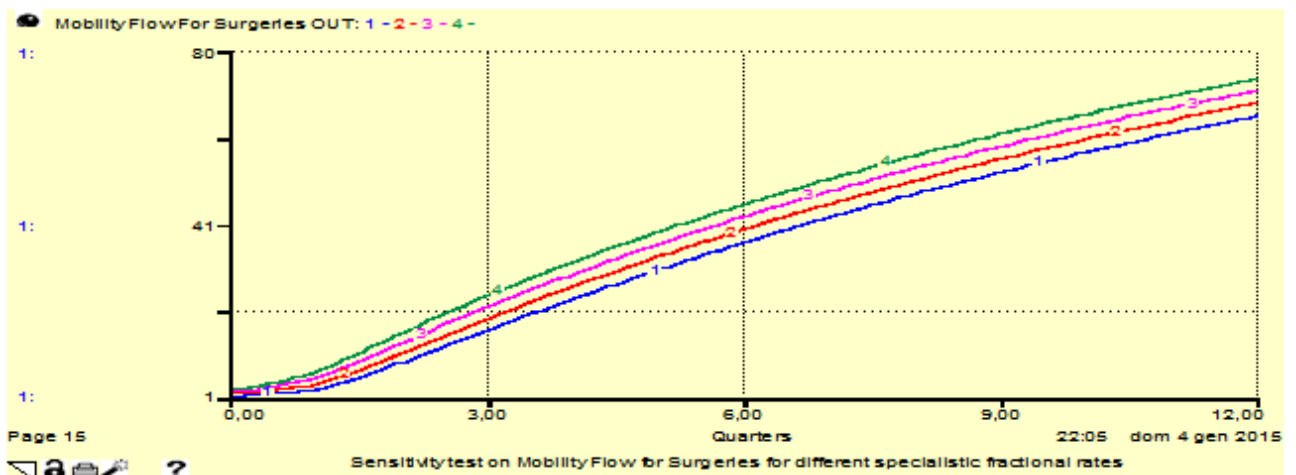
16) How do you rate the discomfort of receiving medical treatment outside your region of residence for you and your companion? Give a rating from 0 to 5 to each element in the table (where 0 = NOT AT ALL IMPORTANT 5=VERY IMPORTANT)	0	1	2	3	4	5
Loss of working days						
Psychological discomfort due to distance from home						
Travelling expenditures						
Other (please specify)						

17) How do you assess the health care received outside Sicily? Give a rating from 0 to 5 to each element in the table (where 0 = NOT AT ALL VERY SATISFACTORY 5=SATISFACTORY)	0	1	2	3	4	5
Welcoming department staff						
Quality of personnel						
Clarity of information received from the medical and nurse personnel						
Cleanness of the structures						
Comfort of the structure						
Easiness to book the treatments						
Acceptable waiting time to access care						
Other (specify)						

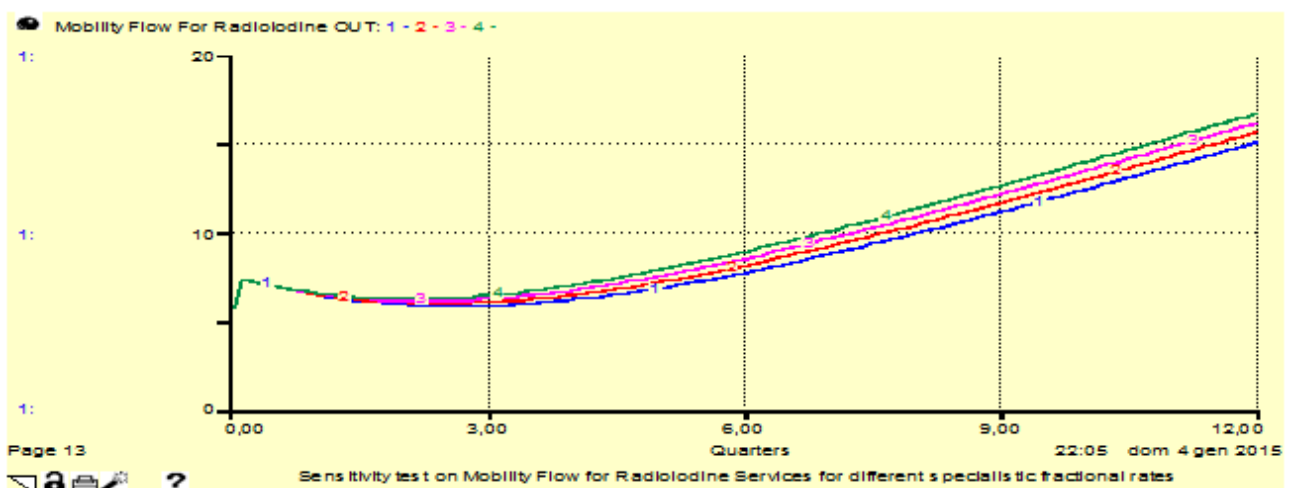
Appendix 2: Sensitivity tests on the parameter specialist fractional rate



