



Universidad de Valladolid



ESCUELA DE INGENIERÍAS
INDUSTRIALES

UNIVERSIDAD DE VALLADOLID

ESCUELA DE INGENIERIAS INDUSTRIALES

Grado en Ingeniería de Organización Industrial

**ANÁLISIS ESTRATÉGICO DEL I.R.C.C.S.
MESSINA & APLICACIÓN TEORÍA
COSTES**

Autor:

Freire López, Antonio Jesús

Angel Manuel Gento Municio

**UNIVERSITÁ DEGLI STUDI MEDITERRANEA DI REGGIO
CALABRIA**

Valladolid, marzo 2018

TFG REALIZADO EN PROGRAMA DE INTERCAMBIO

TÍTULO: “STRATEGIC ANALYSIS OF I.R.C.C.S. MESSINA & COST THEORY APPLICATION.”

ALUMNO: Antonio Jesús Freire López

FECHA: 12 de marzo de 2018

CENTRO: DICEAM Universitá degli studi Mediterranea di Reggio Calabria

TUTOR: Dottore Francesco Carlo Morabito

Resumen

En este Trabajo Fin de Grado, la función que he realizado ha sido la de involucrarme dentro del ambiente que hay alrededor del "Istituto di Ricovero e Cura a Carttere Scientifico" (IRCCS) Bonino-Pulejo de Messina. Entendiendo como funciona este, y lo que supone para la sociedad siciliana e italiana.

Tras ello y teniendo los suficientes datos he realizado un análisis estratégico tanto de la zona como del hospital, utilizando técnicas aprendidas a lo largo de la carrera. A parte de esto, realicé una comparación de las técnicas novedosas que se utilizan en el IRCCS con las técnicas tradicionales, intentando hacer una combinación óptima para la mejora del paciente.

Finalmente habiendo realizado los análisis anteriores y a través de la teoría de coste pude llegar a la matriz de estrategias de actuación a través del análisis interno y externo, además de proponer diferentes indicadores que en un futuro se pueden utilizar para medir la mejora del hospital, teniendo un punto de referencia, donde está ahora, y un objetivo, donde se quiere llegar a estar.

Palabras clave

Ingeniería en la sanidad, teoría de costes, análisis estratégico, exoesqueletos, indicadores.

Abstract

In this Final Degree Project, the function I have performed has been to get involved in the environment around the "Istituto di Ricovero e Cura a Carttere Scientifico" (IRCCS) Bonino-Pulejo de Messina. Understanding how this works, and what it means for the Sicilian and Italian society.

After that and having enough data, I made a strategic analysis of both the area and the hospital, using techniques learned throughout the race. Apart from this, I made a comparison of the innovative techniques used in the IRCCS with the traditional techniques, trying to make an optimal combination for the improvement of the patient. Finally, having performed the previous analyzes and through the cost theory, I was able to arrive at the matrix of action strategies through internal and external analysis, besides proposing different indicators that in the future can be used to measure the improvement of the hospital, taking a point of reference, where you are now, and a goal, where you want to be.

Keywords

Health engineering, cost theory, strategic analysis, exoskeletons, indicators.



Universidad de Valladolid



BACHELOR THESIS

**STRATEGIC ANALYSIS OF I.R.C.C.S.
MESSINA & COST THEORY
APPLICATION**

Author:

Freire López, Antonio Jesús

Tutor:

Morabito, Francesco Carlo

Electrical Engineering Department

Co-tutor:

Bramanti, Alessia

I.R.C.C.S. Bonino Pulejo

Reggio di Calabria, March 2018.

INDEX

1.	Introduction.....	5
1.1.	Objective of the thesis.....	5
1.2.	Structure of the thesis.....	6
1.3.	Who were Bonino and Pulejo, Fundazione.....	8
1.4.	History of the I.R.C.C.S. Bonino-Pulejo	10
2.	Health area of Sicily and Messina	12
2.1.	Aziende Sanitarie Provinciali Sicily	12
2.2.	Aziende Sanitarie Provinciale Messina	14
2.3.	Aziende Ospedaliere in Sicily	15
3.	I.R.C.C.S. in Italy and Sicily.....	18
3.1.	I.R.C.C.S. in Italy	20
3.2.	I.R.C.C.S. in Sicily	26
3.3.	I.R.C.C.S. Neurorehabilitation.....	27
4.	Current situation analysis and ideal situation	29
4.1.	Environment analysis	29
4.2.	Internal analysis	40
5.	New and old rehabilitation techniques	44
5.1.	New techniques	44
5.2.	Old techniques.	60
5.3.	CAREN.....	82
5.4.	Telerehabilitation	87
5.5.	Comparison & Combination	91
6.	Economic study.....	93
6.1.	Objectives.....	93
6.2.	Analysis DAFO/SWOT	94
6.3.	Analysis of a general cost model for I.R.C.C.S.	97

6.4.	Indicators parameters of I.R.C.C.S	98
6.5.	Conclusion	101
7.	Conclusion of the thesis.....	102
8.	Bibliogrphy	103

Figure 1: Sicilian provinces	13
Figure 2: Messina provinces	14
Figure 3: A.O.U.P. Paolo Giaccone di Palermo	15
Figure 4: A.O.U.P. Vittorio Emanuele	15
Figure 5: A.O.U.P. G. Martino	15
Figure 6: A.R.N.A.S. Civico Di C. Benfratelli	16
Figure 7: A.R.N.A.S. Garibaldi	16
Figure 8: A.O. Cannizzaro	16
Figure 9: A.O. Papardo Piemonte	16
Figure 10: A.O. V.Cervello	16
Figure 11: I.R.C.C.S. Bonino-Pulejo	17
Figure 12: I.R.C.C.S. Publics	25
Figure 13: I.R.C.C.S. Private	25
Figure 14: I.R.C.C.S. Sicily	26
Figure 15: I.R.C.C.S. Neurorehabilitation	28
Figure 16: PESTEL Group	30
Figure 17: 5 Forces Porter	33
Figure 18: Amadeo rehabilitation	45
Figure 19: ArmeoPower	47
Figure 20: LokomatNano	49
Figure 21: LokomatPro	49
Figure 22: Vitalstim Device	54
Figure 23: VRSS Device	57
Figure 24: VRSS Rehabilitation	57
Figure 25: Ekso Device	59
Figure 26: CAREN Lab	87
Figure 27: Telerehabilitation	90
Figure 28: Bonino-Pulejo Project	90

1. Introduction

This thesis has been made through an exchange of the Erasmus program, by which the University of Valladolid has an agreement with the Università Mediterranea di Reggio Calabria. After speaking with my Spanish tutor, Prof. Angel Gento, we agreed the conditions of my mobility and he put me in touch with my tutor in Reggio Calabria, Prof. Carlo Francisco Morabito; with which I agreed to carry out the project on IRCCS Neurelosi of Messina, something that we thought was a great option. On my arrival, Professor Morabito assigned me a thesis co-tutor, Prof. Alessia Bramanti, who was my supervisor at the Bonino-Pulejo hospital and with who I would develop most of the thesis in the Neurolesi Bonino Pulejo with the supervision of Professor Morabito in the Reggio University.

Nowadays the "Centro Neurolesi Bonino Pulejo" is a leading research center within Messina and throughout all Sicily, becoming the only public IRCCS in this part of Italy. It is very important to consider the environment to provide this center a continuous improvement of the optimization of resources, this improvement should be notified in patients when they are recovering, and in the hospital's situation.

1.1. Objective of the thesis

In the work of this thesis I have tried to get involved in the hospital environment and be able to understand the advances that the hospital implies in the Sicilian area. I will develop the different types of rehabilitation, dividing them in to

four main groups, comparing them with each other and trying to see how they could be combine with each other, and the expense that they entail. As I will try to perform internal and external analyses, something that could be used for the continuous improvement of the hospital, or something that could be developed in future thesis by other students. Trying to make better the hospital and the area that it covers.

1.2. Structure of the thesis

These thesis is divided in eight main chapters:

Chapter 1: Introduction

Brief development of how I got to do the thesis in the IRCCS of Messina, the structure and purpose of the thesis, little history part of this and a compilation about Bonino, Pulejo and their foundation.

Chapter 2: Health area of Messina

In this chapter I try to explain the area where the hospital of Messina take place, local, Sicilian and National area, trying to put in contest the reader. Here you could find different important information about IRCCS Messina, like the localization, the population and the area that the hospital offers a service. Also, there are some maps trying to make an idea for the external people that are reading this thesis to know the situation of it.

Chapter 3: I.R.C.C.S.

Here, is where I explained what a “*Instituto di Ricovero e Cura Carattere Scientifico*” is, the different types of them, the character they have and what are their situation around Italy and Sicily.

Chapter 4: Analysis of situation and searched situation

What is the current situation of the Hospital and what are the expectative for the future. The two main parts are External and Internal analysis. The first one is a study of the environment in a general and specific mode, to know which are what surrounds I.R.C.C.S. The second part is a definition of the hospital and an evaluation it.

Chapter 5: Knowledge of the different rehabilitation processes and comparison of them (old, new, CAREN and Tele rehabilitation)

In this fragment I try to summarize the new techniques used at the Bonino Pulejo institute, while I collect traditional techniques that could be substituted or mixed with the new ones. I also talk about what CAREN is and tele-rehabilitation and finally I compare all of them and I try to make a good combination of them.



Chapter 6: Economic study of I.R.C.C.S.

This part of the thesis is where I tried to apply the Cost Theory in the hospital environment, doing some indicators that could be used in the future so that it can mean an improvement in the IRCCS. Also, a SWAT analysis is done to know which part is most important to improve.

Chapter 7: Conclusion of the thesis.

This is the part where I try to do a final sum up of the most important parts of the thesis and I give my point of view about the thesis, writing about the parts to have a better development in the future.

Chapter 8: Bibliography.

For the last, I recollect here de the main links, books and references which help me to do this thesis and where the readers could amplify the contain of it.

1.3. Who were Bonino and Pulejo, Fundazione.

Uberto Bonino, banker and politician natural from La Spezia (March 13, 1901), was moved in his youth to Messina where his father was assigned as commander, and where he spent most of his life until his death on June 9, 1988.

In 1946 he was elected deputy of the Constituent Assembly of the National Democratic Union, being elected on several times for the Chamber of Deputies, was also appointed for vice

president of the Commission of Industry and Commerce in the 1950s, coming to represent the House in the European Parliamentary Assembly until 1963.

Apart from his political life, Uberto Bonino founded in 1951 the Sicilian Publishing Company, which began publishing the new newspaper "La Gazzetta del Sud" since April 13, 1952. In December 1972 together with his wife Donna Maria Sofia Pulejo, daughter of the president of the "Camera di Comercio di Messina", Pulejo's family was one of the most important families in Messina, both of them founded the "Fundazione Bonino-Pulejo", with the aim of helping young graduates of Medicine and Law, providing them with scholarships without which they could not have attended the different courses. They became one of the most beloved families in Messina.

This foundation was directed until his death by Uberto Bonino and after that the lawyer Giuseppe Gentile, friend and collaborator of Bonino took the position until 1991 when he was relieved by Nino Calarco, director of Gazzetta del Sud; since 2015 the president of the Foundation is Lino Morgante.

In their origins, the foundation only granted scholarships to the graduates of Messina University, expanding later their limits to graduates of the different universities like Reggio Calabria, Cosenza, Cantazaro, Catania and Palermo. Reaching more than a thousand scholarships, for the value of more than five million euros.



In 1991 the Bonino International Prize was created, they are awarded to personalities from the scientific, social and cultural fields.

1.4. History of the I.R.C.C.S. Bonino-Pulejo

With Ministerial Decree on March 4th, 2006 the center, born from a university consortium (on 23th March 1992) result of an agreement between the University of Messina and the Bonino Pulejo Foundation and originally named "Center for the Study and treatment of long-term care Neurolesi" Bonino Pulejo.

So, the center has been recognized as an Institute of Hospitality and Care by Ministerial Decree of 04/03/2006 and subsequently reconfirmed by Ministerial Decree of 08/03/2011 and by Ministerial Decree of 09/12/2015.

It's a "Insitituto di Ricovero e Cura a Carattere Scientifico", as the translate in English is: "Scientific Institute of Hospitalization and Care". IRCCS is a highly specialized structure designed to offer the patient with serious brain injury the opportunity to have a better quality of life focusing on the professionalism of a team of experts able to exploit the most modern technologies in the field of neurorehabilitation.

The Institute is part of the regional network of intensive rehabilitation for Acquire Severe Brain Injury as HUB center for patients who come regional and extra-regional basin. With the inclusion of the "Piamonte hospital", the institute expanded its healthcare offer to the Emergency-Urgency Area. It includes

special modules for Special Units for Primary Reception of patients in vegetative and minimum consciousness state, for patients with multiple sclerosis, with Parkinson's disease, and an area dedicated to Post Stroke. At the institute are used the most modern techniques of neuro-motoric rehabilitation, speech therapy, cognitive and respiratory rehabilitation with the introduction of conventional and robotic systems, structured in precise pathways within rehabilitation project, drawn on the patient by multidisciplinary staff.

From 2017 IRCCS Bonino Pulejo is the HUB Center for a Regional Rehabilitation Project in Sicily and has activated two Spoke centers in Palermo and one in Salemi (Trapani).

The characteristic of the Institute is the presence and the integration of multiple activities (NeuroReanimatory, Neurological, Neuropsychological, Nutritional, etc.) combined with a structured rehabilitation (Speech Therapy, Occupational, Physiotherapy) and a nursing care with specific responsibilities for the preparation of the individual rehabilitation project.

2. Health area of Sicily and Messina

Since 1947, Sicily has legislated with autonomy the health issues, in 1980 the "Unità Sanitarie Locali" were born, one different for each province. In 1995, nine "Aziende unità sanitarie locali" were created, the main hospitals became "Aziende Ospedaliere" and the top management of the companies were appointed by the regional council. Since 2009 in each province there is an "Azienda Sanitaria Provinciale" with the hospital units that have merged with the ASP, with only nine remaining, those with high regional importance and the polyclinics. The Sicilian sanitary service currently consists of nine "Aziende Sanitarie Provinciali" and nine "Aziende Ospedaliere", which depend on the Regional Department of Health.

2.1. Aziende Sanitarie Provinciali Sicily

The "Aziende Sanitarie Provinciali", constitute the territorial division of the provincial health company within which the services of prevention, diagnosis, treatment, rehabilitation and education for health are provided. The health districts are part of the territorial area, coordinated by a director of health and an administrative director identified in the same way as the hospital districts and with the same degree of autonomy.

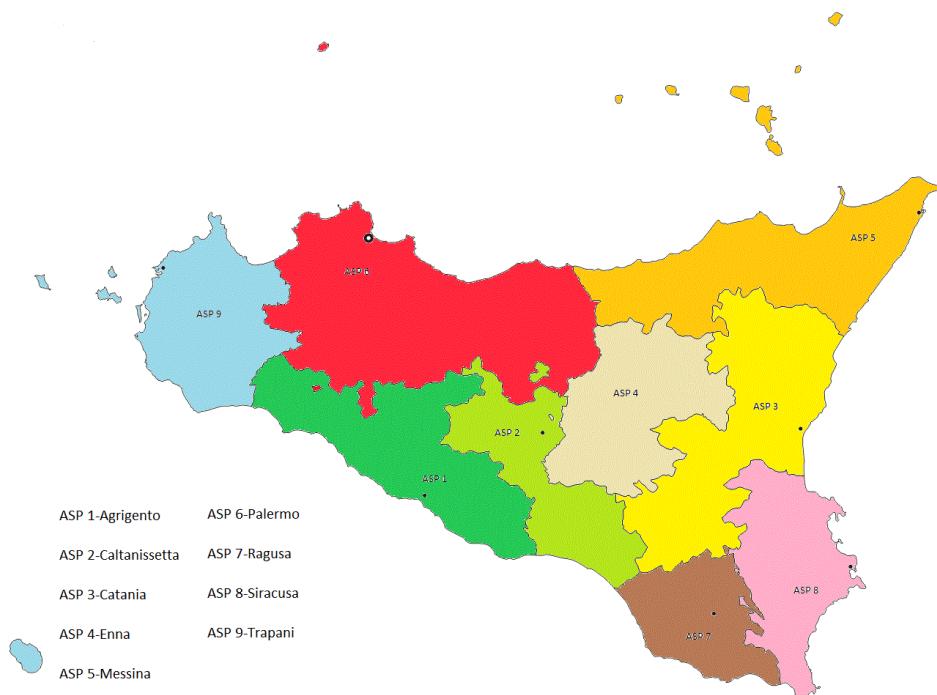


Figure 1: Sicilian provinces.

The island of Sicily has a total population of 5,029,431 divided into nine provinces:

Agrigento: 448.053.

Palermo: 1.244.012.

Caltanissetta: 272.359.

Ragusa: 313.698.

Catania: 1.084.674.

Siracusa: 402.680.

Enna: 173.558.

Trapani: 435.877.

Messina: 654.520

2.2. Aziende Sanitarie Provinciale Messina

The ASP di Messina covers a territory divided in 108 cities with a resident population of 645.000, in 3.247 km². Due to the Regional Law 30/1993 the territory of Messina is divided in 8 "Distretti Sanitarie Territoriali".

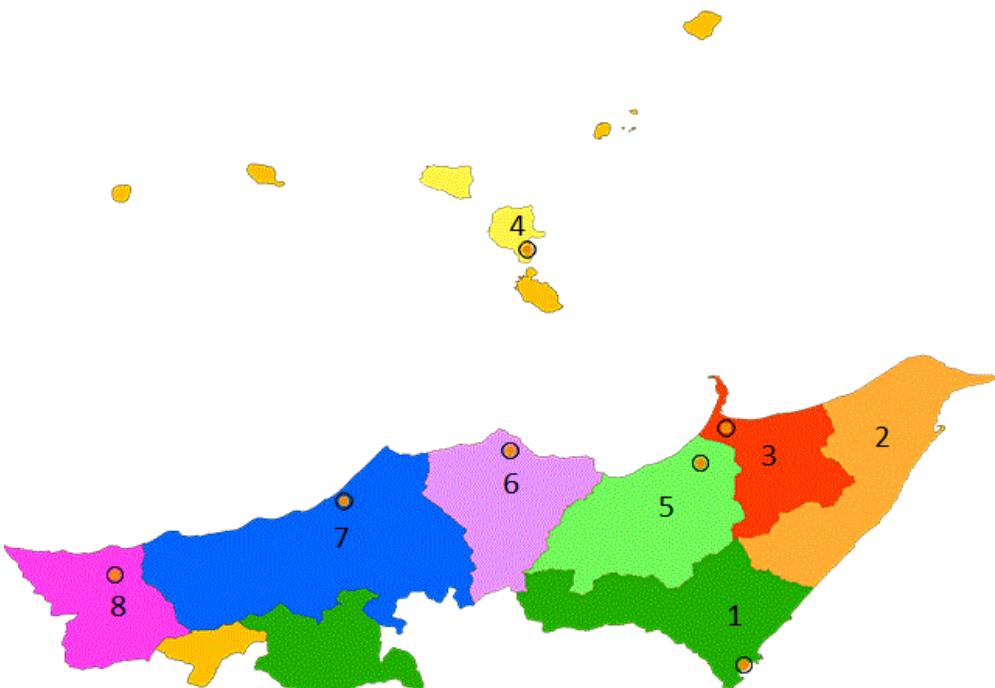


Figure 2: Messina provinces

DST 1-Taormina

DST 5-Barcellona Pozzo

DST 2-Messina

DST 6-Patti

DST 3-Milazzo

DST 7- Sant'Agata di Mitello

DST 4-Lipari

DST 8- Mistretta

2.3. Aziende Ospedaliere in Sicily

The “Aziende Ospedaliere” ensure highly specialized medical care with advanced and innovative diagnostic and therapeutic technologies and perform the tasks specifically assigned by the regional planning documents. They represent structures with technical-administrative and economic-financial autonomy, directed by the general manager.

Of these three structures, three are A.O.U.P., Aziende Ospedaliere Universitarie Policlinico:

<ul style="list-style-type: none"> • A.O.U.P. “P. Giaccone” – Palermo 	 <p>Azienda Ospedaliera Universitaria Policlinico Paolo Giaccone di Palermo</p>  <p><i>Figure 3: A.O.U.P. Paolo Giaccone di Palermo</i></p>
<ul style="list-style-type: none"> • A.O.U.P. “Policlinico - Vittorio Emanuele” – Catania 	 <p><i>Figure 4: A.O.U.P. Vittorio Emanuele</i></p>
<ul style="list-style-type: none"> • A.O.U.P. “G. Martino” – Messina 	 <p><i>Figure 5: A.O.U.P. G. Martino</i></p>

Two are A.R.N.A.S., "Aziende di Rilievo Nazionale di Alta Specializzazione":

<ul style="list-style-type: none"> • A.R.N.A.S. "Cívico e Benfratelli, G. Di Cristina e M. Ascoli" – Palermo 	<p>Cívico Di Cristina Benfratelli Azienda di Rilievo Nazionale ed Alta Specializzazione</p>
<ul style="list-style-type: none"> • A.R.N.A.S. "Garibaldi, S.Luigi Currò, Ascoli – Tomaselli" – Catania 	<p>ARNAS GARIBALDI CATANIA AZIENDA OSPEDALIERA DI RILIEVO NAZIONALE E DI ALTA SPECIALIZZAZIONE</p>

Three classic "Aziende Ospedaliere":

<ul style="list-style-type: none"> • Azienda Ospedaliera "Cannizzaro" – Catania 	<p>OSPEDALE CANNIZZARO CATANIA AZIENDA OSPEDALIERA PER L'EMERGENZA</p>
<ul style="list-style-type: none"> • Azienda Ospedaliera "Papardo – Piemonte" – Messina 	<p>A.O. PAPARDO PIEMONTE MESSINA AZIENDA OSPEDALIERA OSPEDALI RIUNITI</p>
<ul style="list-style-type: none"> • Azienda Ospedaliera "V. Cervello - Villa Sofia" – Palermo 	<p>AZIENDA OSPEDALIERA OSPEDALI RIUNITI VILLA SOFIA - CERVELLO PALERMO</p>

And a I.R.C.C.S., "Instituto di Ricovero e Cura a Carattere Scientifico":

- I.R.C.C.S. Centro Neurolesi
"Bonino Pulejo" – Messina



Figure 11: I.R.C.C.S. Bonino-Pulejo

3.I.R.C.C.S. in Italy and Sicily

The "*Istituti di Ricovero e Cura a Carattere Scientifico*" (IRCCS) are hospitals of excellence that carry out research, mainly clinical, in the biomedical field and in the organization and management of health services and perform high-quality hospitalization and care services or carry out other activities that have the characteristics of excellence mentioned in the Legislative Decree of October 16, 2003. That ordered the reorganization of public scientific institutes for hospitalization and treatment. The Ministry of Health controls the I.R.C.C.S. to ensure that the research is of public interest with a direct impact on patient care.

Hospitals to be recognized I.R.C.C.S. must have the following requirements in possession:

1. Legal personality of public or private law.
2. Ownership of authorization and health accreditation.
3. Economy and efficiency of the organization, quality of the structures and technological level of the equipment.
4. Characteristics of excellence in the level of hospitalization and high specialty care carried out directly in the last three years, or of the technical-scientific contribution provided.
5. Characteristics of excellence of the research activity carried out in the last three years in relation to the specific discipline assigned.

6. Demonstrated ability to establish contacts with research institutes in the same reference area and collaborations with other public and private organizations.
7. Demonstrated ability to attract independent public and private funds.
8. Certification of quality of services in accordance with internationally recognized procedures.

Institutes for hospitalization and care of a scientific nature have a different legal, public or private nature.

The public IRCCS are national public bodies subject to a regional control and supervision by the Ministry of Health. The minister is responsible for the appointment of the scientific director of the public IRCCS in the context of a panel of three candidates selected by a special commission. The public law IRCCS, at the request of the region in which the Institute has the predominant place of clinical and research activities, can be transformed into important national foundations, open to the participation of public and private entities and subject to the supervision of the Ministry of Health and the Ministry of Economy and Finance. The transformed entities assume the name of the IRCCS Foundation.

In contrast, private IRCCS have greater freedom of action and control over them is carried out only on the value of the research carried out.

The "Istituti di Ricovero e cura a carattere scientifico" deals with clinical and translational research. They carry out an investigation that must necessarily find an outlet in therapeutic applications in hospitals.

The activity has the objective of investigation areas well-defined, whether they have received recognition for a single subject (IRCCS of a single subject) or have received it for multiple integrated biomedical areas (IRTM polythematic).

These are the areas where they are specialized:

- | | |
|-----------------------|-----------------------|
| - Cardiology | - Neurology |
| - Dermatology | - Neurorehabilitation |
| - Diagnostic Image | - Ophthalmology |
| - Pharmacology | - Oncology |
| - Gastroenterology | - Orthopedics |
| - Genetics | - Pediatrics |
| - Geriatrics | - Psychiatry |
| - Infectious diseases | - Rehabilitation |
| - Complexity medicine | |

3.1. I.R.C.C.S. in Italy

There are 49 I.R.C.C.S. present in the all Italian territory, 21 public and 28 private.

In this table the 21 public IRCCS are collected with the place and the area they work in.

Name	Place	Area
Istituto Oncologico Veneto	Padova	Oncology
Ospedale infantile Burlo Garofolo	Trieste	Pediatrics
C.R.O. Centro di Riferimento Oncologico	Aviano (PN)	Oncology
Fondazione Istituto Neurologico Carlo Besta	Milano	Neurology
Fondazione I.R.C.C.S. Istituto Nazionale per lo studio e la cura dei tumori	Milano	Oncology
Fondazione Ca'Granda Ospedale Maggiore Policlinico	Milano	Completes
Fondazione Policlinico San Matteo	Pavia	
Istituto delle Scienze Neurologiche	Bologna	Neurology
Istituto Ortopedico Rizzoli	Bologna	Orthopedics
Istituto in tecnologie avanzate e modelli assistenziali in oncologia	Reggio Emilia	Oncology
Istituto Giannina Gaslini	Genova	Pediatrics
Azienda ospedaliera universitaria San Martino I.S.T. Istituto nazionale per la ricerca sul cancro	Genova	Oncology
Istituto Nazionale di Riposo e Cura per Anziani	Ancona	Geriatrics

Istituti fisioterapici Ospitalieri Istituto Regina Elena	Roma	Oncology
Istituto Dermatologico Santa Maria e San Gallicano	Roma	Dermatology
Istituto per le Malattie Infettive Lazzaro Spallanzani	Roma	Infectious diseases
Istituto nazionale tumori Fondazione Giovanni Pascale	Napoli	Oncology
Ente Ospedaliero specializzato in gastroenterologia Saverio De Bellis	Castellana Grotte (BA)	Gastroenterology
Istituto tumori Giovanni Paolo II	Bari	Oncology
CROB Centro di Riferimento Oncologico della Basilicata	Rionero in Vulture (PZ)	Oncology
I.R.C.C.S. Centro Neurolesi Bonino Pulejo	Messina	Neurology – Neurorehabilitation

Table 1: I.R.C.C.S. Public

In this table the 28 private IRCCS are collected with the place and the area they work in:

Name	Place	Area
Fondazione Ospedale San Camillo	Venezia	Neurology - Neurorehabilitation
IRCCS Centro San Giovanni di Dio Fatebenefratelli	Brescia	Psychiatry

Centro Cardiologico S.P.A. Fondazione Monzino	Milano	Cardiology
IEO - Istituto Europeo di Oncologia	Milano	Oncology
Istituto Ortopedico Galeazzi	Milano	Rehabilitation
Istituto Auxologico Italiano	Milano	Rehabilitation
IRCCS Ospedale San Raffaele	Milano	Genetics
IRCCS Multimedica	Milano	Cardiology
Fondazione Don Carlo Gnocchi	Milano	Rehabilitation
Istituto di ricerche farmacologiche Mario Negri	Milano, Bergamo, Ranica	Pharmacology - Neurology - Complexity medicine
Istituto Clinico Humanitas	Rozzano (Milano)	
Policlinico San Donato	San Donato Milanese	Cardiology - Pediatrics
Fondazione Istituto Neurologico Casimiro Mondino	Pavia	Neurology - Neurorehabilitation
Istituti Clinici Scientifici Maugeri	Pavia	Rehabilitation
Istituto Eugenio Medea	Bosisio Parini (LC)	Rehabilitation
Fondazione del Piemonte per l'Oncologia	Candiolo (TO)	Oncology

Istituto scientifico romagnolo per lo studio e la cura dei tumori	Meldola (FC)	Oncology
Fondazione Stella Maris	Calambrone (Pisa)	Neurology - Pediatrics
Fondazione G.B. Bietti per lo studio e la ricerca in oftalmologia	Roma	Ophtalmology
Fondazione Santa Lucia	Roma	Neurorehabilitation
Ospedale pediatrico Bambino Gesù	Roma	Pediatrics
Istituto Dermopatico dell'Immacolata	Roma	Dermatology
IRCCS San Raffaele Pisana	Roma	Rehabilitation
Istituto Neurologico Mediterraneo Neuromed	Pozzilli (IS)	Neurology
SDN Istituto di Ricerca Diagnostica e Nucleare	Napoli	Diagnostic Image
Ospedale Casa Sollievo della Sofferenza	San Giovanni Rotondo (FG)	Genetics
Istituto Mediterraneo per i Trapianti e Terapie ad Alta Specializzazione (ISMETT)	Palermo	Complexity medicine
Oasi di Maria Santissima	Troina (EN)	Neurology - Complexity medicine

Table 2: I.R.C.C.S. Private

The publics I.R.C.C.S. are distributed on the Italian map as follows:

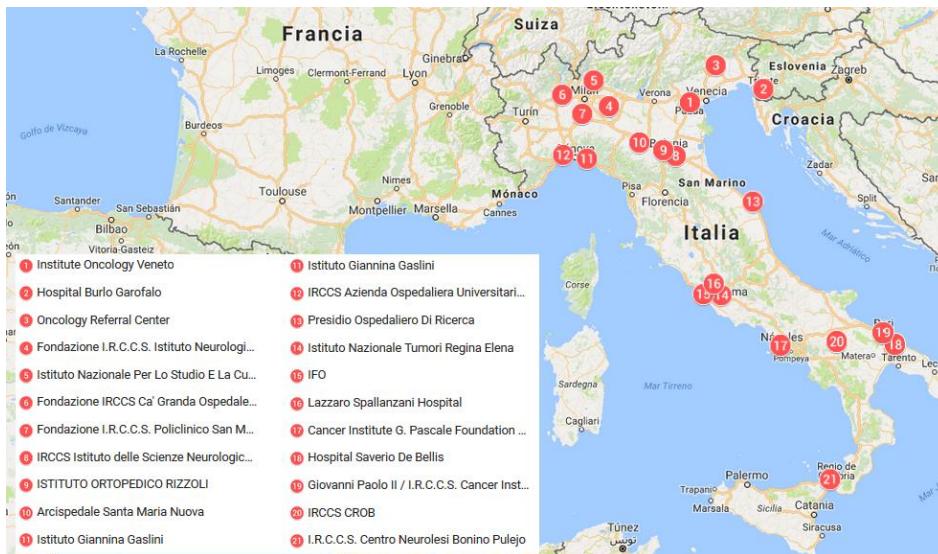


Figure 12: I.R.C.C.S. Publics

The privates I.R.C.C.S. are distributed on the Italian map as follows:

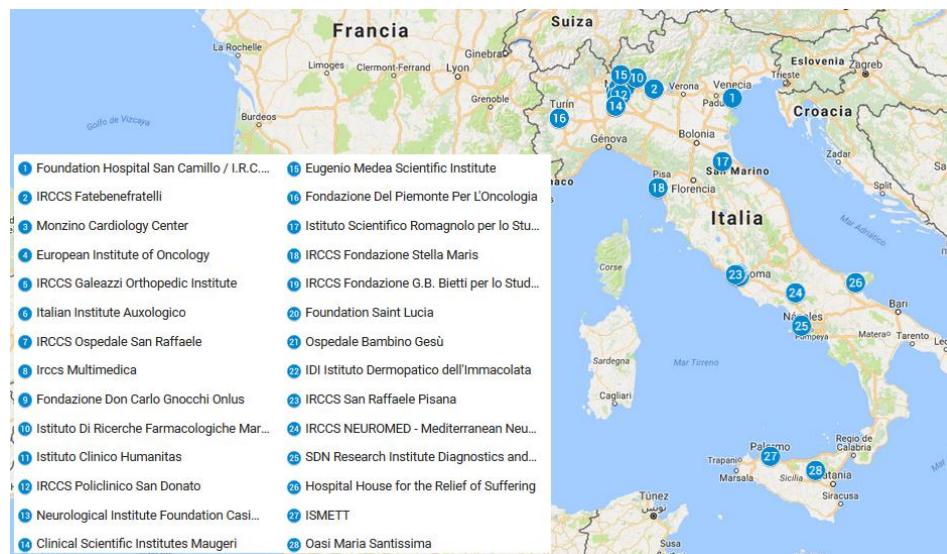


Figure 13: I.R.C.C.S. Private

3.2. I.R.C.C.S. in Sicily

Apart from the IRCCS Bonino Pulejo Neurolesi di Messina, there are two other IRCCS centers that are private, l'ISMETT in Palermo and the Oasi di Maria SS in Troina.



Figure 14: I.R.C.C.S. Sicily

- ISMETT: the “*Istituto Mediterraneo per i Trapianti e Terapie ad Alta Specializzazione*” is a I.R.C.C.S. based on the field of end-stage organ failure treatment and research. A transplant center that is involved in important projects designed to provide patients with the most advanced therapies for end-stage vital organ failure.
 - ✓ Area worked on: Complexity medicine.
 - ✓ Character: Private.

- Oasi Maria Santissima: is a I.R.C.C.S. based on the research for mental retardation and brain aging.
 - ✓ Area worked on: Neurology–Complexity medicine.
 - ✓ Character: Private.
- IRCCS Bonino Pulejo: has its mission in the field of "neuroscience in the field of prevention, recovery and treatment of serious acquired neurolesions".
 - ✓ Area worked on: Neurorehabilitation - Neurology.
 - ✓ Character: Public.

3.3. I.R.C.C.S. Neurorehabilitation

From all these I.R.C.C.S. the ones that work on the same are that Bonino Pulejo works (Neurorehabilitation) are:

- 1) I.R.C.C.S. Neurolesi Bonino Pulejo – Messina.
- 2) Fondazione Ospedalle San Camillo – Venezia.
- 3) Fondazione Santa Lucia – Roma.
- 4) Fondazione Istituto Neurologico Casimiro Mondino – Pavia.

The other three Institutes that work on Neurorehabilitation apart from the Neurolesi, are private sense.

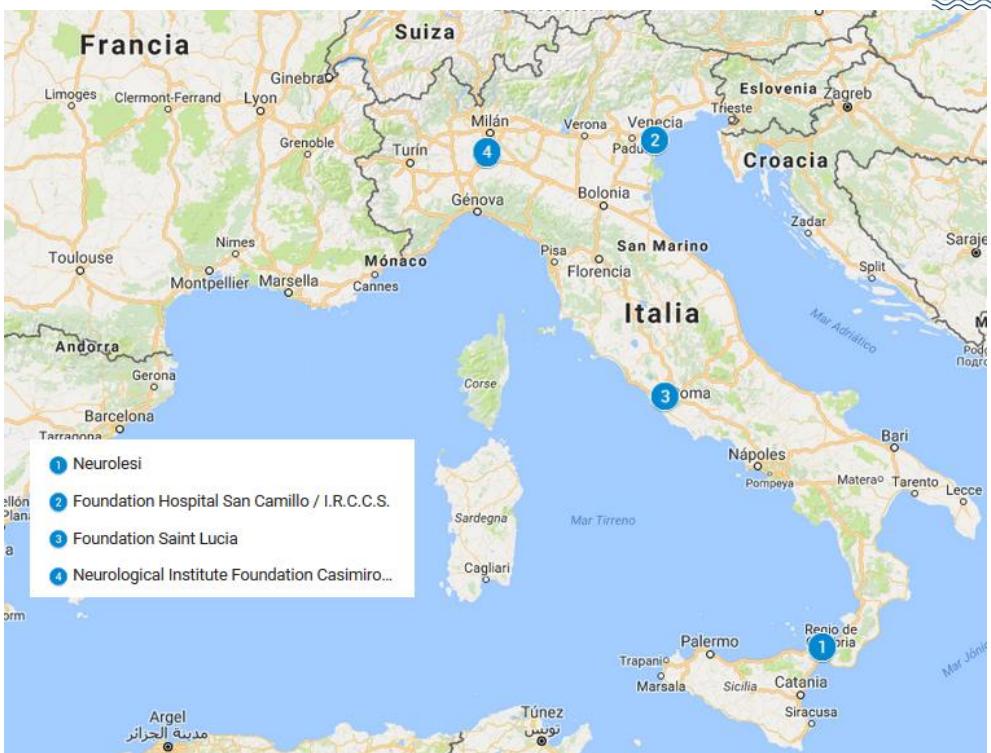


Figure 15: I.R.C.C.S. Neurorehabilitation

4. Current situation analysis and ideal situation

4.1. Environment analysis

In this part of the thesis I will perform an analysis of all causes outside the company but that also affect it in a relevant way because they are uncontrollable variables by the I.R.C.C.S., to obtain information for the organization, which will analyze and obtain conclusion that will guide us to determine strategic decisions.

GENERAL-PESTEL-MACROECONOMICAL

To obtain competitive strategies, it is essential to consider the environment of an organization, so I will use the PESTEL Analysis to do it. This tool consists of a strategic analysis of the external macro environment in which the organization works, it helps to consider what environmental influences have been important in the past and what changes could make them more important in the future.

This analysis is structured in 6 factors, which are not independent of each other, many of them are related. The 6 factors are these:

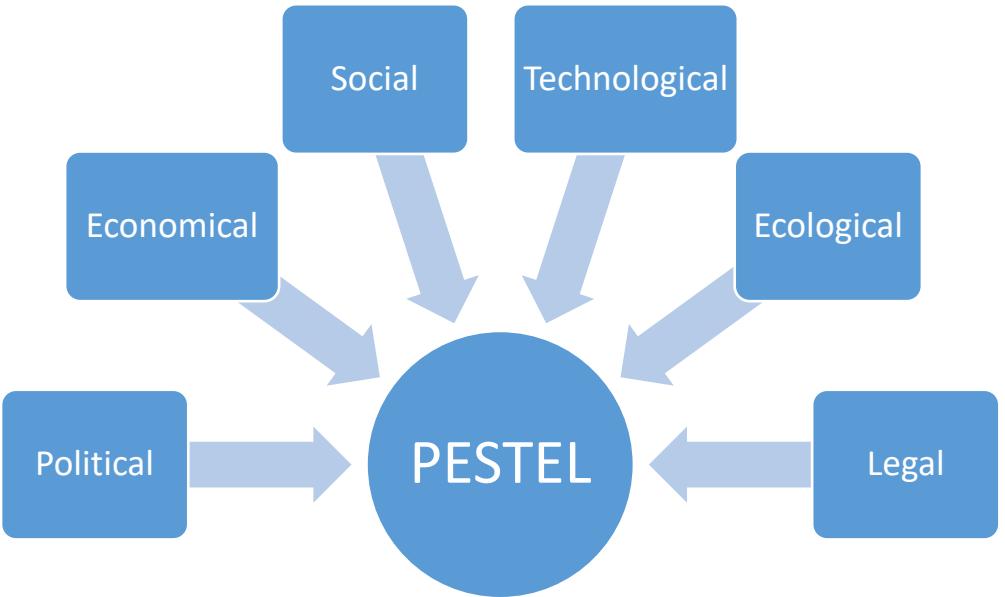


Figure 16: PESTEL Group

- **Political Area:** this point will mark the development of the I.R.C.C.S., considering the public character of the hospital, an essential aspect for the future.
 - ✓ Political situation.
 - ✓ Health budget.
 - ✓ Political organization in the hospital.
- **Economical Area:** aspect through which the I.R.C.C.S. can subsist and improve its conditions every day.
 - ✓ Infrastructure state.
 - ✓ Quality of staff.
 - ✓ Spending energy resources.
- **Social Area:** the health community is a multicultural environment, where the patients and professionals from the health area coexist.

- ✓ Values and attitudes.
- ✓ People availability.
- ✓ Labor conflicts.
- ✓ Number of university programs.
- **Technological Area:** this point should be important in a I.R.C.C.S. looking for a diary improvement, trying to have the last technology and being pioneer in the research and development.
 - ✓ Teaching software management.
 - ✓ Technological and scientific knowledge.
 - ✓ Scientific and technological infrastructure.
 - ✓ Maturity current technologies.
 - ✓ Availability of new technologies.
- **Ecological Area:** the Bonino Pulejo hospital should be aware of improving the environment, taking increasingly ecological initiatives that can help the atmosphere that surrounds it. It is restricted by certain laws.
 - ✓ Environmental policy.
 - ✓ Recycling.
 - ✓ Renewable energy consumption.
- **Legal Area:** the legal limits in which the hospital works are restricted by the government of Italy and by the Sicilian one.
 - ✓ State rates.
 - ✓ Quality law.

Strategic Profile of the Environment		SITUATION				
Functional areas & key aspects						
Profile	FACTORS	V	N	M	P	V
Political	Political situation				X	O
	Health Budget					X
	Political organization in the hospital			X	O	
Economic	Infrastructure state				X	O
	Quality of staff				X	O
	Spending energy resources			X	O	
Social	Values and attitudes					X
	People availability.					X
	Labor conflicts				X	O
	Number of university programs				X	O
Technological	Teaching software management			X	O	
	Technological and scientific knowledge				X	O
	Scientific and technological infrastructure					X
	Maturity current technologies				X	
	Availability of new technologies					X
Environmental	Environmental policy				X	
	Recycling			X	O	
	Renewable energy consumption			X	O	
Legal	State rates				X	
	Quality law				X	O

Table 3: PESTEL Situation

We can see that in the hospital thinks that their situation is very good, especially in aspects such as aspects of the staff and aspects related to the technologies used.

The points that have to improve are especially in the expenditure of resources, use of renewable energy and recycling.

SPECIFIC- 5 Forces Porter - Microeconomical

In this section we will perform an analysis of the business environment, using the Five Forces of M. Porter, which will allow us to identify the key factors that will influence the competitive position of the business and which is the correct strategy to follow.



Figure 17: 5 Forces Porter

These are the 5 Porter Forces, and all of them have different factors that influence them:

1. Rivalry among competitors.
2. Bargaining power of sellers.
3. Threat of substitute products.
4. Bargaining power of customers.
5. Threat of potential competitors.

Rivalry among competitors:

This part of the analysis will allow us to compare the different strategic or competitive advantages between our business and the other rival companies.

It is important to know the number of competitors and the concentration of them to get the level of the competence with the other enterprises. In the sector of I.R.C.C.S. the Bonino Pulejo is the only one with public character, but there are other two from the private sector.

Our hospital is the only one in all Sicily with this kind of rehabilitation, but it is in an environment with many competitors due to the different traditional rehabilitation centers that are around Messina. This poses a risk to the hospital cause this kind of clinics could launch aggressive offers to get new clients.

Messina is the third region most populated of Sicily and a very important point cause of the situation, this make the hospital's situation good to develop their programs. The Bonino Pulejo has a great difference in services that they offer compared to their competitors in the region, so they make a product differentiation.

Bargaining power of sellers:

Suppliers have the power of negotiate with the companies increasing prices or decreasing the quality of products or services. Some of these suppliers have a lot of power because they work in a territory that there aren't a lot of companies that offer alternatives.

In the health sector where the hospital works, there are several providers groups:

- ✓ **Rehabilitation machines:** they design, manufacture, commercialize, install and maintain in a correct way the main part of the machines used in the I.R.C.C.S.
- ✓ **Expendable materials:** they are dedicated to the distribution and advice of the different medical services. Bandages, antiseptics, sharp objects, gauze, plasters sterile kits, gloves...
- ✓ **Pharmacists:** medical specialized and primary care who are dedicated to the distribution of pharmaceutical products for the needs of each medical part.
- ✓ **Office supplies:** they are basic things for every day. Less important but fundamental things for the correct development of the company.

Threat of substitute products:

These substitute products or services are those that could be used instead of the ones that the hospital offers. They cause a potential limitation in the company and the services could be looked by the competence and be offered by them.

The traditional rehabilitation clinics offer treatments that may be alternatives for those that Bonino Pulejo offers, but most of the rehabilitation processes that our hospital offer are not direct competition, because the techniques developed are leading in our area and in all Italy. This has made a competitive advantage over these other clinics.