1) Behavior of the mobility flow for specialist services after a sensitivity test on the specialist fractional rate (line 1=baselin 0.0075; line 2= 0.01; line 3= 0.0125; line 4= 0.015).

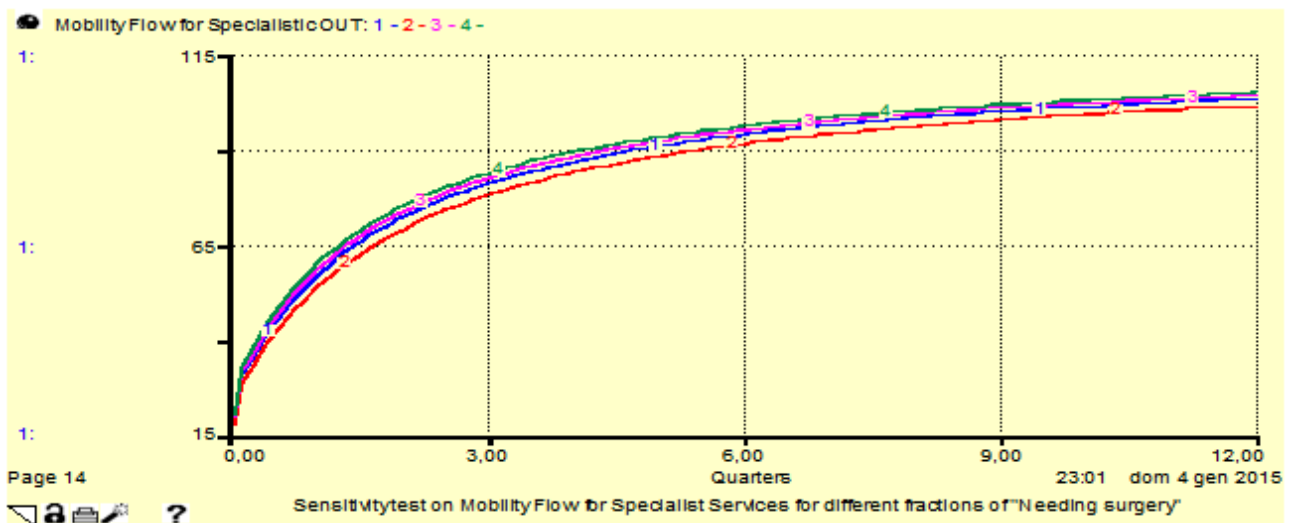


2) Behavior of the mobility flow for surgeries after a sensitivity test on the specialist fractional rate (line 1=baselin 0.0075; line 2= 0.01; line 3= 0.0125; line 4= 0.015)

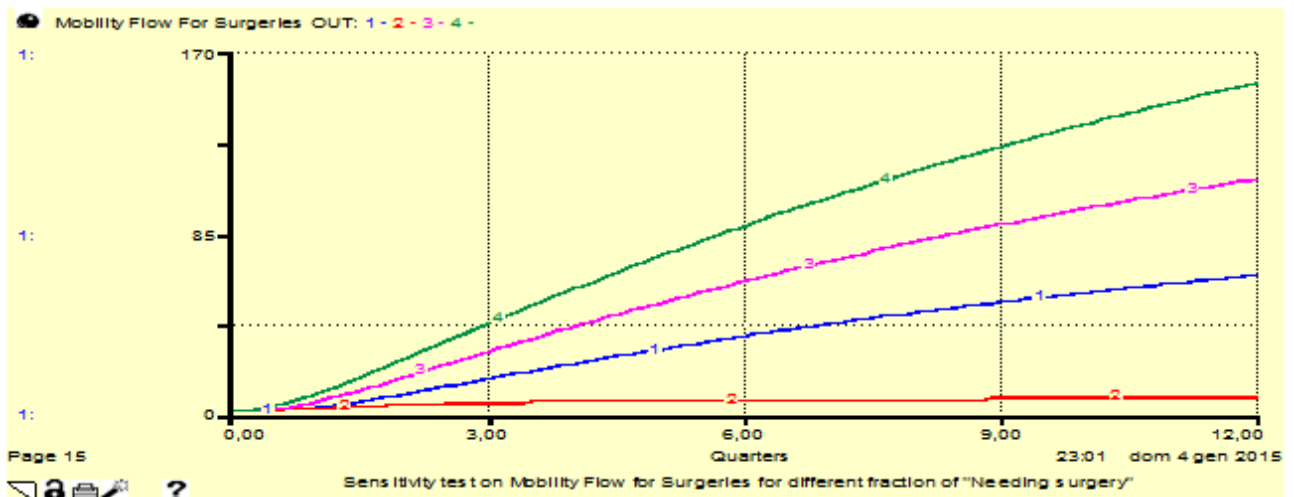


3) Behavior of the mobility flow for radioiodine services after a sensitivity test on the specialist fractional rate (line 1=baselin 0.0075; line 2= 0.01; line 3= 0.0125; line 4= 0.015)

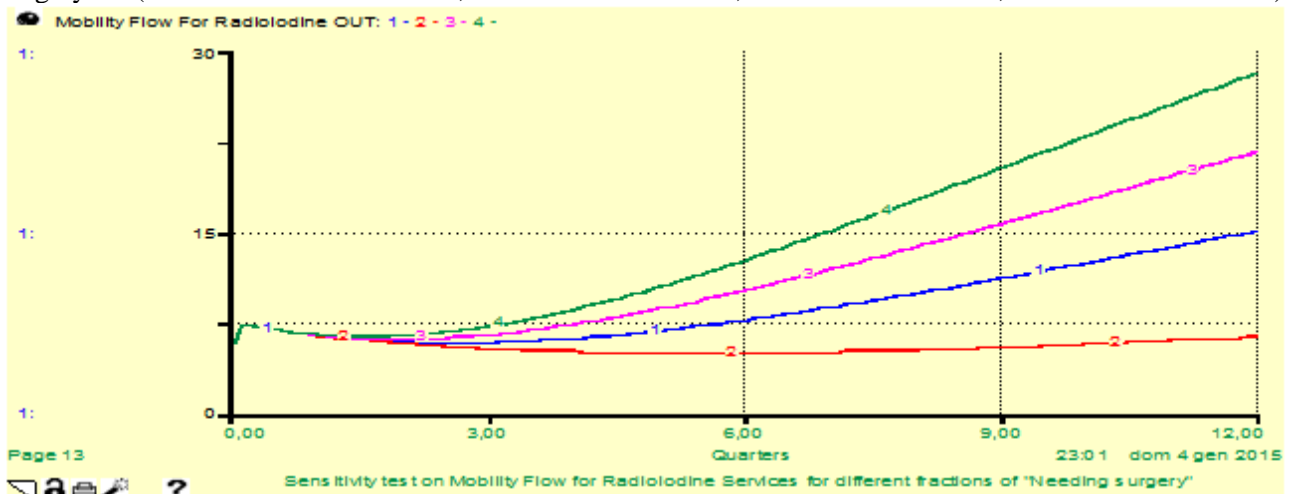
Appendix 3: Sensitivity tests on the parameter fraction of people needing surgery



1) Behavior of the mobility flow for specialist services after a sensitivity test on the fraction of people needing surgery (line 1=baselrun 0.08; line 2= 0.04; line 3= 0.1; line 4= 0.12)