This has an impact on a better absorption of clients who seek our services and will provide the hospital a greater market share. The way to maintain the competitive advantage is to continue improving the services offered by the hospital and try to continue being a pioneer in these services and techniques.

Bargaining power of customers:

The key factor of a company are the clients, without them the business doesn't work, no clients no success. In the hospitals clients are part of the service's development, without them wouldn't be such a service.

The potential of each client depends on several variables:

- ✓ **Information for clients:** patients have access to information through the publicity and the internet to could compare the clinics and the different options to select the best choice for them.
- ✓ **Substitute products:** our services could be similar in different hospitals, so we have to overcome them offering a higher quality of service and also some products that they couldn't offer.

- ✓ **Amount of services rendered**: this hospital offer high quantity of different services in order to could provide the clients a total recuperation of their problems, also is important to make a personal plan of recuperation.
- ✓ **Variety of customers**: in our sector there are a lot of different groups that are looking for a good recovery.

Threat of potential competitors:

Given the threat of entry of new potential competitors, barriers to entry are an important point.

An essential factor is experience, which is an advantageous barrier to entry that offers existing specialists to new graduates, their experience and knowledge in the sector, skills they have acquired and efficiency. A newly qualified person who tries to open a private clinic cannot compete with a hospital that has many years of experience with patient service, with their clients and with great experience.

Another great barrier to entry is the immediate provision of means and infrastructures that the hospital has been creating over time and if a potential rival wanted to compete directly with the IRCCS, it should be acquired in a short period of time.

In conclusion, the experience and the infrastructures that have been built over time are the great obstacles that have to be overcome to be a real potential threat.

Competitors

Our hospital is oriented to a market sector with a competition not very high compared to other health sectors, since it is using techniques that are novel and still under development. After that, I am going to analyze in this section of the thesis the direct competition found in the health market.

There are a lot of types of competitors that have different offers in the cities of Italy, but we are going to focus on the competitors that are more like the I.R.C.C.S. Bonino Pulejo and that could offer similar services to those that it offers.

Here I will explain a little of each I.R.C.C.S. that could be a competitor from Bonino Pulejo, being these the hospitals that offer the most similar services:

- **Fondazione Ospedalle San Camillo** (Venezia): This hospital has 115 beds, all equipped with anti-decubitus systems: 75 beds are dedicated to intensive neurological rehabilitation and 40 beds make up the highly specialized unit for the rehabilitation of acquired neuropsychological disorders (URNA).
- **Fondazione Santa Lucia** (Roma): This hospital has six units on separate floors, occupying a total floor area of over 30,000 square meters. The rooms are 46 square meters wide. Patient can choose between single and double room, both provided with bathroom. Each hospital unit has its own 400 square meter rehabilitation facility. The hospital maintains also a swimming pool for hydrokinetic therapy.

- **Fondazione Istituto Neurologico Casimiro Mondino**

(Pavia): The service that this hospital provide is some beds in single / double room for patients who need specific assistance and continued. After verification of the clinical suitability, the patients are hosted in a separate area of a department dedicated to them for a fixed period according to the needs and according to the availability of the beds.

In this part I mention also the traditional and innovative rehabilitation clinics in Messina, that could take some clients:

- **New Delta**: Born in 1999 in the center of Messina, with the aim of promoting the physical and psychological well-being of patients through modern therapeutic and diagnostic techniques.
- **Centro di Riabilitativa e Fisioterapia di Cilia & Co.:**
the intention of this company is to provide a health service for outpatient functional rehabilitation and rehabilitation (physical and neurological recovery and rehabilitation) which, using equipment for the physical therapies and rehabilitative techniques always at the forefront.
- **Kinecenter**: is a non-accredited Medical Rehabilitation Center with the National Health System. It develops a personalized therapy program that includes a mix of treatments consisting of Kinesitherapy, physical therapies, manual therapies and muscle reconditioning. To achieve maximum functional recovery of the patient.

4.2. Internal analysis

Definition of the company

Age:

The research center has its origin on 23rd of March 1992, born from an agreement with the University of Messina and the foundation "Bonino Pulejo". On 4th of March 2006 the hospital obtained the title of IRCCS, being confirmed twice: 3rd of March 2011 and 9th of December 2015.

Size:

The IRCCS "Bonino Pulejo" offers 94 beds for inpatients who must stay in the hospital to correctly perform the rehabilitation. Also, the hospital offers the utilization of all the machines with 85 nurses and 50 doctors.

Field of activity:

The institute, the Health Research Institute, has its own Mission in the field of "neuroscience in the field of prevention, recovery and treatment of serious acquired neuro-lesions", whose aims are pursued through the synergy between research activities, health care high specialty, technological innovation and high training.

Kind of property:

The IRCCS has a public character, due to the origin of its incomes come from the state aid.

Geographical field:

The Bonino Pulejo Neurolesi Center is located in:

Via S. 123 Via Palermo C/ Casazza

98123 Messina.

By car:

- From Palermo: 232 km (2h 51min).
- From Catania: 86 km (1h 32min).
- From the Maritime Station Messina: 7,6 km (26min).
- From Private Ferries: 6,5 km (23min).

By bus:

- N. 70: from Piazza Cavallotti.
- N. 71: from Piazza Cavallotti.

Legal structure:

- Decree of the Ministry of Health 04th March 2006
"Recognition of the scientific character of the Center for
the study and treatment of long-term Neurolesi of
Messina" (GU n.61 of 14 March 2006).
- Decree of the Ministry of Health 09th December 2015
"Recognition of the scientific nature of the IRCCS of
public law Center neurolesi Bonino Pulejo, the Messina,
for the discipline of Neurosciences in the prevention,
recovery and treatment of serious brain injury purchase"
(GU Series General, No. 4 of 07 January 2016)

Strategic profile of the company

Strategic profile of I.R.C.C.S. Bonino-Pulejo	SITUATION				
	VN	N	M	P	VP
Functional areas and key aspects					
• COMMERCIAL AREA					
Market share				X	
Brand image				X	
Sales force					X
• PRODUCTION AREA					
Cost structure			X		
Quality control					X
Productivity					X
• FINANCIAL AREA					
Financial structure			X		
Cost of capital			X		
Investment profitability			X		
• TECHNOLOGICAL AREA					
Available technology					X
Effort in R & D					X
Technological assimilation					X
• HUMAN RESOURCES					
Incentive system				X	
Social environment				X	
Level of education					X
• DIRECTION AND ORGANIZATION					
Direction style				X	
Organizational structure				X	
Corporate culture				X	

Table 4: Strategic Profile

In this chapter we will identify the strengths and weakness of the I.R.C.C.S. Bonino Pulejo, through the study and analysis of functional areas.

This excel has been completed by the staff of the hospital, with it we get a global idea of how they are selling themselves and what are the strengths and the weaknesses from the IRCCS Bonino Pulejo. We could see that the financial part is what should be improved.

5. New and old rehabilitation techniques

In this chapter, I tried to explain the different types of machines that are used in Bonino-Pulejo and look for some traditional rehabilitation that could act like a complement of this rehabilitation, doing a combination of them.

5.1. New techniques

AMADEO

What is?

AMADEO developed by TYROMOTION, an Austrian company, is a hand's and finger's therapy unit used for the rehabilitation neurological of the upper extremity. AMADEO isn't just the neurological rehabilitation it is also orthopedically and pediatratically

It could be adapted for each patient necessity, the therapist should adapt it, to could be useful for the different phases of rehabilitation. Using Amadeo we should be care with the people that have the following problems:

- ✓ Ictus
- ✓ Commotional head injury (SHT)
- ✓ Spinal cord injury
- ✓ Brain tumor
- ✓ Parkinson's disease
- ✓ Chronic diseases, such as multiple sclerosis
- ✓ Cerebral paresis (CP)
- ✓ Motor neuron diseases.
- ✓ Meningitis, encephalitis
- ✓ Muscular dystrophies
- ✓ Paralysis due to herniated discs in the spine.

- ✓ Fractures and injuries of the distal upper extremity

Utilization:

In all the fingers we put the guide, to place each finger in the magnets that are in the display, after the hand of the patient hand is positioned in the correct place of the unit to start the treatment. The therapist must select the correct program for each people to get a good performance:

- ✓ Continuous Passive Motion Therapy: Passive hand is simulated.
- ✓ Assistive Therapy: Allows active training at the patient's limit of performance.
- ✓ Interactive Therapy: Active training with different virtual games.

Cost:

- ✓ Economic → 80.000€
- ✓ Personal → 1 person 15 min per session.



Figure 18: Amadeo rehabilitation.

ArmeoPower

What is?

ArmeoPower developed by Hocoma, a Swiss company, is an arm's and hand's therapy used for the rehabilitation neurological of this part.

ArmeoPower help the therapist to evaluate the patient giving the results to optimize the recovery process, getting us a patient tracking report.

It automatically adapts the arm movement guide to each patient necessities, from people with big amount of movement for patients in the first part of the recovery, to people with short amount of movement for patients in an advanced part of the treatment.

Considering the contraindications and every patient's individual profile, indications for the use of the ArmeoPower include:

- ✓ Stroke
- ✓ Multiple sclerosis (MS).
- ✓ Cerebral palsy (CP).
- ✓ Recovery from neurosurgical interventions.
- ✓ Spinal cord injuries (SCI).
- ✓ Traumatic brain injury (TBI).
- ✓ Muscle diseases.
- ✓ Parkinson's disease and other movement disorders.
- ✓ Upper limb ataxia.
- ✓ Neuropathies.

Utilization:

First, we set up ArmeoPower for the affected side and we position the patient, then we do the adjustment of the shoulder joint position and select the correct height of the orthosis from the upper part and arrange the patient's limb in it, after it we should adjust the length of the upper limb and adjust the forearm length. Finally, we select the correct position of the handle and check and adjust the settings.

After the end of the process it evaluates and measures the different movement parameters. Providing visual feedback information of the patient, which can be used to modify the patient therapy.

Cost

- ✓ Economic → 90.000€
- ✓ Personal → 45min ½ person necessary cause one physiotherapeutic could be working with two machines at same time.



Figure 19: ArmeoPower.

Lokomat

What is?

Lokomat developed by Hocoma, a Swiss company, it is a lower extremity's therapy used for the rehabilitation neurological of this part.

It is an electronical controlled robotic exoskeleton with a weight relief system and a treadmill. The supports are applied to the lower extremities and provide diversified assistance to the legs. The speed, the frequency, the length of the stride, the excursion of the joints of the knee and the hip are among the parameters of the route that can be modified during the rehabilitation phase. The patient is actively involved, thanks to the virtual reality visible on a screen.

Utilization:

This is a very advanced technology: a support that is applied to the legs, is connected to a computer that allows discharge the weight of the patient totally or partially, it helps in a motorized way, varying the different parameters, providing different assistance in one leg in comparison with the other.

At the end of the process it evaluates and measures the various movement parameters. Providing visual feedback information of the patient, which can be used to modify the patient therapy. This activity is shown on the PC Lokontrol for the therapist's control, it can be saved in a file for further analysis.

Cost:

Economic → LokomatNano: 200.000€. LokomatPro: 280.000€

Personal → 45min ½ person necessary cause one physiotherapeutic could be working with two machines at same time.

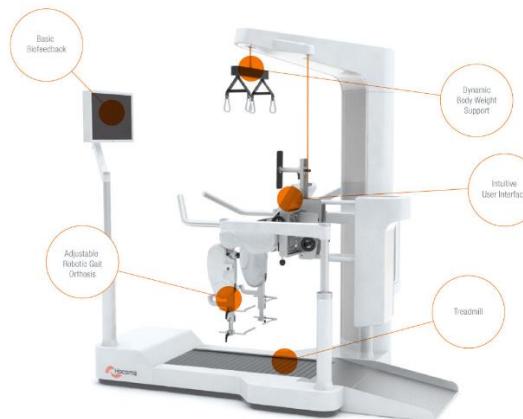


Figure 20: LokomatNano.

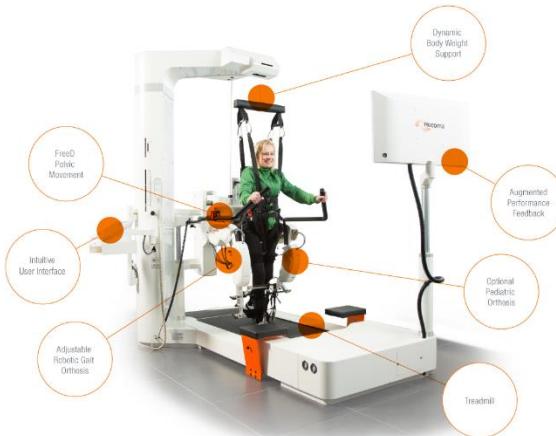


Figure 21: LokomatPro.

Vitalstim

What is?

It is a neuromuscular electrical stimulation that helps to recruit and re-educate muscles in the process of swallowing. This stimulation allows a constant drainage neuromuscular stimulation to facilitate the sensorimotor system during an active exercise and generates a current that flows once for each direction (each unidirectional flow period is called phase then the VitalStim device can generate a wave of two phase). Both wave phases last 300 µseg.

The equipment of Neuromuscular Electrical Stimulation (NMES) in the hospital is the Vitalism Intelect, which has been developed by the American company DJO Global.

Utilization:

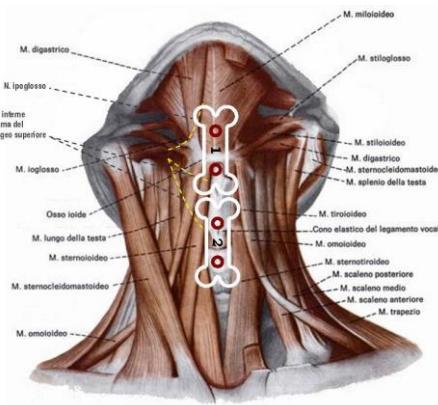
VitalStim is set to work at a fixed frequency of 80 Hz to obtain fast stimulation of motor neurons. The penetration depth of the current is related with the amplitude or intensity (mA) of the current reached during the impulse: for safety reasons this has its top at 25 mA.

The 7 positions of how the electrodes should be placed:

Position 1: All the electrodes are aligned vertically.

-Musculature involved:

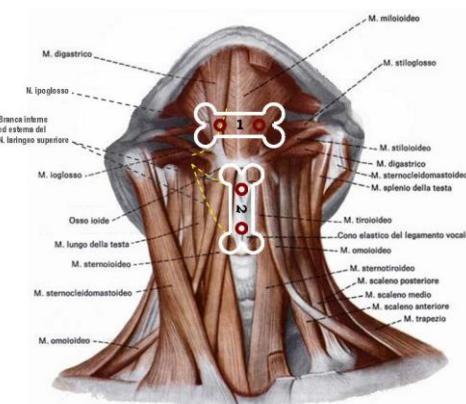
- On the surface: mylohyoid and sternohioid muscles.
- In depth: geniohyoid and cricothyroid muscles.