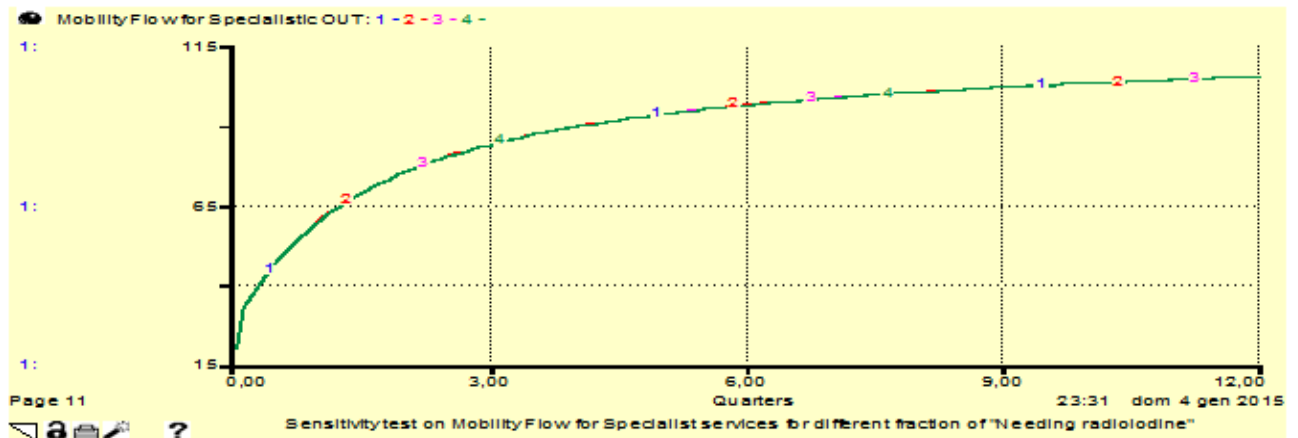


2) Behavior of the mobility flow for surgeries after a sensitivity test on the fraction of people needing surgery (line 1=baselrun 0.08; line 2= 0.04; line 3= 0.1; line 4= 0.12)

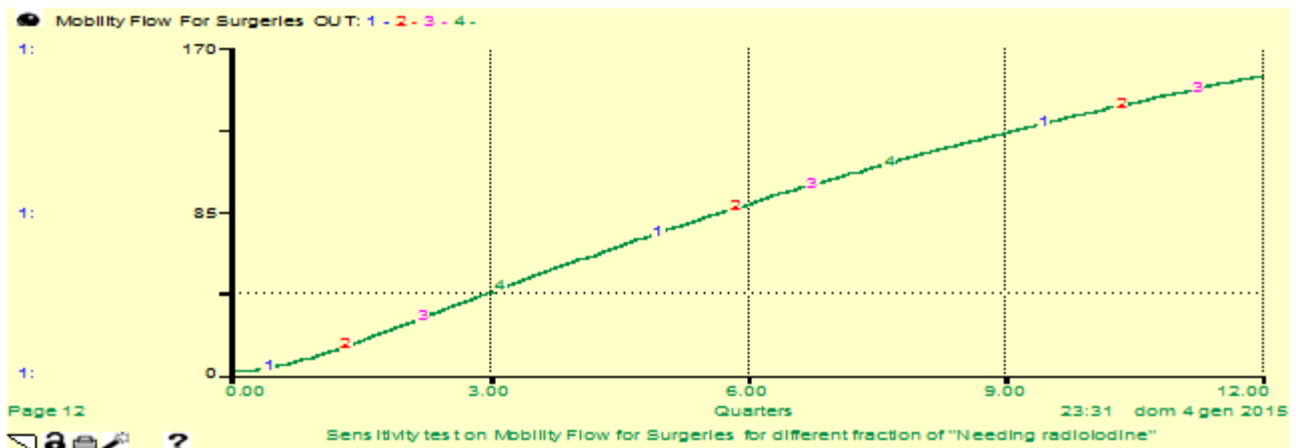


3) Behavior of the mobility flow for radioiodine services after a sensitivity test on the fraction of people needing surgery (line 1=baselrun 0.08; line 2= 0.04; line 3= 0.1; line 4= 0.12)