Position 2: the first pair of electrodes is placed horizontally, while the second pair vertically.

-Musculature involved:

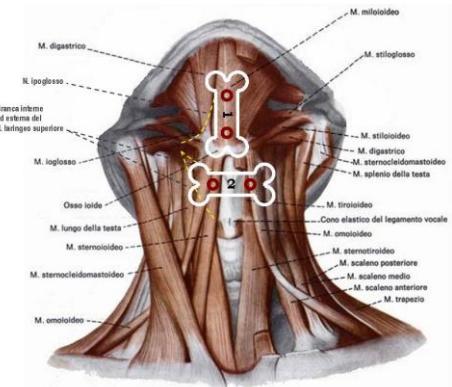
- On the surface: mylohyoid and sternohioid muscles.
- In depth: geniohyoid and cricothyroid muscles.



Position 3: the first pair of electrodes is placed vertically, while the second pair horizontally.

-Musculature involved:

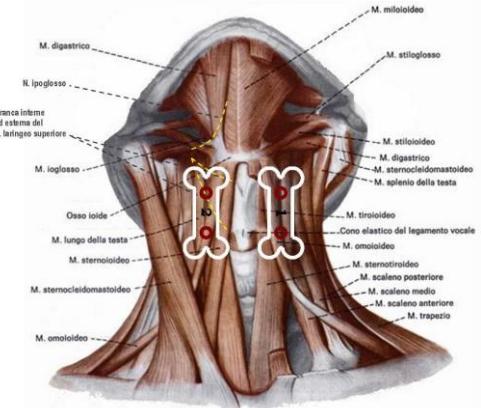
- On the surface: mylohyoid muscle, sternohyoid and omohyoid muscles.
- In depth: geniohyoid muscles, and the internal branch of the superior laryngeal nerve.



Position 4: Both pairs of electrodes are placed vertically and laterally to the midline.

-Musculature involved:

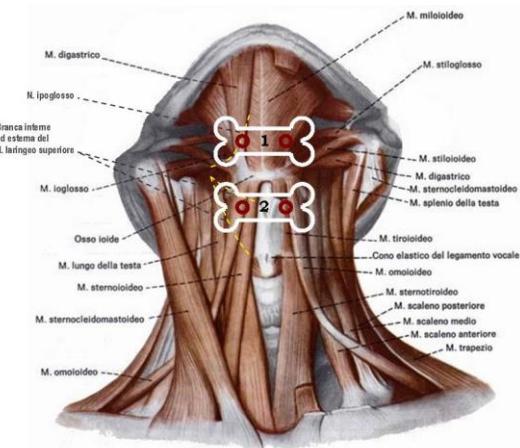
- On the surface: digastric (abdominal), sternohyoid and omohyoid muscles.
- In depth: thyroid muscle, and hypoglossal nerves and superior laryngeal nerve.



Position 5: Both pairs of electrodes are placed horizontally so that the upper rests above the hyoid bone.

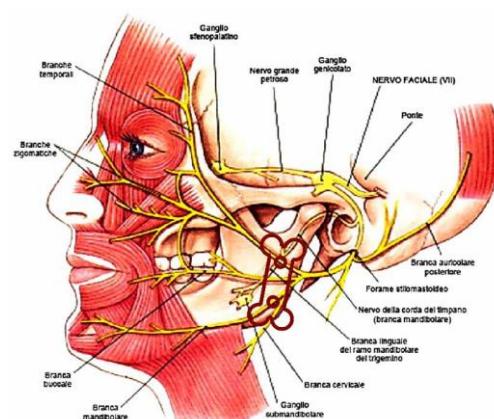
-Musculature involved:

- On the surface: mylohyoid, digastric (anterior abdomen), sternohyoid and omohyoid muscles.
- In depth: geniohyoid, thyroid, medial pharyngeal constrictors and hypoglossal nerve.



Position 6: The electrodes are placed on the buccal branch of the facial nerve bilaterally or individually depending on the clinical situation.

The second pair of electrodes could be positioned horizontally above the hyoid bone to facilitate recruitment of the hypoglossal nerve.



Position 7: The electrodes are placed on the main trunk of the facial nerve bilaterally or individually.

The second pair of electrodes could be positioned horizontally above the hyoid bone to facilitate recruitment of the hypoglossal nerve.

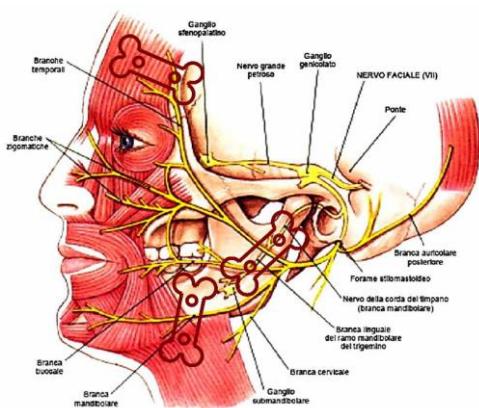


Table 5: Vitalstim table.

Cost:

Economic → 40.000€

Personal → 45min ½ person necessary cause one physiotherapeutic could be working with two machines at same time.



Figure 22: Vitalstim Device.

VRRS

What is?

The Virtual Reality Rehabilitation System (VRRS) is one of the most advanced, comprehensive and clinically tested virtual reality system for rehabilitation and tele-rehabilitation in the market. It is developed by Khymeia, an Italian company.

The extreme ease of use, the high customization capabilities, the complete automatic reporting, the tele-rehabilitation functionalities, are some of the principles that lead the continuous development of the system. VRRS, in fact, is conceived as a "central HUB" to which it is possible to connect via USB a wide range of specialized peripheral devices, fully synchronized and integrated with the system. VRRS, with the exclusive magnetic kinematic acquisition system, is used as a clinical routine for the rehabilitation of a wide spectrum of diseases via the numerous rehabilitative modules containing the most extensive library of clinically validated exercises available.

Utilization:

The use of this device is very simple, in the VRRS screen the therapist selects the desired program that will be developed, in the monitor the patient is explained in what it consists of. After this point sensors are installed, through which the computer picks up the movements of the person who is doing the tasks that are marked on the screen. These programs or tasks can be

modified by the therapist introducing and thus varying the difficulty and intensity of the rehabilitation.

VRRS is equipped with 3D magnetic sensors with 6 degrees of freedom in 3 axes allowing a real time kinematic tracking (120fr/s) with high accuracy, avoiding any umbra area and managing the patient compensation issue. The VRRS activates visual feedback, acoustic feedback and force feedback. It has a wide library of exercises, provided with scores.

VRRS could be used in different modules such as:

- | | |
|----------------------|-----------------------|
| ✓ Motor skills | ✓ Hand rehabilitation |
| ✓ Cognitive | ✓ TDCS Simulation |
| ✓ Speech therapy | ✓ Cordiorespiratory |
| ✓ Phonation | ✓ Orthopedic |
| ✓ Postural | ✓ Cervical Spine |
| ✓ Facial Recognition | ✓ VR Full Immersive |

Cost:

Economic → -

Personal → 45min ½ person necessary cause one physiotherapeutic could be working with two machines at same time.



Figure 23: VRRS Device.



Figure 24: VRRS Rehabilitation.

EKSO.

What is?

EksoGT from the American company Bionics, is a wearable exoskeleton for stroke and spinal cord injury rehabilitation. It is the first FDA cleared exoskeleton indicated for stroke and spinal cord injury rehabilitation that is designed to help patients get back on their feet supporting re-learning of correct step patterns, weight shifting, and potentially mitigating compensatory behaviors.

EksoGT could be divided by three main parts:

- **Exoskeleton** promotes early mobility and helps correct posture, this means an innovative way for patients to obtain more effectively and quickly the rehabilitation that are looking for.
- **Controller** allows real-time adjustments to an exoskeleton during rehabilitation, *the changes done by the doctors during the use can help to get goals in an easiest way.*
- **Software** enables personalization and customization during rehabilitation sessions, doctors are helped by the analysis of the measurements made and through which they can *do a specific rehabilitation plan for each patient, adapting to their physical needs.*

Utilization:

The patient should be placed inside the Ekso GT, to start using it. Then we must select the correct mode to start the rehabilitation waiting for a satisfactory recovery of the person that is using the Ekso GT and can improve daily. This instrument has several points that help the different areas of the human body to move or have mobility of the body parts. Patients can use crutches to help themselves when they are walking.

Cost:

Economic → 240.000€.

Personal → 45min ½ person necessary cause one physiotherapeutic could be working with two machines at same time.



Figure 25: Ekso Device.

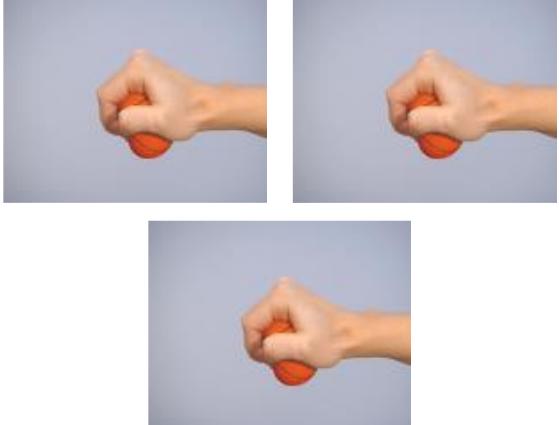
5.2. Old techniques.

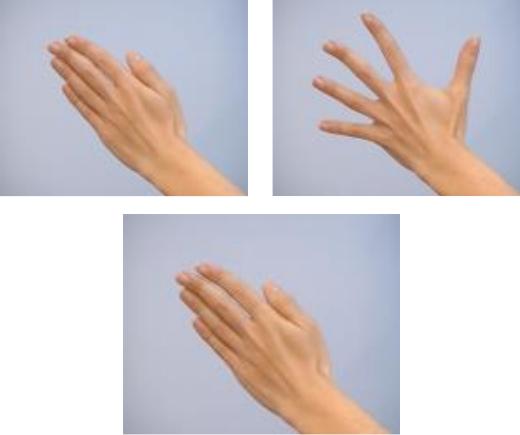
This chapter of the thesis I have searched for some rehabilitation techniques without machines or electronic devices that can be substitute products for the new techniques, but that they can help the rehabilitation with these devices if they are performed in an appropriate way.

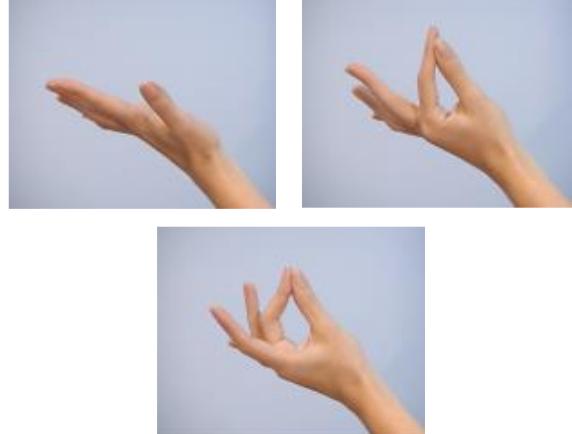
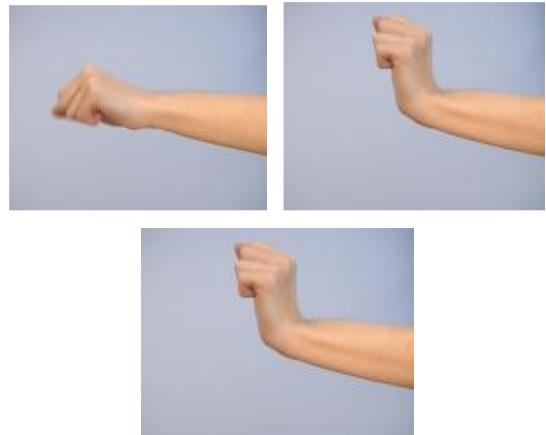
Hand and Fingers rehabilitation.

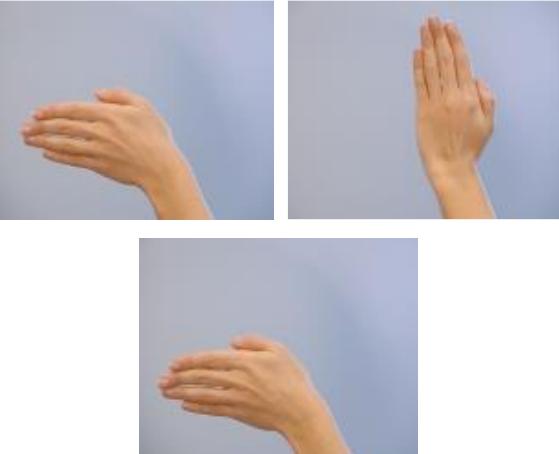
Here there are some exercises and how they are supposed to be done:

Exercise name	Instructions
Fist	<ol style="list-style-type: none">1. Sit or in a chair.2. Close your hand slowly, as much as possible "until you manage to make a fist". We can help with a soft ball or a sponge for example.3. It can be done with the hand submerged in hot water to achieve greater muscle relaxation.

			
Extension of the fingers		<ol style="list-style-type: none">1. It is advised to perform the standing exercise.2. Open the hand and extend the fingers to the maximum. We can help if necessary by pressing the palm of your hand against the plane of a table. 	

Separation of fingers	<ol style="list-style-type: none">1. Standing or sitting on a chair.2. With the open hand try to separate the fingers (in the form of a fan), to the maximum point. 
Opposition	<ol style="list-style-type: none">1. Standing or sitting on a chair.2. With the yolk of each finger try to contact separately with the yolk or thumb pulp.

	
Flexo-extension of the doll	<ol style="list-style-type: none">1. Standing or sitting on a chair.2. Closed hand (making fist), open or almost closed.3. Perform movements of flexion and extension of the wrist slowly alternately. 

Lateralization of the doll	<ol style="list-style-type: none">1. Standing or sitting on a chair.2. Open hand and extended fingers.3. Perform lateral movements with the wrist, directing the hand outward and inwardly from the body. 
Doll turn	<ol style="list-style-type: none">1. Standing or sitting on a chair.2. Half-closed hand3. Do rotational movement around the wrist as if trying to open and close a door (in case of suffering from osteoporosis, consult your doctor).

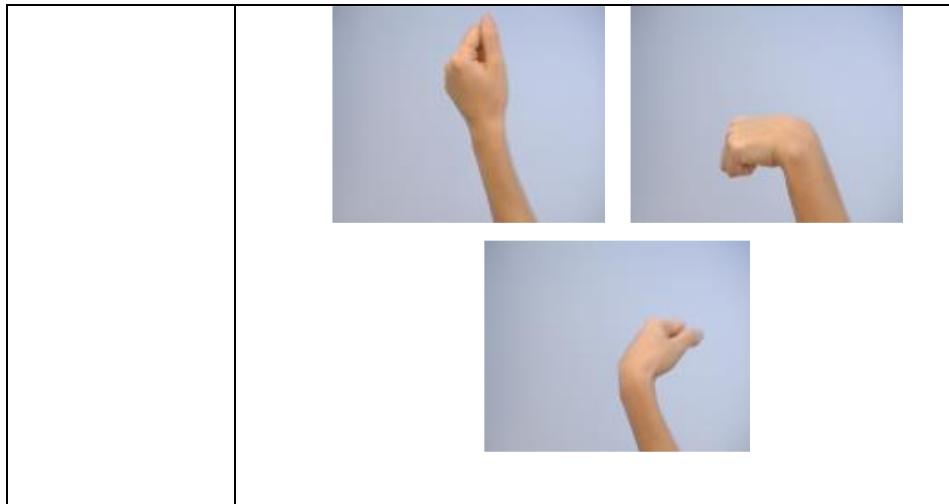
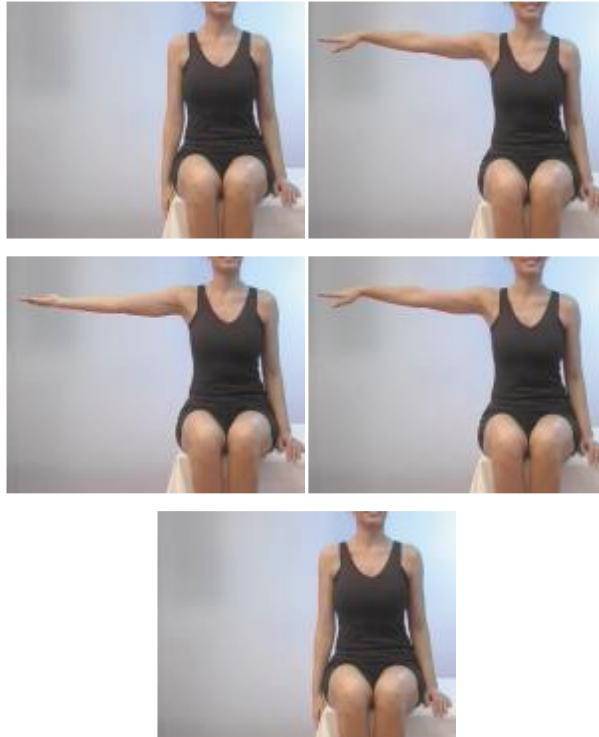


Table 6: Hand & fingers Rehabilitation.

Arm rehabilitation.

Flexo-elbow extension	<ol style="list-style-type: none"> 1. Standing or sitting in a chair without elbow in extension. 2. Flex the elbow slowly until the upper extremity is hanging parallel to the body. 3. Return to the starting position. <div style="display: flex; justify-content: space-around; margin-top: 20px;">   </div> <div style="text-align: center; margin-top: 10px;">  </div>
-----------------------	--

	<ol style="list-style-type: none">1. Standing or sitting in a chair without arms with arms hanging along the body.2. Slowly raise the upper extremity until it is fully horizontal with the elbow extended.3. Rotate the extremity so that the palm of the hand faces upwards.4. Rotate the limb again so that the palm of the hand faces the ground.5. Lower the limb until returning to the initial position slowly. <p>Arm's elevation</p> 
--	---

<p>ELBOW FLEXION</p>	<ol style="list-style-type: none"> 1. Standing or sitting in a chair without arms with the extremity completely horizontal and extended and with the palm of the hand looking at the ground. It can be done holding a light weight. 2. Perform rotation of the limb so that the hand (with the weight) faces upwards. 3. Slowly flex the limb until the hand touches the shoulder. 4. Extend the elbow to the horizontal position again with the hand facing up. 5. Rotate the limb again until the hand (with the weight) looks at the floor. <div style="display: flex; justify-content: space-around; margin-top: 20px;">   </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;">   </div>
--------------------------	---

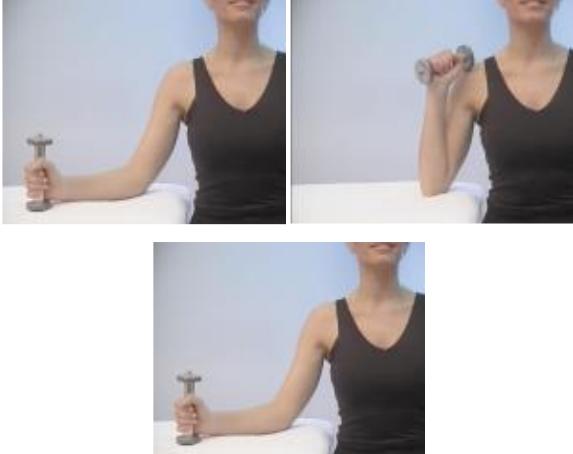
Flexo-extension of the elbow weight	<p>1. Standing or sitting in a chair without arms.</p> <p>2. With a weight held in the hand, go extending and flexing the elbow slowly.</p> 
-------------------------------------	--

Table 7: Arm Rehabilitation.

Dysphagia rehabilitation. Stimulation of face and mouth.

If there is a lack of sensitivity and mobility in the face, tongue or lips, specific massages can be performed.

Using the tactile stimulation: massages to promote the rise or decrease of muscle tone.

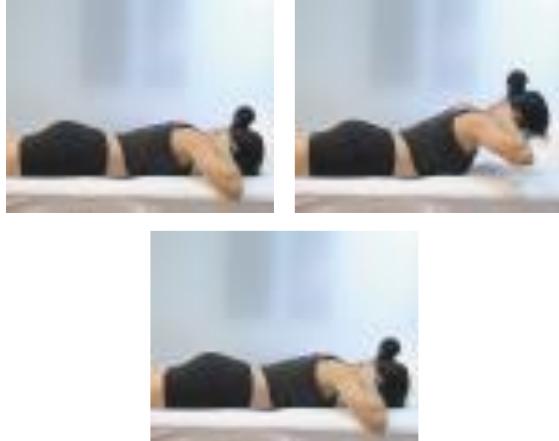
- Pinched to raise tone in cases of hypotonia.
- Vibration on the hypotonic musculature with some vibratory device.
- Kneading with wide circular movements for hypertonia.

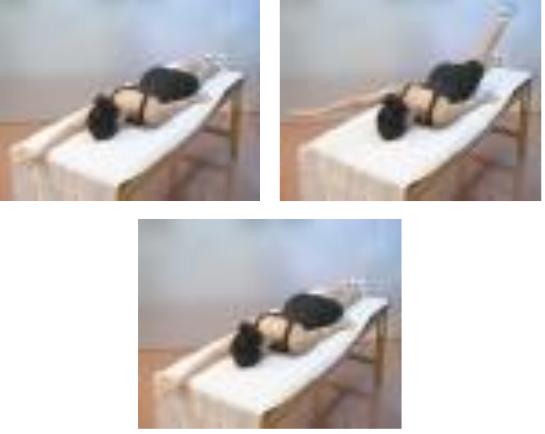
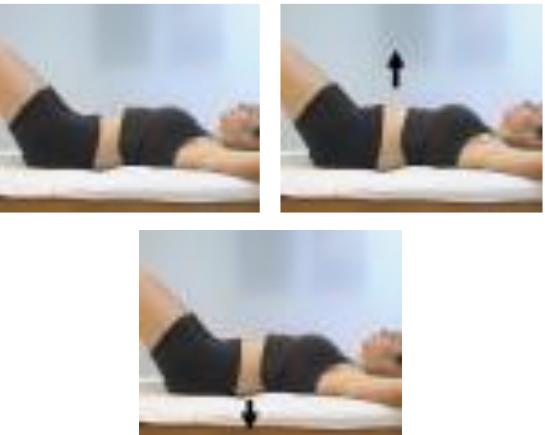
- Circular pressure on the muscles of the jaw: with the tips of the fingers at the level of the temporo-mandibular joint, press slowly circling.
- Buccinator massage: with the thumbs on the cheeks, just below the eyes and on both sides of the nose, we perform a sweep while pressing slowly and firmly.

Rehabilitation for the dorsal and lumbar column.

Dorsal	<ol style="list-style-type: none">1. Stretched patient (decubitus), legs flexed. Arms flexed with hands on the nape.2. Press your elbows to the ground, without moving your neck or head (inspire) for a few seconds.3. Relax (exhale)4. If the starting position is not possible, you can perform the exercise by supporting the arms on the ground, separated from the body by pressing the palms of the hand and the forearms against the ground.
--------	---

	
Trunk extension	<ol style="list-style-type: none">1. Patient lying on his stomach, legs and arms outstretched. Front touching the ground.2. When inspiring raise the head, shoulders and arms, keep a few seconds.3. Relax (exhale) 

Elevation of head and shoulders	<ol style="list-style-type: none"> 1. Patient lying face down, legs and arms extended. Front touching the ground with arms flexed and hands on the nape. 2. When inspiring raise the head and shoulders, extending the head slightly, keep a few seconds. 3. Relax (exhale). 
Elevation of arm and opposite leg	<ol style="list-style-type: none"> 1. Patient lying on his stomach, legs and arms outstretched. Front touching the ground with one arm extended forward and the other stretched along the body. 2. When inspiring raise the extended arm forward and simultaneously raise a little the opposite leg. Relax (exhale). 3. Repeat the exercise with the arm and leg on the other side.

	
Lumbar	<ol style="list-style-type: none">1. Decubitus patient, legs flexed. Arms flexed with hands on the nape.2. When inspiring to swell the abdomen.3. Exhale by pressing the lower back against the ground. 
Flexo-extension of	<ol style="list-style-type: none">1. On all fours on a hard plane (knees, elbow extension arms, hands resting on the floor, at shoulder height).

column (Cat)	<ol style="list-style-type: none"> 2. Bend the column, head in flexion, (inspire), keep a few seconds. 3. When expiring hyperextend the spine, extending the head, keep a few seconds. 4. Relax. <div style="text-align: center; margin-top: 20px;">    </div>
Elevation arm and opposite leg (Cat)	<ol style="list-style-type: none"> 1. On all fours on a hard plane (knees, elbow extension arms, hands resting on the floor, at shoulder height). 2. Stretch the arm and leg on the opposite side, extended and elevated. Head in neutral position. 3. Inspire, keep a few seconds and relax. 4. Repeat with the opposite arm and leg.

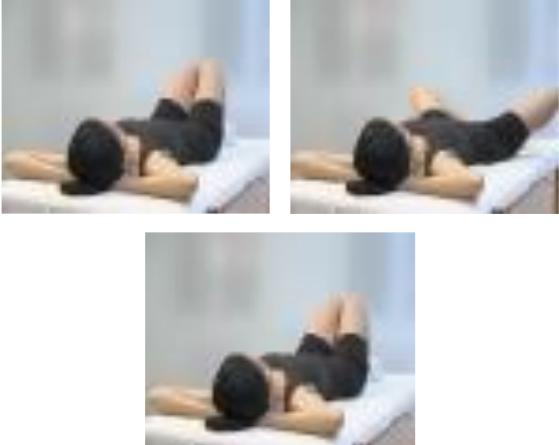


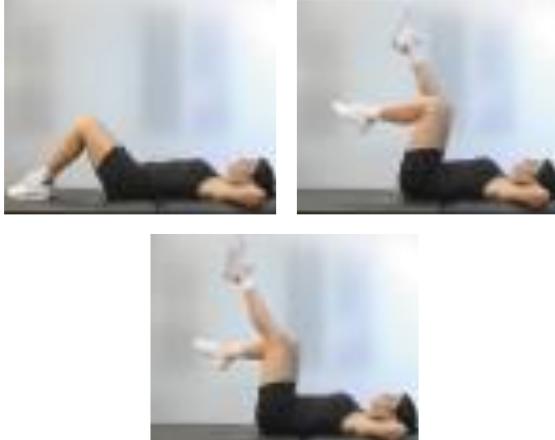
Table 8: Back Rehabilitation.

Rehabilitation for the hip

Hip Flexion	<ol style="list-style-type: none">1. Stretched patient (decubitus), legs in extension. Arms stretched along the body.2. Flex one leg, bringing the knee to the abdomen (inspire).3. Relax (exhale) by extending the leg.4. Repeat the exercise with the other leg.
-------------	---

	 Three photographs illustrating hip rotation exercises. The first two images show the patient lying on their side, with one leg bent at the knee and the other extended. The third image shows the patient lying on their back with both legs bent at the knees.
Hip rotation	<ol style="list-style-type: none">1. Stretched patient (decubitus), one leg in flexion and the other in extension. Arms stretched along the body.2. When inspiring, turn your leg flexed, directing the knee towards the extended leg.3. On expiration, turn the knee outwards.

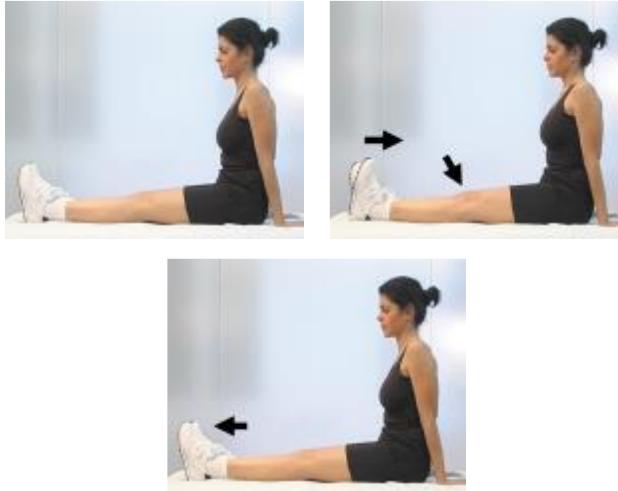
	
Separations	<ol style="list-style-type: none">1. Stretched patient (decubitus), legs in flexion with feet together, resting on the floor. Arms stretched along the body.2. When inspiring to separate the knees, keep a few seconds and return to the starting position (exhale). 

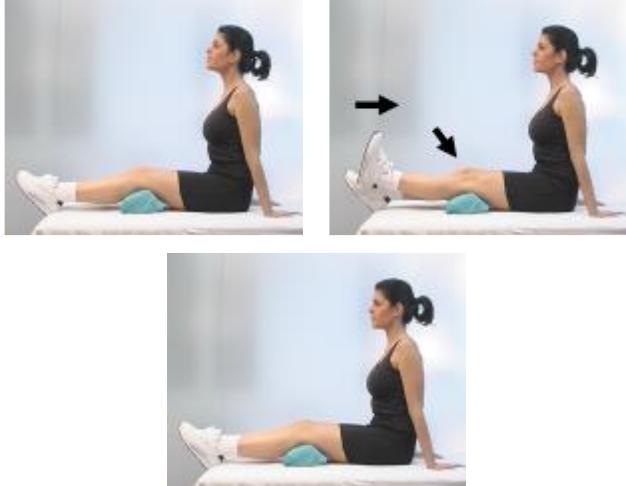
Bicycle	<ol style="list-style-type: none"> 1. Stretched patient (decubitus), legs flexed. Arms flexed with hands on the nape. 2. Pedaling movements forward, hips as flexed possible. 3. Repeat the exercise with back pedaling movements. 
Side deck (middle glute)	<ol style="list-style-type: none"> 1. Patient lying on one side, leg resting on the floor in flexion and the other in extension. 2. When inspiring, raise the extended leg parallel to the ground (prevent the foot from facing the ceiling). 3. Hold for a few seconds and return to the starting position (exhale).