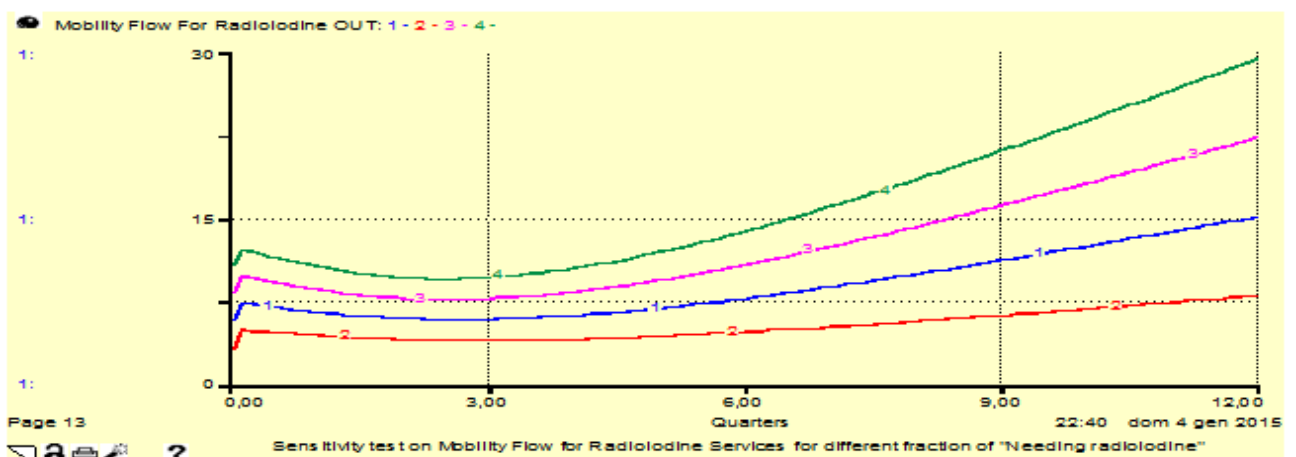
Appendix 4: Sensitivity tests on the parameter fraction of people needing radioiodine



1) Behavior of the mobility flow for specialist services after a sensitivity test on the fraction of people needing radioiodine (line 1=baserun 0.05; line 2= 0.025; line 3= 0.075; line 4= 0.1)

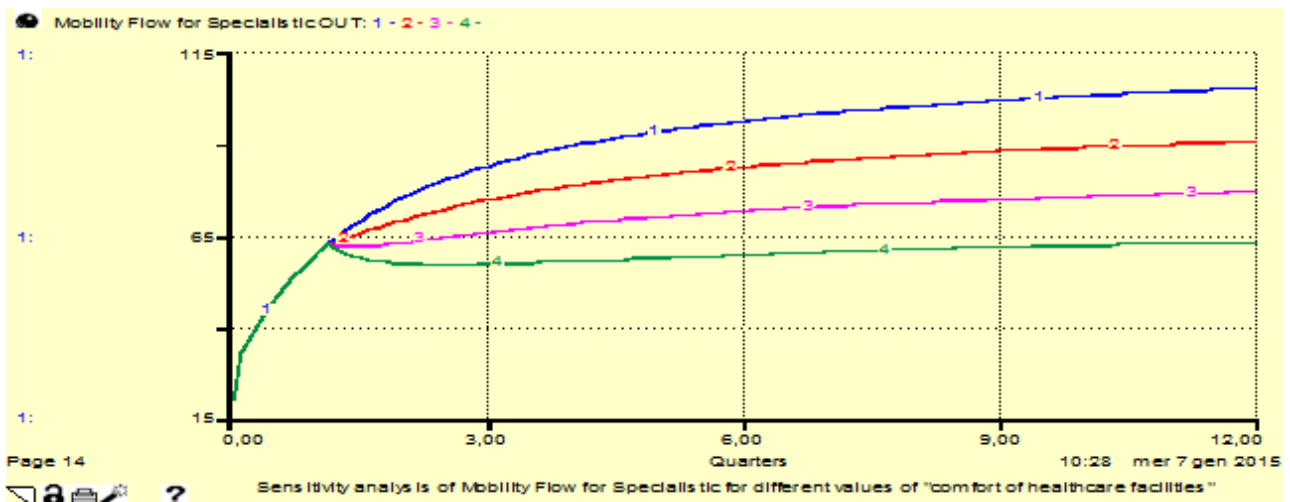


2) Behavior of the mobility flow for surgeries after a sensitivity test on the fraction of people needing radioiodine (line 1=baserun 0.05; line 2= 0.025; line 3= 0.075; line 4= 0.1).