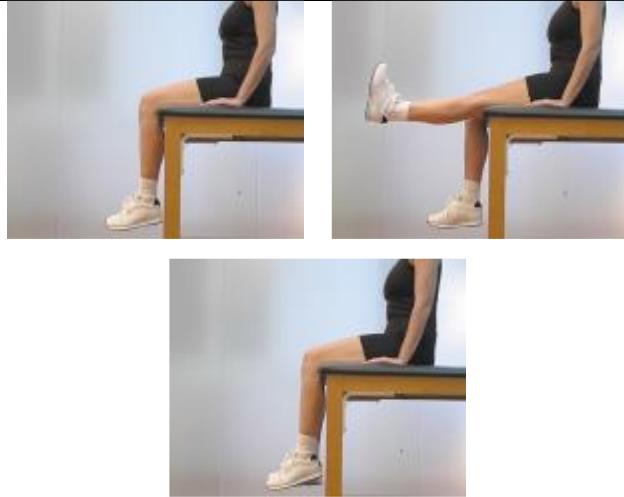
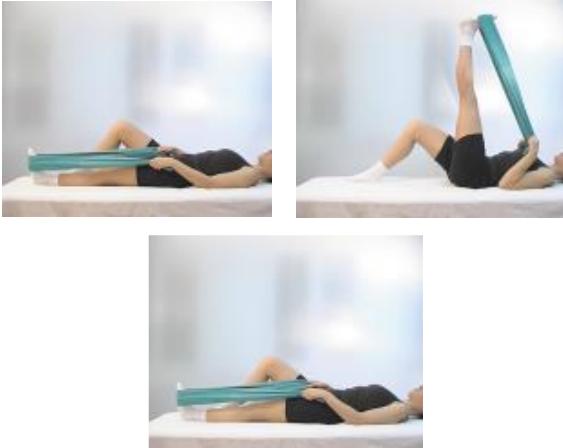
	  
Lateral decubitus (Flexion-hip extensión)	<ol style="list-style-type: none">1. Patient lying on his side, the leg resting on the ground in flexion and the other in extension.2. Upon inspiration, flex the extended leg parallel to the floor, bringing the knee to the abdomen.3. Hold for a few seconds and return to the starting position (exhale).   

Table 9: Hip Rehabilitation.

Rehabilitation of the knee.

Quadriceps in knee extension	<ol style="list-style-type: none"> 1. Patient sitting on hard floor with knees in extension (90 ° hip flexion) and straight back. 2. By inspiring the leg tense while the tip of the foot is directed as far as possible towards the patient. 3. Trying to squeeze the back of the thigh against the ground. 4. Hold for a few seconds and relax to the starting position (exhale). 5. Repeat the exercise with the other leg. 
Quadriceps in semi-knee flexion	<ol style="list-style-type: none"> 1. Patient sitting on hard floor with knees in slight flexion (place a pillow under the hollow of the knees) and straight back.

	<p>2. When inspiring to stretch the leg while extending the knee, raising the foot, while the tip of the foot is directed as far as possible towards the patient and squeezes the back of the thigh against the pillow.</p> <p>3. Hold for a few seconds and relax to the starting position (exhale).</p>
Flexo-Knee extension	 <p>1. Patient sitting on hard floor with knees bent at 90° and back straight.</p> <p>2. When inspiring to extend a knee, keep a few seconds tensing the leg with the tip of the foot directed towards the patient.</p> <p>3. Hold for a few seconds and relax to the starting position (exhale).</p>

	
Decorative isquiotibial stretches	<ol style="list-style-type: none"> 1. Patient lying on his back, with his foot and leg well stretched. 2. Place a piece of cloth or tape by passing it through the sole of the foot. 3. Helping with the arms, lift the limb up to 90°. Hold for a few seconds and slowly return to the starting position. 

<p>Ischiotibial foot stretches</p>	<ol style="list-style-type: none"> 1. Patient standing, located next to a hard surface (bunk, table, ...). 2. Put the tip stretched on the surface. Bend the trunk to grasp the tip of the feet and try to tighten the leg. 3. Hold a few seconds and relax, returning to the starting position. <div style="text-align: center; margin-top: 20px;">  </div>
---	--

Table 10: Knee Rehabilitation.

5.3. CAREN

What is?

CAREN (Computer Assisted Rehabilitation ENvironment), developed by MoTek Medical a Netherlands company, is a versatile and multisensory system for the clinical analysis, rehabilitation, evaluation and recording of the human equilibrium system.

Virtual reality (VR) use allows researchers to evaluate the behavior of the subject, including visual, auditory, vestibular and tactile sensory stimuli. Sensory stimuli can be isolated or combined.

The real-time feedback system records and reacts faster than human perception and any other system.

The protocols and programs developed from this configuration guide the creation of innovative rehabilitation techniques.

This project Cost Bonino-Pulejo around 1.000.000€+200.000 for the building.

Application of CAREN

CAREN offers a wide range of applications and several advantages compared to the current rehabilitation applications:

- ✓ Improves the balance.
- ✓ Useful for those who have suffered brain injuries, brain damage and damage to the spine.
- ✓ In the field of orthopedics and prosthetics, the CAREN Extended system can monitor and track progress during exercises and improve patient movements.
- ✓ The CAREN Extended system can not only provide repeatable measurements, but also monitor patient progress by comparing movements recorded at different time intervals.
- ✓ Reduction of patient rehabilitation times.

- ✓ The problems of movement and dizziness can be treated by replicating the conditions and allowing the patient to adapt to the movement.
- ✓ Allows psycho-cognitive rehabilitation, also addresses aspects of social and labor reintegration thanks to customizable virtual reality protocols.

How is the virtual environment done?

The well-implemented sum of software and hardware gives rise to a virtual environment, trying to simulate reality in the most similar way.

Hardware:

- ✓ Motion Base - Stewart Platform:
 - 6 degrees of freedom
 - X, Y and Z translation.
 - Roll, pitch and yaw rotation.
- ✓ Instrumented Treadmill: Platform with double belt allows a walking speed up to 5m/s. The entire surface of each belt is also a high precision force platform, able to measure the center of pressure, the moments and forces in all directions.
- ✓ Motion capture system: The motion detection system allows to detect the movement of the subjects in real time. It uses infrared cameras to detect the position of the markers passive reflective.
- ✓ Projection system: The 180-degree cylindrical screen totally immerses the subject in the virtual environment.

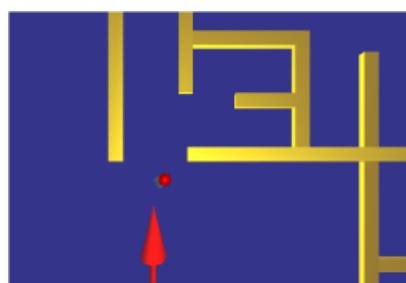
- ✓ Sound system: the 5.1 surround sound system allows the audio signals to come from any direction.

Software:

- ✓ D-Flow software: The D-Flow software allows real-time data exchange between many types of components integrated. It creates a situation in which the subject is immersed in a feedback loop in real time, in which his movements and his behavior are considered a signal in input and a feedback loop output signal, with the system responding to movements of the subject, and the movements of the subject that respond to the system. The modular structure of the D-Flow software allows easy integration of all devices. The software allows users to define the sensory stimuli sent to the subject, the perturbations and sensory conflicts.

Apps:

This apps are a set of four games for rehabilitation:

<p><u>Active Balance</u>: This application is used to train balance and stability during stance by controlling the body's center of mass within the base of support. The training can be made more challenging by letting the patient move near his/her limits of stability.</p>	
--	--

City rider: This application is used to train balance and stability during stance by controlling the body's center of mass within the base of support. The training can be made more challenging to let the patient move towards his/her limits of stability. When the center of mass exceeds the limits of stability a patient becomes unstable and needs to make compensatory steps, thus changing the base of support.



The boat: This application is used to train balance and stability by controlling the body's center of mass within the base of support while standing on a moving platform, and at the same time performing forward, backward and sideways stepping to control the boat.



The road: This application is used to train balance, gait and stability by performing dual tasks while walking. These tasks can be either hitting targets within the upper extremity movement envelope or aiming and shooting targets. These tasks can be performed on a flat road or a road with slopes and curves.



Table 11: Apps CAREN.



Figure 26: CAREN Lab.

5.4. Telerehabilitation

What is?

The World Health Organization WHO already in 1997, offered the definition of telemedicine that we propose to you faithfully:

"Telemedicine is the provision of health care services, when distance is a critical factor, by professionals who use information and communication technologies to exchange useful information for diagnoses, treatments and prevention of diseases, as well as to guarantee continuous information to healthcare providers and support research and evaluation of the cure."

Most services are divided into two categories: clinical evaluation and clinical therapy.

Telerehabilitation allows the therapy to be applied to people who cannot travel to a clinic because the patient has a disability or because of long distances and travel time. It facilitates access to professionals and patients from different locations, saving travel costs, waiting times and consequently greater productivity.

If telemedicine is used correctly, it would allow the entire population and the entire country to have access to diagnosis and treatment. This shouldn't replace in any case the rehabilitation either with new appliances or a rehabilitation in a traditional way.

Some studies suggest that tele-rehabilitation can be an effective and flexible tool for motor and cognitive rehabilitation, as well as for the follow-up of patients suffering from chronic diseases of the Central Nervous System, providing an important continuity of therapeutic quality control. Patients are usually

discharged before obtaining the maximum recovery, due to the follow that the doctors can make with the TR.

In Europe, two important studies have demonstrated the effectiveness of home telecare in patients with multiple sclerosis, stroke and traumatic brain injury with motor deficit in the upper limb:

- H-CAD (Home Care Activity Desk) This system allows the execution of a configurable set of exercises at home. The rehabilitation treatment designed specifically for the patients' needs can be updated directly from the hospital environment.
- HELLODOC (healthcare service linking telerehabilitation to disabled people and clinicians): The activity was mainly focussed on architectural aspects and a step by step monitoring of the service. It was mainly related to the following aspects: service implementation, service performances, service integration and fault management.

Other studies confirm that Telerehabilitation of post-ACV paralysis using virtual reality seems more effective than traditional practice.

Hardware

The tele-rehabilitation stations are always equipped with a personal computer, local internet connection, and video camera, located both at the patient's home and in the clinic,

allowing both the exchange of information or any corrections in case of erroneous performance.

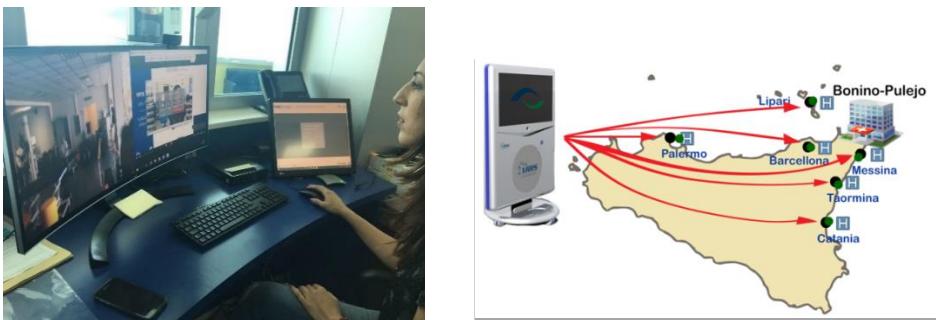


Figure 27: Telerehabilitation.

Bonino Pulejo Project

The Bonino Pulejo Project foresees an early and timely rehabilitation in the Stroke, from the acute phase to the home (through the territory), using advanced technologies in the field of telemedicine.

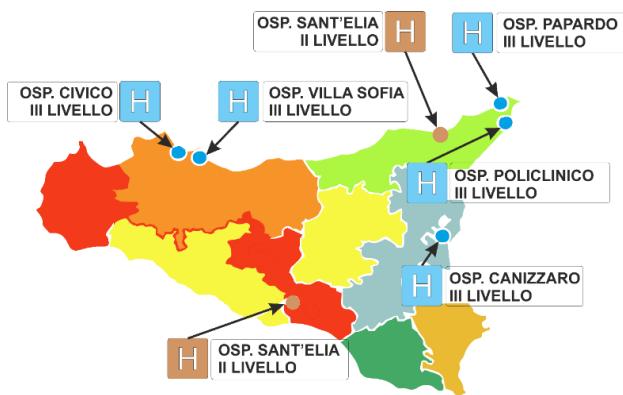


Figure 28: Bonino-Pulejo Project.

In Sicily there are only 5 SU of III level compared to 22 of Piemonte, and 4 in the city of Pavia alone.

The project involves the creation of a telematic network according to the "hub - spoke" model for the emergency management of the acute phase of stroke and teleconsultation, which provides for the telematic connection between the structures present in the local area of ASL and members of the project, with the aim of establishing a continuity of information flow while creating a computerized archive for the diseases in question.

In particular, the project was created to connect hub hospitals to spoke centers located in small islands, so as to guarantee "equal opportunities" and timely treatment, including rehabilitation.

5.5. Comparison & Combination

All the new techniques that are used in the hospital can be used along with the traditional techniques of rehabilitation since the use of a recovery method does not deprive the use of the other, they together could be a better recovery.

The traditional techniques that I have found are techniques that patients can perform at home (external) or in the hospital room (internal). These techniques don't require any special material, in some cases perhaps someone is needed to help carry out the practices or is keep an eye on the person who will perform the activities; in cases when the patient is in a non-advanced stage.

- On the one hand, the strengths of the novel techniques are the stimulations that the patient has when is seeing

fulfilling the objectives with the different games and sessions that they perform in the hospital.

On the other hand, the negative points that these techniques have, are the availability of the machines, since the hospital haven't got enough machines to be able to use each patient a machine when they want, and the displacement that these patients must do to use the machines inside the hospital from their houses.

- The positive aspects of the traditional rehabilitation instead are the ease of performing the exercises anywhere and at any time without the need to have a machine available, although some may have the need to be helped from a third person.

The negative points are, that this kind of exercises don't provide the stimulations that the new ones provide, trying to fulfill the different challenges that the games oppose, and in which the patient observes progress.

For inpatients the best option would be the combination of all these techniques, except tele-rehabilitation that is not necessary. That is, the sum of traditional techniques, new ones and if they can be used it, the CAREN.

For outpatients the best option is also the combination of all the techniques, but to a lesser extent the use of the machines since it involves more displacement, so that loss is compensated with a greater use of traditional techniques from home of the patient where doctors can monitor their progress with telemedicine.

6. Economic study.

The General Theory of Costs offers us the best tools to achieve the results related to the productive objectives foreseen, through the Cost Models, of applicability in the Public Health Sector, with the purpose of contributing to the decision done by the government.

The basic lines and main principles of the General Cost Theory provide the bases and the basic cost techniques for generate an information to evaluate the management in a company, doing the following aspects available to the Management Control of I.R.C.C.S. : What is done, what is the cost, the impact of the action, analysis of productivity and operational management of the public entity, evaluation of the information (qualitative and quantitative), quality of public resources, etc.

6.1. Objectives

General

Improve the Management Control of the IRCCS in the use of available resources; which is necessary to elaborate a detailed Information System adapted to the characteristics of the case under study, based on "Cost Reports and Management Indicators".

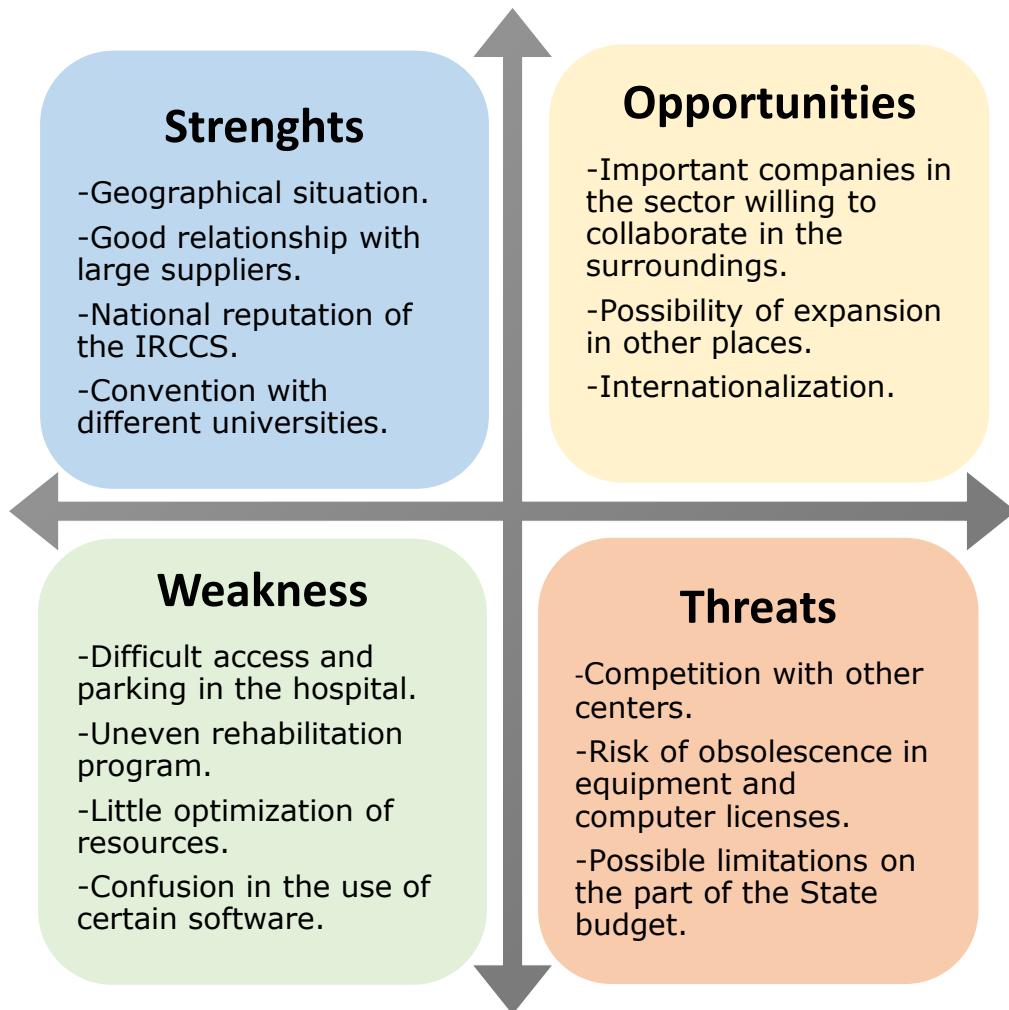
Specific

- Achieve the objective according to complete the Factors/Objectives relationship, it is necessary to do it in a concrete and measurable way, to be rational.
- To do the INTEGRAL AND INTEGRATED CONTROL OF MANAGEMENT, with Financial and Management Reports, of applicability in the Public Sector.
- Evaluate the results achieved for which that the Matrix of Indicators and IRCCS Indicators will be designed for each Area or Unit of service of the Hospital under study, allowing to measure and evaluate how the hospital management has been carried out in a given period.

6.2. Analysis DAFO/SWOT

It is necessary to carry out an analysis prior to the development of a Costing Model, appropriate to the case under study, to evaluate its internal situation and its surroundings, through a SWOT Matrix that encompasses a strategic diagnosis of the Hospital, Opportunities and Threats, Strengths and Weaknesses.

This are the main strengths, weakness, opportunities and threats that the hospital has:



<h3>Matrix of strategies of the corporation</h3>	<p>T1. Competition with other centers. T2. Risk of obsolescence in equipment and computer licenses. T3. Possible limitations on the part of the State budget.</p>	<p>O1. Collaboration with important companies. O2. Possibility of expansion in other places. O3. Internationalization.</p>
<p>W1. Difficult access and parking in the hospital. W2. Uneven rehabilitation program. W3. Little optimization of resources. W4. Confusion in the use of certain software.</p>	<p>SURVIVAL STRATEGY</p> <p>* Invest in machine learning and optimization courses (W2, W4, T2). * Plan an improvement in access and parking. (W1, T1)</p>	<p>CHANGE STRATEGY</p> <p>* Include personnel exchange programs with other similar centers in Europe. (W2, O3)</p>
<p>S1. Geographical situation S2. Good relationship with large suppliers. S3. National reputation of the IRCCS. S4. Convention with different universities.</p>	<p>DEFENSIVE STRATEGY</p> <p>*Help yourself with your good image to seek private funds other than those that the state provides. (S3, T3)</p>	<p>OFFENSIVE STRATEGY</p> <p>*Strengthen the IRCCS relationship with universities and nearby companies. (S2, S4, O1)</p>

6.3. Analysis of a general cost model for I.R.C.C.S.

Doing an analysis of the Costs Models, the main elements that intervene in any productive process are: the productive factors, the actions and the products, that are directly connected with our objective of study.

In this sense, the concept of cost is associated with the linkage between results of the productive product and the recourses that are necessary for the final objective.

In the definition of costs according to the General Theory Costs, the link between necessary factors and results prevail, having the necessity of the factor from the two perspectives:

- Qualitative: we must define what is the quality that a factor must have to be considered a necessary in the achievement of the objective.
- Quantitative: from the factors that qualitatively considered necessary, we must also express what is the amount necessary to achieve the objectives. This amount should refer to both the physical component and the price or value sacrificed to obtain it.

Considering the qualitative needs of the factors, it is important to refer to the Cost models, Variable and Complete, considering them to be applied in the study of the IRCCS that we are doing:

- Variable costing model: this model considers that the only factors necessary to obtain an objective are those

that have the quality of being sensitive to changes in the volumes of the achieved objective. The variable factors are those that are related with the objective or productive result, while the factors of fixed ones, are those that are generated by the maintenance of the productive structure.

- Full costing model: this model considers necessary all those factors that are used in the process where we get the result, regardless of changes in volumes.

Due to the characteristics of the productive processes in the hospital, it is easy to apply the classification of the productive processes. In this case it is possible to apply -to accumulate costs- what we call the Cost Model by Orders:

- Direct costs accumulate directly to each job, depending on the resources they consume.
- The indirect costs of the works are accumulated by production and service centers, distributing the latter between the production centers.
- The indirect costs of the production centers are distributed among the different works by means of some reasonable distribution criterion.

6.4. Indicators parameters of I.R.C.S

The control of the action is based mainly on the measurements made through Indicators, which constitute a tool so that the director or council can make correct decisions in relation to the

progress of the IRCCS, to have a control of what is happening and proceed to take the necessary corrective measures.

Using indicators, good control, learning and improvement of actions in the Public Health Sector can be achieved.

The indicators can be defined as "units of measure" of the health, hospital status or measure other events.

The indicators are not an objective, but they are a tool to:

- For Information, Management and contribute to Decision Making.
- For Users: right to information.
- For Research: knowledge generation.
- For Teaching: training of health professionals.

Using Management Indicators and presenting the Management Report, helps to control and improve the efficiency, effectiveness, effectiveness and productivity of the processes. In the specific case of the Hospital to provide tools and formats for immediate application in a successful way, which will allow Specialists in Costs to measure processes and analyze the results to contribute to the decision making of the managers, in such a way, that they promote continuous improvement at a financial, budgetary and internal processes level.

- A. STRUCTURE INDICATORS: they measure the quality of the characteristics of the framework where the services

are provided and the state of the resources. Here are considered the buildings, financial and human resources.

1. Square meters/bed.
2. Personnel per bed.
3. Nurses for each doctor;
4. Consultations/Expenses;
5. Inpatients/external.

B. PROCESS INDICATORS: Measure, directly or indirectly, the quality of the activities carried out in patient care.

1. Delay in the allocation of shifts.
2. Reason for ambulatory ultrasound with 100 consultations.
3. Practices not related to the diagnosis.
4. % of time stopped some device in working time.
5. Requests from professionals above standard.

C. INDICATORS OF RESULTS: They are focused on the evaluation of the fulfillment of the objectives of the organization considering the activities carried out during the care process. The classification will have to do with the fulfillment of the objectives and the level of satisfaction.

1. Monthly billing of benefits.
2. Patients satisfied with global care.
3. Reduction of intra-hospital infections.

6.5. Conclusion

It is appropriate to perform a macroeconomic analysis of the Rehabilitation Institute, because it allows us to know certain behaviors that help us understand the operation of the Hospital.

For the calculation of costs in the Public Sector, it is necessary to make a preliminary interpretation of the conditions of the technical-organizational process and from it to define the Cost Models that will support the specific costing techniques that are applied for the calculation of the costs.

- Specifically, for this type of Public Health Institute would be appropriate and necessary to develop cost systems by orders and by processes, which provide reliable and reasonable data, to help make correct decisions.
- With this study of costs of the IRCCS, I try to expose some first bases so that in the future this improvement can be carried out with the purpose of achieving an improvement in the optimization.

7. Conclusion of the thesis.

In this thesis I try to integrate myself into the hospital, watching everyday there the atmosphere to evaluate it and help the staff there to improve their position in the national Health. This analysis I've done I get really good results, but there are also some things that the hospital in the future could solve and may be in a near future will do it again to see their advances. The uses of new and old techniques should be combining to get the best rehabilitation results.

Also, is important the part of the Theory Cost applied for the IRCCS. Where the indicators could help the hospital direction with the improvement of their selves and could save money and time. With these parameters they have some tools to evaluate all this things that many times aren't possible to rate.

8. Bibliography

FBP | FONDAZIONE UBERTO BONINO & MARIA SOFIA PULEJO
MESSINA- <http://www.fbpme.it/>

Regione Siciliana - Sito Ufficiale- <http://pti.regione.sicilia.it>

Azienda Sanitarie Provinciali- <http://www.asp.messina.it/>

Istituti di Ricovero e Cura a Carattere Scientifico – IRCCS-
http://www.salute.gov.it/portale/temi/p2_6.jsp?id=794&area=Ricerca%20sanitaria&menu=ss

PESTEL Analysis | SMI-
<https://www.strategicmanagementinsight.com/tools/pest-pestel-analysis.html>

Porter's 5 Forces | Investopedia-
<https://www.investopedia.com/terms/p/porter.asp>

AMADEO- <http://tyromotion.com/en/products/amadeo>

Amadeo System - Neurosolutions Neurosolutions- <http://neuro-solutions.ca/amadeo/>

AMADEO - Exoskeleton Report-
<http://exoskeletonreport.com/product/amadeo/>

Armeo®Power – Hocoma-
<https://www.hocoma.com/solutions/armeo-power/>

Intended Use & Indications – Hocoma-
<https://www.hocoma.com/us/solutions/armeo-power/intended-use-indications/>



Lokomat® - Hocoma-

<https://www.hocoma.com/solutions/lokomat/#product>

Intended Use & Indications – Hocoma-

<https://www.hocoma.com/solutions/lokomat/intended-use-indications/>

Electroestimulador / en carro / NMES / RETS - Intelect®

Vitalstim® - Chattanooga International – Vídeos-

<http://www.medicalexpo.es/prod/chattanooga-international/product-96097-600179.html>

vitalstim_catalogue_2013_en_1.pdf-

https://international.chattgroup.com/sites/default/files/vitalstim_catalogue_2013_en_1.pdf

VRRSTechnology – YouTube-

<https://www.youtube.com/watch?v=OjoagPZoO7w>

VRRS – Khymeia- <http://khymeia.com/en/products/vrrs/>

Bionic Suit, Bionic Exoskeleton Legs, EksoGT, Mobility Device | Ekso Bionics- <https://eksobionics.com/eksohealth/products/>

EksoGT Saes Flyer update - EksoGT-Flyer-

EKSO0001GTREVA.pdf- <https://2t2ine2n47g337am722tf6ek-wpengine.netdna-ssl.com/wp-content/uploads/2017/05/EksoGT-Flyer-EKSO0001GTREVA.pdf>

Ekso GT - Exoskeleton Report-

<https://exoskeletonreport.com/product/ekso-gt/>

Rehabilitación de los dedos de la mano.pdf-

http://www.traumazaragoza.com/traumazaragoza.com/Documentacion_files/Rehabilitaci%C3%B3n%20de%20los%20dedos%20de%20la%20mano.pdf

Rehabilitación del codoantebrazo.pdf-

http://www.traumazaragoza.com/traumazaragoza.com/Documentacion_files/Rehabilitaci%C3%B3n%20del%20codoantebrazo.pdf

[ntacion_files/Rehabilitacio%CC%81n%20del%20%20codoantebrazo.pdf](#)

Rehabilitación de la rodilla.pdf-

http://www.traumazaragoza.com/traumazaragoza.com/Documentacion_files/Rehabilitacio%CC%81n%20de%20la%20rodilla.pdf

ejercicios-columna-dorsal-y-lumbar.pdf-

<https://hermesalud.com/downloads/ejercicios-columna-dorsal-y-lumbar.pdf>

Caren – Centro Neurolesi Bonino Pulejo Messina | IRCCS-

<https://www.irccsme.it/neurolesi/assistenza-sanitaria/riabilitazione-robotica/caren/>

CAREN | Motekforce Link-

<https://www.motekforcelink.com/product/caren/>

¿Que es la telerehabilitacion? – Telerehabilitación.net-

http://www.telerehabilitacion.net/?page_id=23

Teleradiologia_metodologia e applicazioni-Alessia Bramanti

Nacimiento y evolución de la telerehabilitación en el tratamiento del paciente hemipléjico adulto - Dr. Valerio Sarmati-

<http://www.valeriosarmati.es/telerehabilitacion/>

Schroeder Roger – Administración de operaciones – Mc. Graw Hill – 1989

Guía para la elaboración de Indicadores Sistema de Estadística de Salud. Resolución Ministerial 54/2003 Ministerio de salud de la Nación - 2005.

Osorio Oscar M. – Hacia una Teoría General de Costos en Contabilidad – Revista de Costos y Gestión N° 10 – Ed. Dic. 1993.