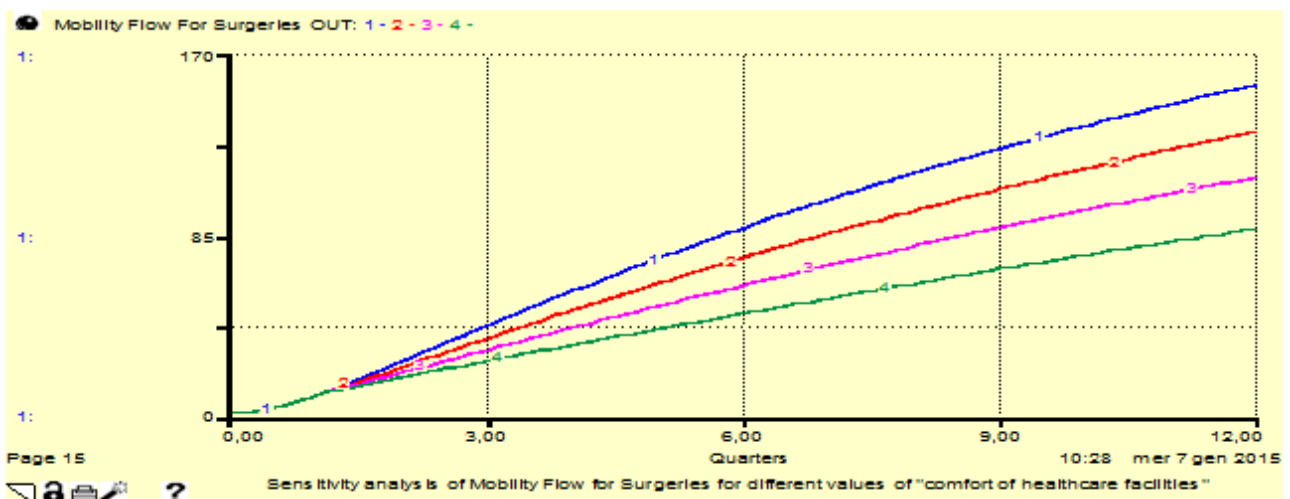


3) Behavior of the mobility flow for radioiodine services after a sensitivity test on the fraction of people needing radioiodine (line 1=baserun 0.05; line 2= 0.025; line 3= 0.075; line 4= 0.1)

Appendix 5 : Sensitivity tests on the parameter comfort of healthcare facility



1) Behavior of the mobility flow for specialist services after a sensitivity test on the “comfort of healthcare facility” (line 1=2.9 baserun; line 2= 3.6; line 3=4.3; line 4=5)



2) Behavior of the mobility flow for surgeries after a sensitivity test on the “comfort of healthcare facility” (line 1=2.9 baserun; line 2= 3.6; line 3=4.3; line 4=5)

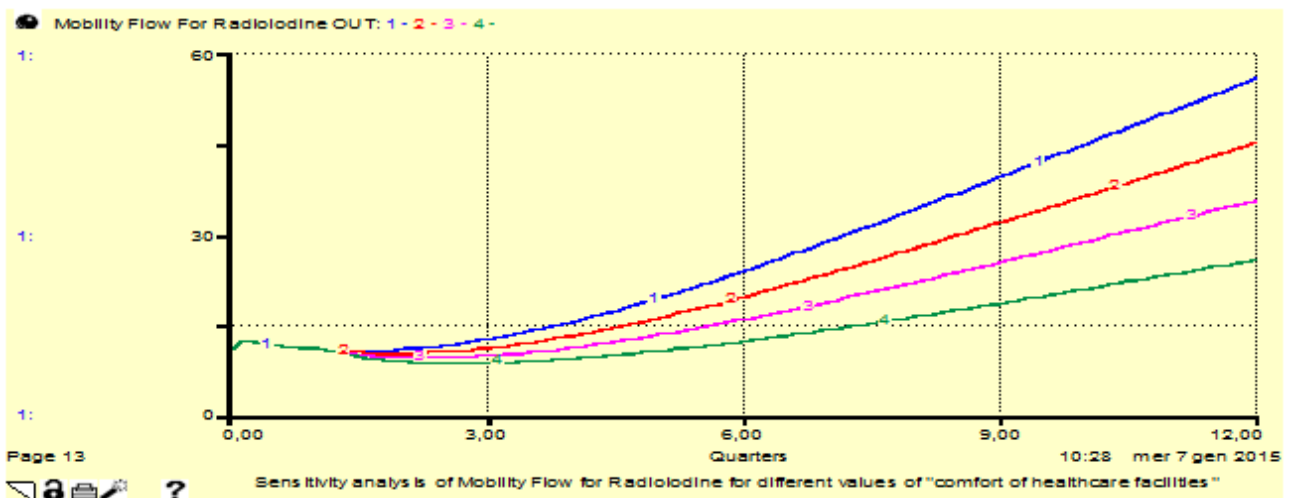


Figure 62. Behavior of the mobility flow for radioiodine treatment after a sensitivity test on the “comfort of healthcare facility” (line 1=2.9 baserun; line 2= 3.6; line 3=4.3; line 4=5)